

NJTPA Regional ITS Architecture and Deployment Plan – Appendices

Submitted to:



North Jersey
Transportation
Planning
Authority

Submitted by:

ConSysTec Corp

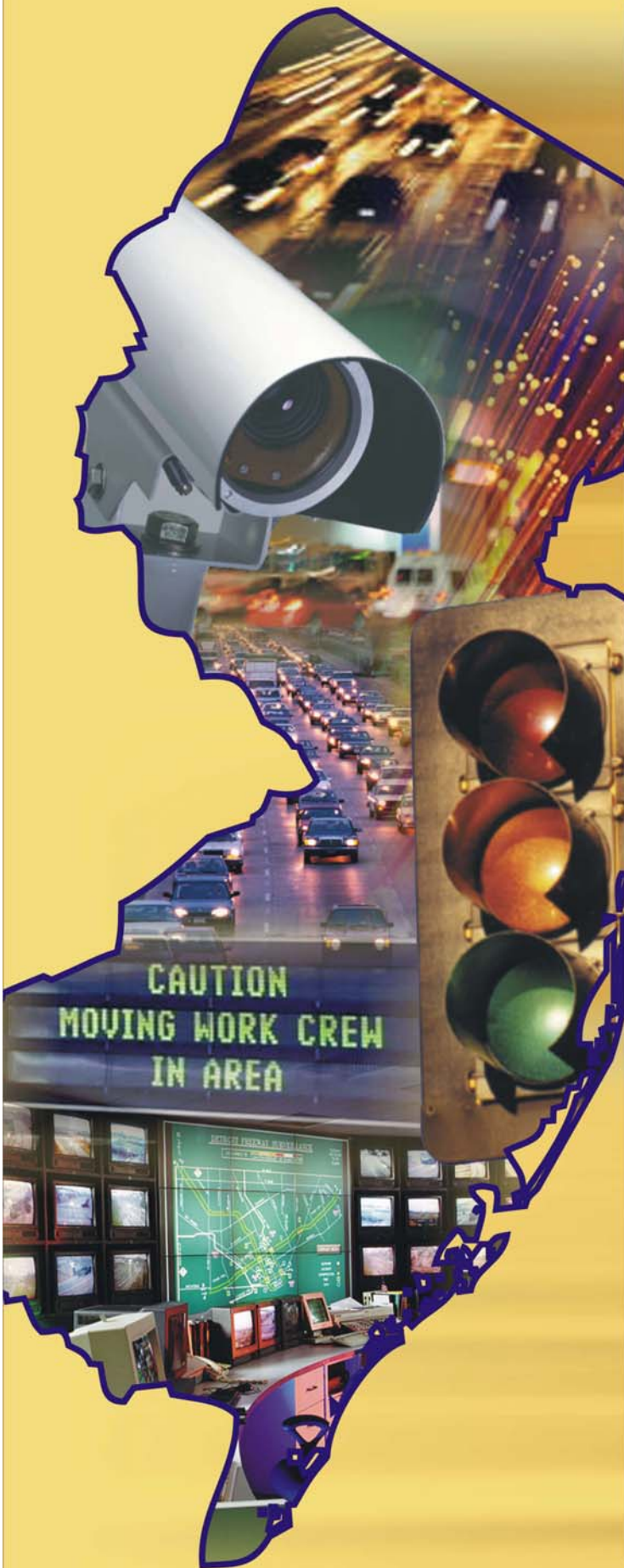
In association with:



Eng-Wong, Taub & Associates

Traffic and Transportation Consultants

February 2005



Appendix 3.A

Stakeholder Participation

**New Jersey ITS Architecture Program
NJTPA Regional ITS Architecture**

**New Jersey ITS Architectures
and Deployment Plans
Stakeholders by Workshop**

**Title: Training Workshop
Region: North
Date: 14 April 2004
Number of Stakeholders Present: 22**

Name	Affiliation	Present	Special Meeting
Kevin Vande Velde	Cisco Systems	✓	
Juan Feijoo	City of Newark	✓	
John Araneo	French and Parrello Associates	✓	
Jenise Cooper	Hudson TMA	✓	
Robert Magro	Hudson TMA	✓	
Morfeza Ansari	Keep Middlesex Moving Inc	✓	
Bruce McCracken	Middlesex County Planning Dept	✓	
Jeffrey Vesnick	Monmouth County Planning Board	✓	
Michael Pilsbury	New Jersey Department of Transportation	✓	
Robert Miller	New Jersey Department of Transportation	✓	
Jerry Kraft	New Jersey Turnpike Authority	✓	
James Kemp	NJ Transit	✓	
Robert James	NJ Transit	✓	
Dave Dawson	North Jersey Transportation Planning Authority	✓	
Hamou Meghdir	North Jersey Transportation Planning Authority	✓	
John Hummer	North Jersey Transportation Planning Authority	✓	
Ron Tindall	North Jersey Transportation Planning Authority	✓	
Ronnie Taste	Port Authority of NY & NJ	✓	
James Crane	Ridewise TMA	✓	
Ken Wedeen	Somerset County Planning Bd.	✓	
Nicholas Pantina	Union County Division of Engineering	✓	
Christine Bugel	Union County Division of Engineering	✓	

Table 3-1. Training Workshop – NJTPA Region

**New Jersey ITS Architecture Program
NJTPA Regional ITS Architecture**

**New Jersey ITS Architectures
and Deployment Plans
Stakeholders by Workshop**

Title: Travel and Traffic Management; Maintenance Management

Region: North

Date: 14 May 2004

Number of Stakeholders Present: 12

Name	Affiliation	Present	Special Meeting
Roger Sager	Delaware River Joint Toll Bridge Commission	✓	
Morfeza Ansari	Keep Middlesex Moving Inc	✓	
Bruce McCracken	Middlesex County Planning Dept	✓	
Tiberiu Tajts	New Jersey Department of Transportation	✓	
Alfonse Voza	New Jersey Turnpike Authority	✓	
James Kemp	NJ Transit	✓	
Robert James	NJ Transit	✓	
Hamou Meghdir	North Jersey Transportation Planning Authority	✓	
Ron Tindall	North Jersey Transportation Planning Authority	✓	
Ira Huttner	Port Authority of New York and New Jersey	✓	
Christine Bugel	Union County Division of Engineering	✓	
Nicholas J. Pantina	Union County Division of Engineering	✓	
Bernadette McPherson	Bergen County		
Kevin Vande Velde	Cisco Systems		
Tony Morelli	Cisco Systems		
Juan Feijoo	City of Newark		
Michael Roberson	Federal Highway Administration - NJ Division		
Jenise Cooper	Hudson TMA		
Robert Magro	Hudson TMA		
Jeffrey Vernick	Monmouth County Planning Board		
Dennis Motiani	New Jersey Department of Transportation		
William Ducsak	New Jersey Department of Transportation		
Tom Rafferty	NJ State Police		
Ken Wedeen	Somerset County Planning Board		
Tom Batz	TRANSCOM		

Table 3-2. Travel and Traffic, Maintenance Management Architecture Workshop – NJTPA Region

**New Jersey ITS Architecture Program
NJTPA Regional ITS Architecture**

**New Jersey ITS Architectures
and Deployment Plans
Stakeholders by Workshop**

Title: Parking Management
Region: North
Date: 20 May 2004
Number of Stakeholders Present: 12

Name	Affiliation	Present	Special Meeting
Michael Roberson	Federal Highway Administration - NJ Division	✓	
Kinga Skora	Meadowlink TMA	✓	
Krishna Murthy	Meadowlink TMA	✓	
Anthony Minniti	Meadowlink TMA	✓	
Frank Mongioi	Meadowlink TMA	✓	
Bruce McCracken	Middlesex County Planning Dept	✓	
Jeffrey Vernick	Monmouth County Planning Board	✓	
Dennis Motiani	New Jersey Department of Transportation	✓	
William Ducsak	New Jersey Department of Transportation	✓	
James Kemp	NJ Transit	✓	
Hamou Meghdir	North Jersey Transportation Planning Authority	✓	
James Crane	Ridewise TMA	✓	
Jenise Cooper	Hudson TMA		
Robert Magro	Hudson TMA		
Morfeza Ansari	Keep Middlesex Moving Inc		
Robert James	NJ Transit		
Ken Wedeen	Somerset County Planning Board		
Tom Batz	TRANSCOM		

Table 3-3. Parking Management Architecture Workshop – NJTPA Region

**New Jersey ITS Architecture Program
NJTPA Regional ITS Architecture**

**New Jersey ITS Architectures
and Deployment Plans
Stakeholders by Workshop**

Title: Public Transportation Management

Region: North

Date: 20 May 2004

Number of Stakeholders Present: 15

Name	Affiliation	Present	Special Meeting
Michael Roberson	Federal Highway Administration - NJ Division	✓	
Christopher Campos	Hudson TMA	✓	
Sean Meehan	Keep Middlesex Moving Inc	✓	
Anthony Minniti	Meadowlink TMA	✓	
Frank Mongioi	Meadowlink TMA	✓	
Kinga Skora	Meadowlink TMA	✓	
Bruce McCracken	Middlesex County Planning Dept	✓	
Jeffrey Vernick	Monmouth County Planning Board	✓	
James Kemp	NJ Transit	✓	
Robert James	NJ Transit	✓	
Hamou Meghdir	North Jersey Transportation Planning Authority	✓	
Ron Tindall	North Jersey Transportation Planning Authority	✓	
James Crane	Ridewise TMA	✓	
Robert Glantzberg	TRANSCOM	✓	
Donald Watt	TransOptions (TMA)	✓	
Bernadette McPherson	Bergen County		
John Lane	Hudson County Engineering		
Jenise Cooper	Hudson TMA		
Robert Magro	Hudson TMA		
Morfeza Ansari	Keep Middlesex Moving Inc		
Dennis Motiani	New Jersey Department of Transportation		
William Ducsak	New Jersey Department of Transportation		
Ken Wedeen	Somerset County Planning Board		
Tom Batz	TRANSCOM		
Nicholas J. Pantina	Union County Division of Engineering		

Table 3-4. Public Transportation Management Architecture Workshop – NJTPA Region

**New Jersey ITS Architecture Program
NJTPA Regional ITS Architecture**

**New Jersey ITS Architectures
and Deployment Plans
Stakeholders by Workshop**

Title: Information Archive Management

Region: North

Date: 27 May 2004

Number of Stakeholders Present: 6

Name	Affiliation	Present	Special Meeting
Dennis Motiani	New Jersey Department of Transportation	✓	
Tiberiu Tajts	New Jersey Department of Transportation	✓	
James Kemp	NJ Transit	✓	
Hamou Meghdir	North Jersey Transportation Planning Authority	✓	
Ron Tindall	North Jersey Transportation Planning Authority	✓	
Nicholas Antoniou	TRANSCOM	✓	
Michael Roberson	Federal Highway Administration - NJ Division		
Jenise Cooper	Hudson TMA		
Robert Magro	Hudson TMA		
William Ducsak	New Jersey Department of Transportation		
Robert James	NJ Transit		
Tom Batz	TRANSCOM		
Nicholas J. Pantina	Union County Division of Engineering		

Table 3-5. Information Archive Management Architecture Workshop – NJTPA Region

**New Jersey ITS Architecture Program
NJTPA Regional ITS Architecture**

**New Jersey ITS Architectures
and Deployment Plans
Stakeholders by Workshop**

**Title: Ports
Region: North
Date: 27 May 2004
Number of Stakeholders Present: 18**

Name	Affiliation	Present	Special Meeting
Jerry Von Dohlen	BISTATE	✓	
James Adams	City Of Newark	✓	
Mark Kociewda	Edwards & Kelcey	✓	
Scott Parker	Edwards & Kelcey	✓	
Michael Roberson	Federal Highway Administration - NJ Division	✓	
John Lane	Hudson County Engineering	✓	
Dennis Motiani	New Jersey Department of Transportation	✓	
John Powers	New Jersey Department of Transportation	✓	
Tiberiu Tajts	New Jersey Department of Transportation	✓	
George Fallat	NJIT	✓	
Mike McGuinness	NJ-NAIOP	✓	
David Dawson	North Jersey Transportation Planning Authority	✓	
John Hummer	North Jersey Transportation Planning Authority	✓	
Paul Gessner	Port Authority of NY & NJ	✓	
Steva Brown	Port Authority of NY & NJ	✓	
Maria Boile	Rutgers University	✓	
Mike Gollias	Rutgers University	✓	
Ray Rugguri	TRANSCOM	✓	
Stan Platt	Delaware Valley Regional Planning Commission		
Jenise Cooper	Hudson TMA		
Robert Magro	Hudson TMA		
William Ducsak	New Jersey Department of Transportation		
Hamou Meghdir	North Jersey Transportation Planning Authority		
Tom Batz	TRANSCOM		
Nicholas J. Pantina	Union County Division of Engineering		

Table 3-6. Ports Architecture Workshop – NJTPA Region

**New Jersey ITS Architecture Program
NJTPA Regional ITS Architecture**

**New Jersey ITS Architectures
and Deployment Plans
Stakeholders by Workshop**

Title: Public Safety/Emergency Management/Homeland Security

Region: North

Date: 9 June 2004

Number of Stakeholders Present: 15

Name	Affiliation	Present	Special Meeting
Michael Meeker	Delaware River Joint Toll Bridge Commission	✓	
Michael Roberson	Federal Highway Administration - NJ Division	✓	
Sean Meehan	Keep Middlesex Moving Inc	✓	
Frank Mongioi	Meadowlink TMA	✓	
Dennis Motiani	New Jersey Department of Transportation	✓	
Tiberiu Tajts	New Jersey Department of Transportation	✓	
Alfonse Voza	New Jersey Turnpike Authority	✓	
Lt. Paul Sinckler	NJ State Police	✓	
Tom Rafferty	NJ State Police	✓	
Jat Beaton	NJIT-UMDNJ-SPH	✓	
David Dawson	North Jersey Transportation Planning Authority	✓	
Hamou Meghdir	North Jersey Transportation Planning Authority	✓	
Ron Tindall	North Jersey Transportation Planning Authority	✓	
Eskil Danielson	Sussex County OEM	✓	
Robert Glantzberg	TRANSCOM	✓	
Kevin Vande Velde	Cisco Systems		
John Araneo	French & Parrello Associates		
John Lane	Hudson County Engineering		
Jenise Cooper	Hudson TMA		
Robert Magro	Hudson TMA		
John Gahwyler	New Jersey Department of Transportation		
William Ducsak	New Jersey Department of Transportation		
Dennis Burke	New Jersey Turnpike Authority		
James Kemp	NJ Transit		
Robert James	NJ Transit		
John Hummer	North Jersey Transportation Planning Authority		
Tom Batz	TRANSCOM		
Nicholas J. Pantina	Union County Division of Engineering		

Table 3-7. Public Safety/Emergency Management/Homeland Security Architecture Workshop – NJTPA Region

**New Jersey ITS Architecture Program
NJTPA Regional ITS Architecture**

**New Jersey ITS Architectures
and Deployment Plans
Stakeholders by Workshop**

Title: Travel and Traffic Management: Maintenance Management

Region: North

Date: 17 June 2004

Number of Stakeholders Present: 7

Name	Affiliation	Present	Special Meeting
Sing Wong	City of Newark	✓	
Roger Sager	Delaware River Joint Toll Bridge Commission	✓	
Michael Roberson	Federal Highway Administration - NJ Division	✓	
Tiberiu Tajts	New Jersey Department of Transportation	✓	✓
Ron Tindall	North Jersey Transportation Planning Authority	✓	
Robert Glantzberg	TRANSCOM	✓	
Donald Watt	TransOptions (TMA)	✓	
Bernadette McPherson	Bergen County		
Juan Feijoo	City of Newark		
John Lane	Hudson County Engineering		
Jenise Cooper	Hudson TMA		
Robert Magro	Hudson TMA		
Morfeza Ansari	Keep Middlesex Moving Inc		
Bruce McCracken	Middlesex County Planning Dept		
Jeffrey Vernick	Monmouth County Planning Board		
Dennis Motiani	New Jersey Department of Transportation		✓
William Ducsak	New Jersey Department of Transportation		
Alfonse Voza	New Jersey Turnpike Authority		
Tom Rafferty	NJ State Police		
Hamou Meghdir	North Jersey Transportation Planning Authority		
Ronnie Taste	Port Authority of New York and New Jersey		
Ken Wedeen	Somerset County Planning Board		
Tom Batz	TRANSCOM		
Christine Bugel	Union County Division of Engineering		
Nicholas J. Pantina	Union County Division of Engineering		

Table 3-8. Travel and Traffic, Maintenance Management Deployment Workshop – NJTPA Region

**New Jersey ITS Architectures
and Deployment Plans
Stakeholders by Workshop**

Title: Parking Management

Region: North

Date: 24 June 2004

Number of Stakeholders Present: 6

Name	Affiliation	Present	Special Meeting
Frank Mongioi	Meadowlark TMA	✓	
Kinga Skora	Meadowlark TMA	✓	
Tiberiu Tajts	New Jersey Department of Transportation	✓	
Ron Tindall	North Jersey Transportation Planning Authority	✓	
James Crane	Ridewise TMA	✓	
Robert Glantzberg	TRANSCOM	✓	
Jim Bartell	County of Essex		
Michael Roberson	Federal Highway Administration - NJ Division		
Jenise Cooper	Hudson TMA		
Robert Magro	Hudson TMA		
Morfeza Ansari	Keep Middlesex Moving Inc		
Bruce McCracken	Middlesex County Planning Dept		
Jeffrey Vernick	Monmouth County Planning Board		
Dennis Motiani	New Jersey Department of Transportation		
William Ducsak	New Jersey Department of Transportation		
Hamou Meghdir	North Jersey Transportation Planning Authority		
Ken Wedeen	Somerset County Planning Board		
Tom Batz	TRANSCOM		

Table 3-9. Parking Management Deployment Workshop – NJTPA Region

**New Jersey ITS Architecture Program
NJTPA Regional ITS Architecture**

**New Jersey ITS Architectures
and Deployment Plans
Stakeholders by Workshop**

Title: Public Transportation Management

Region: North

Date: 24 June 2004

Number of Stakeholders Present: 6

Name	Affiliation	Present	Special Meeting
Morfeza Ansari	Keep Middlesex Moving Inc	✓	
Frank Mongioi	Meadowlink TMA	✓	
Kinga Skora	Meadowlink TMA	✓	
Ron Tindall	North Jersey Transportation Planning Authority	✓	
James Crane	Ridewise TMA	✓	
Robert Glantzberg	TRANSCOM	✓	
Bernadette McPherson	Bergen County		
Michael Roberson	Federal Highway Administration - NJ Division		
John Lane	Hudson County Engineering		
Jenise Cooper	Hudson TMA		
Robert Magro	Hudson TMA		
Bruce McCracken	Middlesex County Planning Dept		
Jeffrey Vernick	Monmouth County Planning Board		
Dennis Motiani	New Jersey Department of Transportation		
William Ducsak	New Jersey Department of Transportation		
James Kemp	NJ Transit		
Hamou Meghdir	North Jersey Transportation Planning Authority		
Ronnie Taste	Port Authority of NY & NJ		
Ken Wedeen	Somerset County Planning Board		
Tom Batz	TRANSCOM		
Nicholas J. Pantina	Union County Division of Engineering		

Table 3-10. Public Transportation Management Deployment Workshop – NJTPA Region

**New Jersey ITS Architecture Program
NJTPA Regional ITS Architecture**

**New Jersey ITS Architectures
and Deployment Plans
Stakeholders by Workshop**

**Title: Information Archive Management
Region: North
Date: 15 July 2004
Number of Stakeholders Present: 11**

Name	Affiliation	Present	Special Meeting
Michael Meekar	Delaware River Joint Toll Bridge Commission	✓	
Michael Roberson	Federal Highway Administration - NJ Division	✓	
Frank Mongioi	Meadowlink TMA	✓	
Michael Pilsbury	New Jersey Department of Transportation	✓	
Tiberiu Tajts	New Jersey Department of Transportation	✓	
Tim Herlihy	New Jersey Department of Transportation	✓	
William Ducsak	New Jersey Department of Transportation	✓	
James Kemp	NJ Transit	✓	
Hamou Meghdir	North Jersey Transportation Planning Authority	✓	
Ron Tindall	North Jersey Transportation Planning Authority	✓	
Nicholas Antoniou	TRANSCOM	✓	
Jenise Cooper	Hudson TMA		
Robert Magro	Hudson TMA		
Dennis Motiani	New Jersey Department of Transportation		
Tom Batz	TRANSCOM		
Christine Bugel	Union County Division of Engineering		

Table 3-11. Information Archive Management Deployment Workshop – NJTPA Region

**New Jersey ITS Architecture Program
NJTPA Regional ITS Architecture**

**New Jersey ITS Architectures
and Deployment Plans
Stakeholders by Workshop**

Title: Ports
Region: North
Date: 15 July 2004
Number of Stakeholders Present: 10

Name	Affiliation	Present	Special Meeting
Fernando Rubio	City of Newark	✓	
Michael Meekar	Delaware River Joint Toll Bridge Commission	✓	
Michael Roberson	Federal Highway Administration - NJ Division	✓	
Frank Mongioi	Meadowlink TMA	✓	
Michael Pilsbury	New Jersey Department of Transportation	✓	
Miki Krakauer	New Jersey Department of Transportation	✓	
Tiberiu Tajts	New Jersey Department of Transportation	✓	
David Dawson	North Jersey Transportation Planning Authority	✓	
Hamou Meghdir	North Jersey Transportation Planning Authority	✓	
Ray Ruggieri	TRANSCOM	✓	
Stan Platt	Delaware Valley Regional Planning Commission		
John Lane	Hudson County Engineering		
Jenise Cooper	Hudson TMA		
Robert Magro	Hudson TMA		
Dennis Motiani	New Jersey Department of Transportation		
William Ducsak	New Jersey Department of Transportation		
John Hummer	North Jersey Transportation Planning Authority		
Ronnie Taste	Port Authority of NY & NJ		
Karen Ryan Tobia	Port Authority of NY & NJ		
Tom Batz	TRANSCOM		
Nicholas J. Pantina	Union County Division of Engineering		

Table 3-12. Ports Deployment Workshop – NJTPA Region

**New Jersey ITS Architecture Program
NJTPA Regional ITS Architecture**

**New Jersey ITS Architectures
and Deployment Plans
Stakeholders by Workshop**

Title: Public Safety/Emergency Management/Homeland Security

Region: North

Date: 21 July 2004

Number of Stakeholders Present: 5

Name	Affiliation	Present	Special Meeting
Michael Meekar	Delaware River Joint Toll Bridge Commission	✓	
Michael Roberson	Federal Highway Administration - NJ Division	✓	
Frank Mongioi	Meadowlink TMA	✓	
Tiberiu Tajts	New Jersey Department of Transportation	✓	
Shai Jaskoll	UMDNJ-University Hospital EMS	✓	
John Araneo	French & Parrello Associates		
John Lane	Hudson County Engineering		
Jenise Cooper	Hudson TMA		
Robert Magro	Hudson TMA		
Dennis Motiani	New Jersey Department of Transportation		
John Gahwyler	New Jersey Department of Transportation		
William Ducsak	New Jersey Department of Transportation		
Dennis Burke	New Jersey Turnpike Authority		
Lt. Paul Sinckler	NJ State Police		
Tom Rafferty	NJ State Police		
David Dawson	North Jersey Transportation Planning Authority		
Hamou Meghdir	North Jersey Transportation Planning Authority		
John Hummer	North Jersey Transportation Planning Authority		
Ron Tindall	North Jersey Transportation Planning Authority		
Tom Batz	TRANSCOM		
Nicholas J. Pantina	Union County Division of Engineering		

Table 3-13. Public Safety/Emergency Management/Homeland Security Deployment Workshop – NJTPA Region

**New Jersey ITS Architecture Program
NJTPA Regional ITS Architecture**

**New Jersey ITS Architectures
and Deployment Plans
Stakeholders by Workshop**

**Title: Final Integration Workshop
Region: North
Date: 19 August 2004
Number of Stakeholders Present: 7**

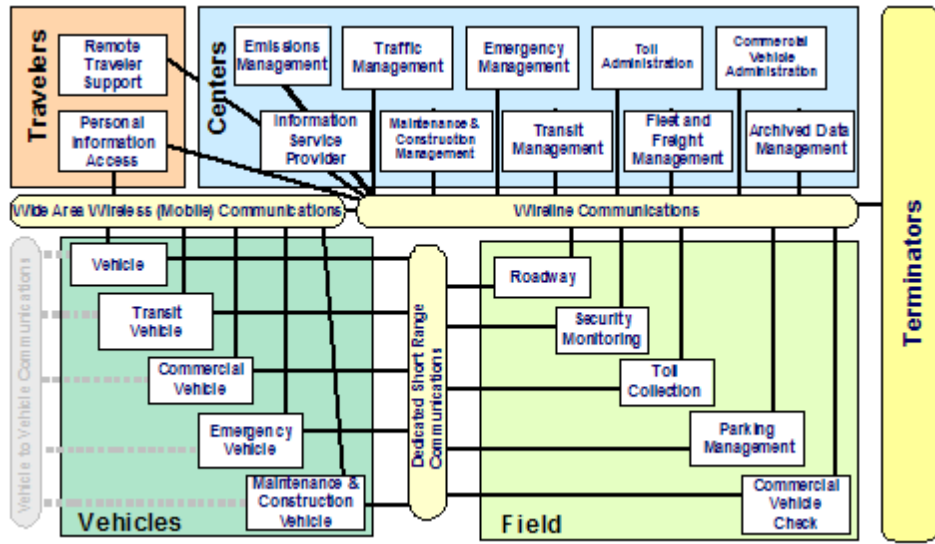
Name	Affiliation	Present	Special Meeting
Kinga Skora	Meadowlark TMA	✓	
Anne Chmielewski	New Jersey Department of Transportation	✓	
Michael Pilsbury	New Jersey Department of Transportation	✓	
James Kemp	NJ Transit	✓	
Robert James	NJ Transit	✓	
Hamou Meghdir	North Jersey Transportation Planning Authority	✓	
Ron Tindall	North Jersey Transportation Planning Authority	✓	
Michael Meeker	Delaware River Joint Toll Bridge Commission		
Roger Sager	Delaware River Joint Toll Bridge Commission		
Michael Roberson	Federal Highway Administration - NJ Division		
William J. Hoffman	Federal Highway Administration - NJ Division		
John Araneo	French & Parrello Associates		
John Lane	Hudson County Engineering		
Jenise Cooper	Hudson TMA		
Robert Magro	Hudson TMA		
Morfeza Ansari	Keep Middlesex Moving Inc		
Bruce McCracken	Middlesex County Planning Dept		
Jeffrey Vernick	Monmouth County Planning Board		
Dennis Motiani	New Jersey Department of Transportation		
Tiberiu Tajts	New Jersey Department of Transportation		
Tom Batz	TRANSCOM		
Nicholas J. Pantina	Union County Division of Engineering		

Table 3-14. Final Integration Workshop – NJTPA Region

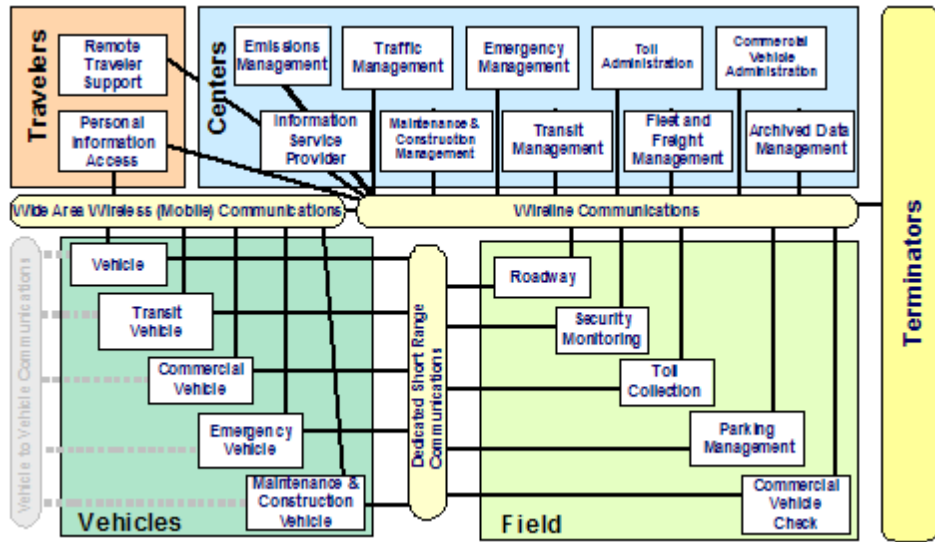
Appendix 4.A

Sausage Diagram

New Jersey ITS Architecture Sausage Diagram



Subsystem	Emergency Management	Information Service Provider	Traffic Management	Transit Management
Center	NJTPA Counties EOCs	Private Ferry Operators Traveler Information Systems	National Park Service Management Center	NJT Fare Management System
Archived Data Management Subsystem	NJTPA Municipalities EOCs	Private HAZMAT Security Provider	New York City Joint TMC	NJT LRT - Hudson-Bergen Operations Center
DVRPC ITS Data Archive	NJTPA Region Incident and Mutual Aid Network	Private ISPs	NJDEP State Parks	NJT LRT - Newark City Subway Operations Center
NJ CVO Safety Archive Database	NJTPA Region Public Safety Dispatch	RIMIS IEN	NJDOT REOC Central	NJT LRT - River Line Operations Center
NJDOT Accident Reporting System	Other States OEMs	Rutgers Campus Shuttle Website	NJDOT REOC North	NJT Rail Operations Center Systems
NJDOT Highway Performance Monitoring System (HPMS)	Other States Public Safety Department	SJTA Traveler Information System	NJDOT STOC	NJTPA Counties/Municipalities Transit Fare Management Systems
NJSP Traffic Records Management	Palisades Interstate Parkway Police	TRANSCOM Communications Center Servers	NJDOT TEOC	NJTPA Counties/Municipalities Transit Systems
NJT Bus Archive	PANYNJ PAPD 211 Communications Center Dispatch	TRANSCOM TRIPS123 Traveler Information System	NJDOT TOC Central	NJTPA Region TMA Fare Management Systems
NJT Global Archive	PANYNJ PATH Operations Center	Maintenance and Construction Management	NJDOT TOC North	NJTPA Region TMA Systems
NJT Rail Archive	PANYNJ Port Commerce Operations Centers	DRJTBC District Operations	NJDOT TOC South	NJTPA Region Transit Coordination Network
NJT Rail RWIS Database	PANYNJ TB/T Tunnels/Bridges Communications Desk/Operations Center	DRJTBC Facility Operations Center	NJSP/NJDOT Statewide Dispatch Center	NJTPA Regional Fare Reciprocity Network
NJTA RWIS Database	PANYNJ Port Commerce Operations Center Pennsylvania State Police	DVRPC Region Counties/Municipalities PWD Operations	NJTA Parkway Division TOC	PANYNJ Airports AirTrain Operations Center
NJTPA ITS Data Archive	Private Venues TOCs	New York City Joint TMC	NJTPA Counties TOCs	PANYNJ Airports Communications Desk/Operations Center
NJTPA Region Probe Data	RIMIS IEN	NJDOT Construction Management System	NJTPA Municipalities TOCs	PANYNJ PATH Fare Management System
NJTPA Region RWIS Database	SJTA TOC	NJDOT Maintenance	NYS DOT IEN	PANYNJ PATH Operations Center
NYMT/DCP Regional Planning Database	SJTPO Counties EOCs	NJDOT REOC Central	NYS DOT Region 8 TMC	PANYNJ PATH Vehicle Detection System
SJTPO ITS Data Archive	SJTPO Region Public Safety Dispatch	NJDOT REOC North	NYSTA Operations Center	PANYNJ TB/T Bus Terminals/Stations Communications Desk/Operations Center
Statewide RWIS Database	TRANSCOM Communications Center Servers	NJDOT STOC	Other Facility (Toll) Operations Centers	Private Demand Response Operators Central Systems
Subregional Data Archives	Emissions Management	NJDOT TEOC	Other NJTPA Counties TOCs	Private Demand Response Operators Fare Management Systems
TRANSCOM Archived Data Management System	New York City Joint TMC	NJDOT TOC Central	Palisades Interstate Parkway HQ	Private Ferry Operators Fare Management Systems
Wilmington Area Planning Council (WILMAPCO) ITS Data Archive	Fleet and Freight Management	NJDOT TOC North	PANYNJ Airports Communications Desk/Operations Center	Private Ferry Operators Systems
Commercial Vehicle Administration	Private Commercial Vehicle and Fleet Dispatch	NJDOT TOC South	PANYNJ Port Commerce Operations Centers	Private Fixed-Route Bus/Shuttle Operators Fare Management Systems
DRJTBC Facility Operations Center	Travelers Personal Computing Devices	NJTA Parkway Division Maintenance	PANYNJ TB/T Bus Terminals/Stations Communications Desk/Operations Center	Private Fixed-Route Transit Bus/Shuttle Operators
NJ CVIEW System	Information Service Provider	NJTA Parkway Division TOC	PANYNJ TB/T Tunnels/Bridges Communications Desk/Operations Center	Private Long-Distance Bus Operators Systems
NJDEP HAZMAT Permit System	Cross County Connection TMA Systems	NJTA Turnpike Maintenance	PennDOT District 4 TOC	Private Passenger Rail
NJTA HAZMAT Permit System	DRJTBC Website	NJTA Turnpike TOC	PennDOT District 5 TOC	RIMIS IEN
Other Facility (Toll) Operations Centers	National Park Service Management Center	NJTPA Counties PWD Operations	PennDOT District 6 TOC	Rutgers Campus Shuttle System
PANYNJ Port Commerce Credentialing Back Office (SEALINK)	NJDOT 511 System	NJTPA Municipalities PWD Operations	PennDOT Statewide TOC	School Bus Operators
PANYNJ Port Commerce Operations Centers	NJDOT Central Traveler Information System	Other NJTPA Counties PWD Operations	Private Venues TOCs	SJTPO Counties/Municipalities Transit Systems
PANYNJ TB/T Tunnels/Bridges Communications Desk/Operations Center	NJDOT North Traveler Information System	PANYNJ Airports Communications Desk/Operations Center	PTC Operations Center	TRANSCOM Communications Center Servers
Emergency Management	NJDOT South Traveler Information System	PANYNJ PATH Operations Center	SJTPO Counties TOCs	TRANSCOM TRIPS123 Traveler Information System
AMTRAK Emergency Dispatch	NJDOT STOC	PANYNJ Port Commerce Operations Centers	SJTPO Municipalities TOCs	Field
DVRPC Region Public Safety Dispatch	NJDOT Website	PANYNJ TB/T Maintenance Unit	TRANSCOM Communications Center Servers	Commercial Vehicle Check
National Park Service Management Center	NJT Corporate Customer Information Center Systems	PANYNJ TB/T Tunnels/Bridges Communications Desk/Operations Center	TRANSMIT Agencies TRANSMIT Servers	DRJTBC Facility Commercial Vehicle Check
New York City Joint TMC	NJT Transit Itinerary Planning System	RIMIS IEN	Transit Management	NJSP Commercial Carrier/Safety Inspection Unit
NJ State Office of Emergency Management	NJTA IVR	SJTA TOC	AMTRAK National Operations Center	Other Facility (Toll) Commercial Vehicle Check
NJDEP State Parks	NJTA Website	SJTPO Counties PWD Operations	AMTRAK New Jersey Operations Centers	PANYNJ Port Commerce Terminal Access Equipment
NJDOT STOC	NJTPA Counties/Municipalities Websites	SJTPO Municipalities PWD Operations	Cross County Connection TMA Systems	PANYNJ TB/T Bridges/Tunnels Commercial Vehicle Check
NJDOT TEOC	NJTPA Region TMA Traveler Information Systems	TRANSCOM Communications Center Servers	DRBA Cape May - Lewes Ferry System	Parking Management
NJDOT TOC Central	Other Facility (Toll) Website	Toll Administration	DRPA PATCO Operations Center	National Park Service Management Center
NJDOT TOC North	PANYNJ Airports Traveler Information Systems	E-ZPass CSC	DVRPC Transit Operators Systems	NJDEP State Parks
NJDOT TOC South	PANYNJ PATH Traveler Information Systems	Traffic Management	NJDOT STOC	NJT Parking Facilities
NJSP Dispatch - Troop A, B, C	PANYNJ Port Commerce FIRST Web Site	Atlantic City Area Joint Operations Center	NJT Access Link Dispatch	Parking Facility Operators
NJSP Dispatch - Troop D	PANYNJ Port Commerce Traveler Information System	Burlington County Bridge Commission Facility	NJT Bus Operations North	Roadway Subsystem
NJSP Dispatch - Troop E	PANYNJ TB/T Bus Terminals/Stations Traveler Information System	DelDOT TMC	NJT Bus Operations South	
NJSP/NJDOT Statewide Dispatch Center	PANYNJ TB/T Customer Relations Division	DRJTBC Facility Operations Center	NJT Bus PABT Management System (TRANSMIT)	
NJT Police Dispatch / Command Center	PANYNJ TB/T Tunnels/Bridges Traveler Information System	DRPA TMC	NJT Corporate Customer Information Center Systems	
NJT Rail Operations Center Systems	PANYNJ Traveler Information Systems	DVRPC Region Counties/Municipal TOCs		
NJTA Parkway Division TOC		I-95 CC Information Exchange Network		
NJTA Turnpike TOC				



Roadway Subsystem
DRJTBC ITS Field Equipment
NJDOT Central ITS Field Equipment
NJDOT North ITS Field Equipment
NJTA Turnpike ITS Field Equipment
NJTPA Counties ITS Field Equipment
NJTPA Municipalities ITS Field Equipment
Other Facility (Toll) ITS Field Equipment
Palisades Interstate Parkway ITS Field Equipment
PANYNJ Airports Field Equipment
PANYNJ PATH Vehicle Detection System
PANYNJ Port Commerce CCTV
PANYNJ Port Commerce Field Equipment
PANYNJ TB/T Bus Ramp Field Equipment
PANYNJ TB/T Bus Terminals/Internal Roads Field Equipment
PANYNJ TB/T Bus Terminals/Stations Field Equipment
PANYNJ TB/T Tunnels/Bridges Field Equipment
TRANSCOM XBL Corridor Field Equipment
Security Monitoring Subsystem
NJT Facility Security Equipment
PANYNJ TB/T Infrastructure Security Equipment
Toll Collection
Parking Facility Operators
Traveler
Personal Information Access
TRANSCOM TRIPS123 Subscriber Systems
Travelers Personal Computing Devices
Remote Traveler Support
Cross County Connection TMA Kiosks
Newark Pennsylvania Station Information Displays
NJT Corporate Customer Information / Display Systems
NJT Facility Security Equipment
NJT Fare Point of Sale
NJTPA Counties/Municipalities Transit Customer Information / Display Systems
NJTPA Region TMA Kiosks
PANYNJ Airports In-Terminal Customer Information Systems
PANYNJ PATH CCTV Cameras
PANYNJ PATH Fare Point of Sale
PANYNJ PATH PATH/VISION
PANYNJ TB/T Bus Terminals/Stations In-Terminal Customer Information Systems
SJTA Kiosks
TRANSCOM Kiosks
Vehicle
Commercial Vehicle Subsystem
Private Commercial and Fleet Vehicles
Emergency Vehicle Subsystem
DRJTBC Emergency Vehicles
NJTPA Counties/Municipalities EMS/Fire Vehicles

Emergency Vehicle Subsystem
NJTPA Region Sheriffs/Police Vehicles
PANYNJ TB/T Tunnels/Bridges Emergency Response Vehicles
Maintenance and Construction Vehicle
DRJTBC Maintenance Vehicle
NJTA Parkway Division Maintenance Vehicles
NJTPA Counties PWD Vehicles
NJTPA Municipalities PWD Vehicles
PANYNJ TB/T Maintenance Vehicles
Transit Vehicle Subsystem
NJT Access Link Vehicles
NJT Bus Vehicles
NJT LRT - Hudson-Bergen Rail Vehicles
NJT LRT - Newark City Subway Vehicles
NJT Rail Trains
NJTPA Counties/Municipalities Transit Vehicles
PANYNJ PATH Transit Vehicles
Private Demand Response Operators Vehicles
Private Ferry Operators Ferries
Private Ferry Operators Landside Shuttles
Private Fixed-Route Transit Bus/Shuttle Operators Vehicles
Rutgers Campus Shuttles
School Buses
TMA Vehicles
Vehicle
Private Commercial and Fleet Vehicles
Travelers Vehicles
Terminator
Center
Archived Data User Systems
FHWA Data Users
FRA Data Users
FTA Data Users
NJDOT Data Archive Users
NJT Archive Users
NJTPA Planning Staff Systems
Subregional Data Users
Transportation Information Users Systems
Care Facility
Regional Hospitals
Enforcement Agency
NJSP Commercial Carrier/Safety Inspection Unit
NJSP Dispatch - Troop D
NJSP Dispatch - Troop E
NJSP/NJDOT Statewide Dispatch Center
NJT Police Dispatch / Command Center
PANYNJ PAPD 211 Communications Center Dispatch
Equipment Repair Facility

Equipment Repair Facility
NJTPA Counties PWD Equipment Repair Facilities
NJTPA Municipalities PWD Equipment Repair Facilities
Event Promoters
Regional Event Promoters
RIMIS IEN
TRANSCOM Communications Center Servers
Financial Institution
E-ZPass CSC
Financial Institution
NJT Fare Management System
Intermodal Freight Depot
PANYNJ Port Commerce Operations Centers
Map Update Provider
Regional GIS/Mapping Systems
Media
Print and Broadcast Media
Multimodal Transportation Service Provider
AMTRAK New Jersey Operations Centers
Multimodal Passenger Air and Water Terminals/Stations
National Airline Information Centers
Newark Pennsylvania Station Control Center
NJT Bus Operations North
NJT Rail Operations Center Systems
PANYNJ Airports AirTrain Operations Center
PANYNJ Airports Communications Desk/Operations Center
PANYNJ PATH Operations Center
PANYNJ TB/T Bus Terminals/Stations Communications Desk/Operations Center
Private Cruise Operators
Regional Airline Operations
Regional Airport Operations
Rail Operations
AMTRAK National Operations Center
AMTRAK New Jersey Operations Centers
NJT LRT - Hudson-Bergen Operations Center
NJT LRT - Newark City Subway Operations Center
NJT LRT - River Line Operations Center
NJT Rail Operations Center Systems
Railroad Operation Centers
Storage Facility
DRJTBC Storage Facilities
NJTA Parkway Division Storage Facilities
NJTPA Counties PWD Storage Facilities
NJTPA Municipalities Storage Facilities
Weather Service
Weather Service Provider Systems
Field
Multimodal Crossings

Multimodal Crossings
NJTPA Counties Drawbridge Equipment
Wayside Equipment
NJT Rail Grade Crossing Protection
Railroad Operators Wayside Equipment
Traveler
Traveler Card
NJ Universal Smart Card
PANYNJ PATH SmartCard

Appendix 4.B

ITS Inventory – Sorted By Stakeholder

Inventory by Stakeholder

Stakeholder	ITS Element	Entity
AMTRAK		
	AMTRAK Emergency Dispatch	Emergency Management
	AMTRAK National Operations Center	Rail Operations
	AMTRAK National Operations Center	Transit Management
	AMTRAK New Jersey Operations Centers	Rail Operations
	AMTRAK New Jersey Operations Centers	Transit Management
	AMTRAK New Jersey Operations Centers	Multimodal Transportation Service Provider
Atlantic City Area Joint Operations Center		
	Atlantic City Area Joint Operations Center	Other Traffic Management
	Atlantic City Area Joint Operations Center	Traffic Management
Burlington County Bridge Commission		
	Burlington County Bridge Commission Facility	Other Traffic Management
	Burlington County Bridge Commission Facility	Traffic Management
Cross County Connection TMA		
	Cross County Connection TMA Kiosks	Remote Traveler Support
	Cross County Connection TMA Systems	Information Service Provider
	Cross County Connection TMA Systems	Transit Management
DeIDOT - Delaware Department of Transportation		
	DeIDOT TMC	Other Traffic Management
	DeIDOT TMC	Traffic Management
DRBA - Delaware River and Bay Authority		
	DRBA Cape May - Lewes Ferry System	Transit Management
DRJTBC - Delaware River Joint Toll Bridge Commission		
	DRJTBC District Operations	Maintenance and Construction Management
	DRJTBC Emergency Vehicles	Emergency Vehicle Subsystem
	DRJTBC Facility Commercial Vehicle Check	Commercial Vehicle Check
	DRJTBC Facility Operations Center	Commercial Vehicle Administration
	DRJTBC Facility Operations Center	Traffic Management
	DRJTBC Facility Operations Center	Maintenance and Construction Management
	DRJTBC Facility Operations Center	Other Traffic Management
	DRJTBC ITS Field Equipment	Roadway Subsystem
	DRJTBC Maintenance Vehicle	Maintenance and Construction Vehicle
	DRJTBC Storage Facilities	Storage Facility
	DRJTBC Website	Information Service Provider
DRPA - Delaware River Port Authority		
	DRPA TMC	Traffic Management
	DRPA TMC	Other Traffic Management
DRPA PATCO - Port Authority Transit Corporation		
	DRPA PATCO Operations Center	Transit Management
DVRPC - Delaware Valley Regional Planning Commission		
	DVRPC ITS Data Archive	Archived Data Management Subsystem
	RIMIS IEN	Other Traffic Management
	RIMIS IEN	Emergency Management
	RIMIS IEN	Information Service Provider
	RIMIS IEN	Traffic Management
	RIMIS IEN	Transit Management
	RIMIS IEN	Maintenance and Construction Management
	RIMIS IEN	Event Promoters
DVRPC Counties/Municipalities		

<i>Stakeholder</i>	<i>ITS Element</i>	<i>Entity</i>
DVRPC Counties/Municipalities		
	DVRPC Region Counties/Municipal TOCs	Traffic Management
	DVRPC Region Counties/Municipalities PWD Operations	Maintenance and Construction Management
	DVRPC Region Public Safety Dispatch	Emergency Management
DVRPC Transit Providers		
	DVRPC Transit Operators Systems	Transit Management
Event Promoters		
	Regional Event Promoters	Event Promoters
Financial Institution		
	Financial Institution	Financial Institution
I-95 CC - I-95 Corridor Coalition		
	I-95 CC Information Exchange Network	Traffic Management
	I-95 CC Information Exchange Network	Other Traffic Management
IAG Agencies		
	E-ZPass CSC	Toll Administration
	E-ZPass CSC	Financial Institution
	Other Facility (Toll) Commercial Vehicle Check	Commercial Vehicle Check
	Other Facility (Toll) ITS Field Equipment	Roadway Subsystem
	Other Facility (Toll) Operations Centers	Commercial Vehicle Administration
	Other Facility (Toll) Operations Centers	Traffic Management
	Other Facility (Toll) Website	Information Service Provider
Media		
	Print and Broadcast Media	Media
Multimodal Transfer Terminal/Station Providers		
	Multimodal Passenger Air and Water Terminals/Stations	Multimodal Transportation Service Provider
National and Regional Airlines		
	National Airline Information Centers	Multimodal Transportation Service Provider
	Regional Airline Operations	Multimodal Transportation Service Provider
National Park Service		
	National Park Service Management Center	Emergency Management
	National Park Service Management Center	Information Service Provider
	National Park Service Management Center	Traffic Management
	National Park Service Management Center	Parking Management
Newark Pennsylvania Station		
	Newark Pennsylvania Station Control Center	Multimodal Transportation Service Provider
	Newark Pennsylvania Station Information Displays	Remote Traveler Support
NJ TRANSIT Bus		
	NJT Bus Archive	Archived Data Management Subsystem
	NJT Bus Operations North	Transit Management
	NJT Bus Operations North	Multimodal Transportation Service Provider
	NJT Bus Operations North	Other Transit Management
	NJT Bus Operations South	Transit Management
	NJT Bus PABT Management System (TRANSMIT)	Transit Management
	NJT Bus Vehicles	Transit Vehicle Subsystem
NJ TRANSIT Corporate		
	NJT Archive Users	Archived Data User Systems
	NJT Fare Management System	Financial Institution
	NJT Fare Management System	Transit Management
	NJT Fare Point of Sale	Remote Traveler Support
	NJT Global Archive	Archived Data Management Subsystem
	NJT Parking Facilities	Parking Management
	NJT Transit Itinerary Planning System	Information Service Provider

<i>Stakeholder</i>	<i>ITS Element</i>	<i>Entity</i>
NJ TRANSIT Corporate		
	NJTPA Region Transit Coordination Network	Other Transit Management
	NJTPA Region Transit Coordination Network	Transit Management
NJ TRANSIT Customer Service		
	NJT Corporate Customer Information / Display Systems	Remote Traveler Support
	NJT Corporate Customer Information Center Systems	Information Service Provider
	NJT Corporate Customer Information Center Systems	Transit Management
NJ TRANSIT Paratransit		
	NJT Access Link Dispatch	Transit Management
	NJT Access Link Vehicles	Transit Vehicle Subsystem
NJ TRANSIT Police		
	NJT Facility Security Equipment	Remote Traveler Support
	NJT Facility Security Equipment	Security Monitoring Subsystem
	NJT Police Dispatch / Command Center	Other Emergency Management
	NJT Police Dispatch / Command Center	Emergency Management
	NJT Police Dispatch / Command Center	Enforcement Agency
NJ TRANSIT Rail		
	NJT LRT - Hudson-Bergen Operations Center	Rail Operations
	NJT LRT - Hudson-Bergen Operations Center	Transit Management
	NJT LRT - Hudson-Bergen Rail Vehicles	Transit Vehicle Subsystem
	NJT LRT - Newark City Subway Operations Center	Transit Management
	NJT LRT - Newark City Subway Operations Center	Rail Operations
	NJT LRT - Newark City Subway Vehicles	Transit Vehicle Subsystem
	NJT LRT - River Line Operations Center	Rail Operations
	NJT LRT - River Line Operations Center	Transit Management
	NJT Rail Archive	Archived Data Management Subsystem
	NJT Rail Grade Crossing Protection	Wayside Equipment
	NJT Rail Operations Center Systems	Emergency Management
	NJT Rail Operations Center Systems	Transit Management
	NJT Rail Operations Center Systems	Rail Operations
	NJT Rail Operations Center Systems	Multimodal Transportation Service Provider
	NJT Rail RWIS Database	Archived Data Management Subsystem
	NJT Rail Trains	Transit Vehicle Subsystem
NJDEP - New Jersey Department of Environmental Protection		
	NJDEP HAZMAT Permit System	Commercial Vehicle Administration
	NJDEP State Parks	Traffic Management
	NJDEP State Parks	Parking Management
	NJDEP State Parks	Emergency Management
NJDOT - New Jersey Department of Transportation		
	NJ CVO Safety Archive Database	Archived Data Management Subsystem
	NJDOT 511 System	Information Service Provider
	NJDOT Accident Reporting System	Archived Data Management Subsystem
	NJDOT Central ITS Field Equipment	Roadway Subsystem
	NJDOT Central Traveler Information System	Information Service Provider
	NJDOT Construction Management System	Maintenance and Construction Management
	NJDOT Data Archive Users	Archived Data User Systems
	NJDOT Highway Performance Monitoring System (HPMS)	Archived Data Management Subsystem
	NJDOT Maintenance	Maintenance and Construction Management
	NJDOT North ITS Field Equipment	Roadway Subsystem
	NJDOT North Traveler Information System	Information Service Provider
	NJDOT REOC Central	Maintenance and Construction Management
	NJDOT REOC Central	Traffic Management

NJDOT - New Jersey Department of Transportation

NJDOT REOC North	Traffic Management
NJDOT REOC North	Maintenance and Construction Management
NJDOT South Traveler Information System	Information Service Provider
NJDOT STOC	Traffic Management
NJDOT STOC	Transit Management
NJDOT STOC	Maintenance and Construction Management
NJDOT STOC	Information Service Provider
NJDOT STOC	Other Traffic Management
NJDOT STOC	Emergency Management
NJDOT TEOC	Emergency Management
NJDOT TEOC	Traffic Management
NJDOT TEOC	Maintenance and Construction Management
NJDOT TOC Central	Maintenance and Construction Management
NJDOT TOC Central	Other Traffic Management
NJDOT TOC Central	Emergency Management
NJDOT TOC Central	Traffic Management
NJDOT TOC North	Other Traffic Management
NJDOT TOC North	Emergency Management
NJDOT TOC North	Traffic Management
NJDOT TOC North	Maintenance and Construction Management
NJDOT TOC South	Traffic Management
NJDOT TOC South	Other Traffic Management
NJDOT TOC South	Maintenance and Construction Management
NJDOT TOC South	Emergency Management
NJDOT Website	Information Service Provider
NJTPA Region Probe Data	Archived Data Management Subsystem
Statewide RWIS Database	Archived Data Management Subsystem

NJSP - New Jersey State Police

NJ State Office of Emergency Management	Other Emergency Management
NJ State Office of Emergency Management	Emergency Management
NJSP Commercial Carrier/Safety Inspection Unit	Enforcement Agency
NJSP Commercial Carrier/Safety Inspection Unit	Commercial Vehicle Check
NJSP Dispatch - Troop A, B, C	Emergency Management
NJSP Dispatch - Troop D	Emergency Management
NJSP Dispatch - Troop D	Enforcement Agency
NJSP Dispatch - Troop E	Emergency Management
NJSP Dispatch - Troop E	Enforcement Agency
NJSP Traffic Records Management	Archived Data Management Subsystem

NJSP/NJDOT/NJDEP Statewide Dispatch Center

NJSP/NJDOT Statewide Dispatch Center	Emergency Management
NJSP/NJDOT Statewide Dispatch Center	Traffic Management
NJSP/NJDOT Statewide Dispatch Center	Other Emergency Management
NJSP/NJDOT Statewide Dispatch Center	Enforcement Agency

NJTA - New Jersey Turnpike Authority

NJTA HAZMAT Permit System	Commercial Vehicle Administration
NJTA IVR	Information Service Provider
NJTA Parkway Division Maintenance	Maintenance and Construction Management
NJTA Parkway Division Maintenance Vehicles	Maintenance and Construction Vehicle
NJTA Parkway Division Storage Facilities	Storage Facility
NJTA Parkway Division TOC	Traffic Management
NJTA Parkway Division TOC	Maintenance and Construction Management
NJTA Parkway Division TOC	Other Traffic Management

<i>Stakeholder</i>	<i>ITS Element</i>	<i>Entity</i>
NJTA - New Jersey Turnpike Authority		
	NJTA Parkway Division TOC	Emergency Management
	NJTA RWIS Database	Archived Data Management Subsystem
	NJTA Turnpike ITS Field Equipment	Roadway Subsystem
	NJTA Turnpike Maintenance	Maintenance and Construction Management
	NJTA Turnpike TOC	Emergency Management
	NJTA Turnpike TOC	Maintenance and Construction Management
	NJTA Turnpike TOC	Other Traffic Management
	NJTA Turnpike TOC	Traffic Management
	NJTA Website	Information Service Provider
NJTPA - North Jersey Transportation Planning Authority		
	NJTPA ITS Data Archive	Archived Data Management Subsystem
	NJTPA Planning Staff Systems	Archived Data User Systems
	NJTPA Region RWIS Database	Archived Data Management Subsystem
	Subregional Data Archives	Archived Data Management Subsystem
	Subregional Data Users	Archived Data User Systems
NJTPA Counties		
	NJTPA Counties Drawbridge Equipment	Multimodal Crossings
	NJTPA Counties ITS Field Equipment	Roadway Subsystem
	NJTPA Counties PWD Equipment Repair Facilities	Equipment Repair Facility
	NJTPA Counties PWD Operations	Maintenance and Construction Management
	NJTPA Counties PWD Storage Facilities	Storage Facility
	NJTPA Counties PWD Vehicles	Maintenance and Construction Vehicle
	NJTPA Counties TOCs	Traffic Management
	NJTPA Counties TOCs	Other Traffic Management
	NJTPA Counties/Municipalities Websites	Information Service Provider
	Other NJTPA Counties PWD Operations	Maintenance and Construction Management
	Other NJTPA Counties TOCs	Traffic Management
NJTPA Municipalities		
	NJTPA Municipalities ITS Field Equipment	Roadway Subsystem
	NJTPA Municipalities PWD Equipment Repair Facilities	Equipment Repair Facility
	NJTPA Municipalities PWD Operations	Maintenance and Construction Management
	NJTPA Municipalities PWD Vehicles	Maintenance and Construction Vehicle
	NJTPA Municipalities Storage Facilities	Storage Facility
	NJTPA Municipalities TOCs	Traffic Management
	NJTPA Municipalities TOCs	Other Traffic Management
	Other NJTPA Municipalities PWD Operations	Maintenance and Construction Management
	Other NJTPA Municipalities TOCs	Traffic Management
NJTPA Public Safety Agencies		
	NJTPA Counties EOCs	Emergency Management
	NJTPA Counties/Municipalities EMS/Fire Vehicles	Emergency Vehicle Subsystem
	NJTPA Municipalities EOCs	Emergency Management
	NJTPA Region Incident and Mutual Aid Network	Other Emergency Management
	NJTPA Region Incident and Mutual Aid Network	Emergency Management
	NJTPA Region Public Safety Dispatch	Emergency Management
	NJTPA Region Sheriffs/Police Vehicles	Emergency Vehicle Subsystem
NJTPA Transit Operators		
	NJTPA Counties/Municipalities Transit Customer Information / Display Systems	Remote Traveler Support
	NJTPA Counties/Municipalities Transit Fare Management Systems	Transit Management
	NJTPA Counties/Municipalities Transit Systems	Transit Management
	NJTPA Counties/Municipalities Transit Vehicles	Transit Vehicle Subsystem

<i>Stakeholder</i>	<i>ITS Element</i>	<i>Entity</i>
NYC Joint TMC		
	New York City Joint TMC	Other Traffic Management
	New York City Joint TMC	Emergency Management
	New York City Joint TMC	Other Emergency Management
	New York City Joint TMC	Maintenance and Construction Management
	New York City Joint TMC	Emissions Management
	New York City Joint TMC	Traffic Management
NYMTC - New York Metropolitan Transportation Council		
	NYMTC/DCP Regional Planning Database	Archived Data Management Subsystem
NYSDOT - New York State Department of Transportation		
	NYSDOT IEN	Traffic Management
	NYSDOT Region 8 TMC	Traffic Management
NYSTA - New York State Thruway Authority		
	NYSTA Operations Center	Traffic Management
	NYSTA Operations Center	Other Traffic Management
Other States Public Safety Departments		
	Other States OEMs	Emergency Management
	Other States Public Safety Department	Emergency Management
	Pennsylvania State Police	Emergency Management
Palisades Interstate Park Commission		
	Palisades Interstate Parkway HQ	Traffic Management
	Palisades Interstate Parkway ITS Field Equipment	Roadway Subsystem
	Palisades Interstate Parkway Police	Emergency Management
PANYNJ		
	PANYNJ Traveler Information Systems	Information Service Provider
PANYNJ Airports		
	PANYNJ Airports AirTrain Operations Center	Multimodal Transportation Service Provider
	PANYNJ Airports AirTrain Operations Center	Transit Management
	PANYNJ Airports Communications Desk/Operations Center	Multimodal Transportation Service Provider
	PANYNJ Airports Communications Desk/Operations Center	Transit Management
	PANYNJ Airports Communications Desk/Operations Center	Traffic Management
	PANYNJ Airports Communications Desk/Operations Center	Maintenance and Construction Management
	PANYNJ Airports Field Equipment	Roadway Subsystem
	PANYNJ Airports In-Terminal Customer Information Systems	Remote Traveler Support
	PANYNJ Airports Traveler Information Systems	Information Service Provider
PANYNJ PAPD		
	PANYNJ PAPD 211 Communications Center Dispatch	Enforcement Agency
	PANYNJ PAPD 211 Communications Center Dispatch	Emergency Management
PANYNJ PATH		
	PANYNJ PATH CCTV Cameras	Remote Traveler Support
	PANYNJ PATH Fare Management System	Transit Management
	PANYNJ PATH Fare Point of Sale	Remote Traveler Support
	PANYNJ PATH Operations Center	Multimodal Transportation Service Provider
	PANYNJ PATH Operations Center	Transit Management
	PANYNJ PATH Operations Center	Maintenance and Construction Management
	PANYNJ PATH Operations Center	Emergency Management
	PANYNJ PATH PATHVISION	Remote Traveler Support
	PANYNJ PATH SmartCard	Traveler Card
	PANYNJ PATH Transit Vehicles	Transit Vehicle Subsystem
	PANYNJ PATH Traveler Information Systems	Information Service Provider
	PANYNJ PATH Vehicle Detection System	Roadway Subsystem

<i>Stakeholder</i>	<i>ITS Element</i>	<i>Entity</i>
PANYNJ PATH		
	PANYNJ PATH Vehicle Detection System	Transit Management
PANYNJ Port Commerce		
	PANYNJ Port Commerce CCTV	Roadway Subsystem
	PANYNJ Port Commerce Credentialing Back Office (SEALINK)	Commercial Vehicle Administration
	PANYNJ Port Commerce Field Equipment	Roadway Subsystem
	PANYNJ Port Commerce FIRST Web Site	Information Service Provider
	PANYNJ Port Commerce Operations Centers	Commercial Vehicle Administration
	PANYNJ Port Commerce Operations Centers	Intermodal Freight Depot
	PANYNJ Port Commerce Operations Centers	Maintenance and Construction Management
	PANYNJ Port Commerce Operations Centers	Traffic Management
	PANYNJ Port Commerce Operations Centers	Emergency Management
	PANYNJ Port Commerce Terminal Access Equipment	Commercial Vehicle Check
	PANYNJ Port Commerce Traveler Information System	Information Service Provider
PANYNJ Tunnels/Bridges/Terminals		
	PANYNJ TB/T Bridges/Tunnels Commercial Vehicle Check	Commercial Vehicle Check
	PANYNJ TB/T Bus Ramp Field Equipment	Roadway Subsystem
	PANYNJ TB/T Bus Terminals/Internal Roads Field Equipment	Roadway Subsystem
	PANYNJ TB/T Bus Terminals/Stations Communications Desk/Operations Center	Multimodal Transportation Service Provider
	PANYNJ TB/T Bus Terminals/Stations Communications Desk/Operations Center	Transit Management
	PANYNJ TB/T Bus Terminals/Stations Communications Desk/Operations Center	Traffic Management
	PANYNJ TB/T Bus Terminals/Stations Field Equipment	Roadway Subsystem
	PANYNJ TB/T Bus Terminals/Stations In-Terminal Customer Information Systems	Remote Traveler Support
	PANYNJ TB/T Bus Terminals/Stations Traveler Information System	Information Service Provider
	PANYNJ TB/T Customer Relations Division	Information Service Provider
	PANYNJ TB/T Infrastructure Security Equipment	Security Monitoring Subsystem
	PANYNJ TB/T Maintenance Unit	Maintenance and Construction Management
	PANYNJ TB/T Maintenance Vehicles	Maintenance and Construction Vehicle
	PANYNJ TB/T Tunnels/Bridges Communications Desk/Operations Center	Commercial Vehicle Administration
	PANYNJ TB/T Tunnels/Bridges Communications Desk/Operations Center	Traffic Management
	PANYNJ TB/T Tunnels/Bridges Communications Desk/Operations Center	Maintenance and Construction Management
	PANYNJ TB/T Tunnels/Bridges Communications Desk/Operations Center	Emergency Management
	PANYNJ TB/T Tunnels/Bridges Emergency Response Vehicles	Emergency Vehicle Subsystem
	PANYNJ TB/T Tunnels/Bridges Field Equipment	Roadway Subsystem
	PANYNJ TB/T Tunnels/Bridges Traveler Information System	Information Service Provider
Parking Facility Operators		
	Parking Facility Operators	Parking Management
	Parking Facility Operators	Toll Collection
PennDOT - Pennsylvania Department of Transportation		
	PennDOT District 4 TOC	Traffic Management
	PennDOT District 5 TOC	Traffic Management
	PennDOT District 6 TCC	Traffic Management
	PennDOT District 6 TCC	Other Traffic Management
	PennDOT Statewide TOC	Traffic Management

Stakeholder	ITS Element	Entity
Private Commercial Vehicle and Fleet Operators		
	Private Commercial and Fleet Vehicles	Vehicle
	Private Commercial and Fleet Vehicles	Commercial Vehicle Subsystem
	Private Commercial Vehicle and Fleet Dispatch	Fleet and Freight Management
Private Cruise Operators		
	Private Cruise Operators	Multimodal Transportation Service Provider
Private Ferry Operators		
	Private Ferry Operators Fare Management Systems	Transit Management
	Private Ferry Operators Ferries	Transit Vehicle Subsystem
	Private Ferry Operators Landside Shuttles	Transit Vehicle Subsystem
	Private Ferry Operators Systems	Transit Management
	Private Ferry Operators Traveler Information Systems	Information Service Provider
Private HAZMAT Security Provider		
	Private HAZMAT Security Provider	Information Service Provider
Private ISPs		
	Private ISPs	Information Service Provider
Private Passenger Rail Operators		
	Private Passenger Rail	Transit Management
	Private Passenger Rail	Other Traffic Management
Private Transit Operators		
	Private Demand Response Operators Central Systems	Transit Management
	Private Demand Response Operators Fare Management Systems	Transit Management
	Private Demand Response Operators Vehicles	Transit Vehicle Subsystem
	Private Fixed-Route Bus/Shuttle Operators Fare Management Systems	Transit Management
	Private Fixed-Route Transit Bus/Shuttle Operators	Transit Management
	Private Fixed-Route Transit Bus/Shuttle Operators Vehicles	Transit Vehicle Subsystem
	Private Long-Distance Bus Operators Systems	Transit Management
Private Venues		
	Private Venues TOCs	Traffic Management
	Private Venues TOCs	Emergency Management
PTC - Pennsylvania Turnpike Commission		
	PTC Operations Center	Other Traffic Management
	PTC Operations Center	Traffic Management
Public or Private Smart Card Providers		
	NJ Universal Smart Card	Traveler Card
Railroad Operators		
	Railroad Operation Centers	Rail Operations
	Railroad Operators Wayside Equipment	Wayside Equipment
Regional Airport Authorities		
	Regional Airport Operations	Multimodal Transportation Service Provider
Regional GIS and Map Providers		
	Regional GIS/Mapping Systems	Map Update Provider
Regional Hospitals		
	Regional Hospitals	Care Facility
Regulatory Agencies		
	FHWA Data Users	Archived Data User Systems
	FRA Data Users	Archived Data User Systems
	FTA Data Users	Archived Data User Systems
Rutgers University		
	Rutgers Campus Shuttle System	Transit Management

<i>Stakeholder</i>	<i>ITS Element</i>	<i>Entity</i>
Rutgers University		
	Rutgers Campus Shuttle Website	Information Service Provider
	Rutgers Campus Shuttles	Transit Vehicle Subsystem
School Districts		
	School Bus Operators	Transit Management
	School Buses	Transit Vehicle Subsystem
SJTA - South Jersey Transportation Authority		
	SJTA Kiosks	Remote Traveler Support
	SJTA TOC	Emergency Management
	SJTA TOC	Maintenance and Construction Management
	SJTA TOC	Other Traffic Management
	SJTA TOC	Traffic Management
	SJTA Transportation Services Division	Transit Management
	SJTA Traveler Information System	Information Service Provider
SJTPO - South Jersey Transportation Planning Organization		
	SJTPO ITS Data Archive	Archived Data Management Subsystem
SJTPO Counties		
	SJTPO Counties PWD Operations	Maintenance and Construction Management
	SJTPO Counties TOCs	Traffic Management
	SJTPO Counties TOCs	Other Traffic Management
SJTPO Municipalities		
	SJTPO Municipalities PWD Operations	Maintenance and Construction Management
	SJTPO Municipalities TOCs	Traffic Management
	SJTPO Municipalities TOCs	Other Traffic Management
SJTPO Public Safety Agencies		
	SJTPO Counties EOCs	Emergency Management
	SJTPO Region Public Safety Dispatch	Emergency Management
SJTPO Transit Operators		
	SJTPO Counties/Municipalities Transit Systems	Transit Management
State of New Jersey		
	NJ CVIEW System	Commercial Vehicle Administration
Statewide Fare Reciprocity Administrator		
	NJTPA Regional Fare Reciprocity Network	Transit Management
TMA - Transportation Management Association		
	NJTPA Region TMA Fare Management Systems	Transit Management
	NJTPA Region TMA Kiosks	Remote Traveler Support
	NJTPA Region TMA Systems	Transit Management
	NJTPA Region TMA Traveler Information Systems	Information Service Provider
	TMA Vehicles	Transit Vehicle Subsystem
TRANSCOM		
	TRANSCOM Archived Data Management System	Archived Data Management Subsystem
	TRANSCOM Communications Center Servers	Other MCM
	TRANSCOM Communications Center Servers	Emergency Management
	TRANSCOM Communications Center Servers	Information Service Provider
	TRANSCOM Communications Center Servers	Traffic Management
	TRANSCOM Communications Center Servers	Transit Management
	TRANSCOM Communications Center Servers	Maintenance and Construction Management
	TRANSCOM Communications Center Servers	Event Promoters
	TRANSCOM Communications Center Servers	Other Emergency Management
	TRANSCOM Communications Center Servers	Other Traffic Management
	TRANSCOM Communications Center Servers	Other Transit Management

<i>Stakeholder</i>	<i>ITS Element</i>	<i>Entity</i>
TRANSCOM		
	TRANSCOM Kiosks	Remote Traveler Support
	TRANSCOM TRIPS123 Subscriber Systems	Personal Information Access
	TRANSCOM TRIPS123 Traveler Information System	Other Transit Management
	TRANSCOM TRIPS123 Traveler Information System	Transit Management
	TRANSCOM TRIPS123 Traveler Information System	Information Service Provider
	TRANSCOM XBL Corridor Field Equipment	Roadway Subsystem
TRANSMIT Agencies		
	TRANSMIT Agencies TRANSMIT Servers	Traffic Management
Transportation Information Users		
	Transportation Information Users Systems	Archived Data User Systems
Travelers		
	Travelers Personal Computing Devices	Fleet and Freight Management
	Travelers Personal Computing Devices	Personal Information Access
	Travelers Vehicles	Vehicle
Weather Service Provider		
	Weather Service Provider Systems	Weather Service
WILMAPCO		
	Wilmington Area Planning Council (WILMAPCO) ITS Data Archive	Archived Data Management Subsystem

Appendix 4.C

ITS Inventory – Sorted By Entity

Inventory by Entity

<i>Entity</i>	<i>ITS Element</i>	<i>Stakeholder</i>
Archived Data Management Subsystem		
	DVRPC ITS Data Archive	DVRPC - Delaware Valley Regional Planning Commission
	NJ CVO Safety Archive Database	NJDOT - New Jersey Department of Transportation
	NJDOT Accident Reporting System	NJDOT - New Jersey Department of Transportation
	NJDOT Highway Performance Monitoring System (HPMS)	NJDOT - New Jersey Department of Transportation
	NJSP Traffic Records Management	NJSP - New Jersey State Police
	NJT Bus Archive	NJ TRANSIT Bus
	NJT Global Archive	NJ TRANSIT Corporate
	NJT Rail Archive	NJ TRANSIT Rail
	NJT Rail RWIS Database	NJ TRANSIT Rail
	NJTA RWIS Database	NJTA - New Jersey Turnpike Authority
	NJTPA ITS Data Archive	NJTPA - North Jersey Transportation Planning Authority
	NJTPA Region Probe Data	NJDOT - New Jersey Department of Transportation
	NJTPA Region RWIS Database	NJTPA - North Jersey Transportation Planning Authority
	NYMTC/DCP Regional Planning Database	NYMTC - New York Metropolitan Transportation Council
	SJTPO ITS Data Archive	SJTPO - South Jersey Transportation Planning Organization
	Statewide RWIS Database	NJDOT - New Jersey Department of Transportation
	Subregional Data Archives	NJTPA - North Jersey Transportation Planning Authority
	TRANSCOM Archived Data Management System	TRANSCOM
	Wilmington Area Planning Council (WILMAPCO) ITS Data Archive	WILMAPCO
Archived Data User Systems		
	FHWA Data Users	Regulatory Agencies
	FRA Data Users	Regulatory Agencies
	FTA Data Users	Regulatory Agencies
	NJDOT Data Archive Users	NJDOT - New Jersey Department of Transportation
	NJT Archive Users	NJ TRANSIT Corporate
	NJTPA Planning Staff Systems	NJTPA - North Jersey Transportation Planning Authority
	Subregional Data Users	NJTPA - North Jersey Transportation Planning Authority
	Transportation Information Users Systems	Transportation Information Users
Care Facility		
	Regional Hospitals	Regional Hospitals
Commercial Vehicle Administration		
	DRJTBC Facility Operations Center	DRJTBC - Delaware River Joint Toll Bridge Commission
	NJ CVIEW System	State of New Jersey
	NJDEP HAZMAT Permit System	NJDEP - New Jersey Department of Environmental Protection
	NJTA HAZMAT Permit System	NJTA - New Jersey Turnpike Authority
	Other Facility (Toll) Operations Centers	IAG Agencies
	PANYNJ Port Commerce Credentialing Back Office (SEALINK)	PANYNJ Port Commerce
	PANYNJ Port Commerce Operations Centers	PANYNJ Port Commerce
	PANYNJ TB/T Tunnels/Bridges Communications Desk/Operations Center	PANYNJ Tunnels/Bridges/Terminals

<i>Entity</i>	<i>ITS Element</i>	<i>Stakeholder</i>
Commercial Vehicle Check		
	DRJTBC Facility Commercial Vehicle Check	DRJTBC - Delaware River Joint Toll Bridge Commission
	NJSP Commercial Carrier/Safety Inspection Unit	NJSP - New Jersey State Police
	Other Facility (Toll) Commercial Vehicle Check	IAG Agencies
	PANYNJ Port Commerce Terminal Access Equipment	PANYNJ Port Commerce
	PANYNJ TB/T Bridges/Tunnels Commercial Vehicle Check	PANYNJ Tunnels/Bridges/Terminals
Commercial Vehicle Subsystem		
	Private Commercial and Fleet Vehicles	Private Commercial Vehicle and Fleet Operators
Emergency Management		
	AMTRAK Emergency Dispatch	AMTRAK
	DVRPC Region Public Safety Dispatch	DVRPC Counties/Municipalities
	National Park Service Management Center	National Park Service
	New York City Joint TMC	NYC Joint TMC
	NJ State Office of Emergency Management	NJSP - New Jersey State Police
	NJDEP State Parks	NJDEP - New Jersey Department of Environmental Protection
	NJDOT STOC	NJDOT - New Jersey Department of Transportation
	NJDOT TEOC	NJDOT - New Jersey Department of Transportation
	NJDOT TOC Central	NJDOT - New Jersey Department of Transportation
	NJDOT TOC North	NJDOT - New Jersey Department of Transportation
	NJDOT TOC South	NJDOT - New Jersey Department of Transportation
	NJSP Dispatch - Troop A, B, C	NJSP - New Jersey State Police
	NJSP Dispatch - Troop D	NJSP - New Jersey State Police
	NJSP Dispatch - Troop E	NJSP - New Jersey State Police
	NJSP/NJDOT Statewide Dispatch Center	NJSP/NJDOT/NJDEP Statewide Dispatch Center
	NJT Police Dispatch / Command Center	NJ TRANSIT Police
	NJT Rail Operations Center Systems	NJ TRANSIT Rail
	NJTA Parkway Division TOC	NJTA - New Jersey Turnpike Authority
	NJTA Turnpike TOC	NJTA - New Jersey Turnpike Authority
	NJTPA Counties EOCs	NJTPA Public Safety Agencies
	NJTPA Municipalities EOCs	NJTPA Public Safety Agencies
	NJTPA Region Incident and Mutual Aid Network	NJTPA Public Safety Agencies
	NJTPA Region Public Safety Dispatch	NJTPA Public Safety Agencies
	Other States OEMs	Other States Public Safety Departments
	Other States Public Safety Department	Other States Public Safety Departments
	Palisades Interstate Parkway Police	Palisades Interstate Park Commission
	PANYNJ PAPD 211 Communications Center Dispatch	PANYNJ PAPD
	PANYNJ PATH Operations Center	PANYNJ PATH
	PANYNJ Port Commerce Operations Centers	PANYNJ Port Commerce
	PANYNJ TB/T Tunnels/Bridges Communications Desk/Operations Center	PANYNJ Tunnels/Bridges/Terminals
	Pennsylvania State Police	Other States Public Safety Departments
	Private Venues TOCs	Private Venues
	RIMIS IEN	DVRPC - Delaware Valley Regional Planning Commission
	SJTA TOC	SJTA - South Jersey Transportation Authority

<i>Entity</i>	<i>ITS Element</i>	<i>Stakeholder</i>
Emergency Management		
	SJTPO Counties EOCs	SJTPO Public Safety Agencies
	SJTPO Region Public Safety Dispatch	SJTPO Public Safety Agencies
	TRANSCOM Communications Center Servers	TRANSCOM
Emergency Vehicle Subsystem		
	DRJTBC Emergency Vehicles	DRJTBC - Delaware River Joint Toll Bridge Commission
	NJTPA Counties/Municipalities EMS/Fire Vehicles	NJTPA Public Safety Agencies
	NJTPA Region Sheriffs/Police Vehicles	NJTPA Public Safety Agencies
	PANYNJ TB/T Tunnels/Bridges Emergency Response Vehicles	PANYNJ Tunnels/Bridges/Terminals
Emissions Management		
	New York City Joint TMC	NYC Joint TMC
Enforcement Agency		
	NJSP Commercial Carrier/Safety Inspection Unit	NJSP - New Jersey State Police
	NJSP Dispatch - Troop D	NJSP - New Jersey State Police
	NJSP Dispatch - Troop E	NJSP - New Jersey State Police
	NJSP/NJDOT Statewide Dispatch Center	NJSP/NJDOT/NJDEP Statewide Dispatch Center
	NJT Police Dispatch / Command Center	NJ TRANSIT Police
	PANYNJ PAPD 211 Communications Center Dispatch	PANYNJ PAPD
Equipment Repair Facility		
	NJTPA Counties PWD Equipment Repair Facilities	NJTPA Counties
	NJTPA Municipalities PWD Equipment Repair Facilities	NJTPA Municipalities
Event Promoters		
	Regional Event Promoters	Event Promoters
	RIMIS IEN	DVRPC - Delaware Valley Regional Planning Commission
	TRANSCOM Communications Center Servers	TRANSCOM
Financial Institution		
	E-ZPass CSC	IAG Agencies
	Financial Institution	Financial Institution
	NJT Fare Management System	NJ TRANSIT Corporate
Fleet and Freight Management		
	Private Commercial Vehicle and Fleet Dispatch	Private Commercial Vehicle and Fleet Operators
	Travelers Personal Computing Devices	Travelers
Information Service Provider		
	Cross County Connection TMA Systems	Cross County Connection TMA
	DRJTBC Website	DRJTBC - Delaware River Joint Toll Bridge Commission
	National Park Service Management Center	National Park Service
	NJDOT 511 System	NJDOT - New Jersey Department of Transportation
	NJDOT Central Traveler Information System	NJDOT - New Jersey Department of Transportation
	NJDOT North Traveler Information System	NJDOT - New Jersey Department of Transportation
	NJDOT South Traveler Information System	NJDOT - New Jersey Department of Transportation
	NJDOT STOC	NJDOT - New Jersey Department of Transportation
	NJDOT Website	NJDOT - New Jersey Department of Transportation
	NJT Corporate Customer Information Center Systems	NJ TRANSIT Customer Service

<i>Entity</i>	<i>ITS Element</i>	<i>Stakeholder</i>
Information Service Provider		
	NJT Transit Itinerary Planning System	NJ TRANSIT Corporate
	NJTA IVR	NJTA - New Jersey Turnpike Authority
	NJTA Website	NJTA - New Jersey Turnpike Authority
	NJTPA Counties/Municipalities Websites	NJTPA Counties
	NJTPA Region TMA Traveler Information Systems	TMA - Transportation Management Association
	Other Facility (Toll) Website	IAG Agencies
	PANYNJ Airports Traveler Information Systems	PANYNJ Airports
	PANYNJ PATH Traveler Information Systems	PANYNJ PATH
	PANYNJ Port Commerce FIRST Web Site	PANYNJ Port Commerce
	PANYNJ Port Commerce Traveler Information System	PANYNJ Port Commerce
	PANYNJ TB/T Bus Terminals/Stations Traveler Information System	PANYNJ Tunnels/Bridges/Terminals
	PANYNJ TB/T Customer Relations Division	PANYNJ Tunnels/Bridges/Terminals
	PANYNJ TB/T Tunnels/Bridges Traveler Information System	PANYNJ Tunnels/Bridges/Terminals
	PANYNJ Traveler Information Systems	PANYNJ
	Private Ferry Operators Traveler Information Systems	Private Ferry Operators
	Private HAZMAT Security Provider	Private HAZMAT Security Provider
	Private ISPs	Private ISPs
	RIMIS IEN	DVRPC - Delaware Valley Regional Planning Commission
	Rutgers Campus Shuttle Website	Rutgers University
	SJTA Traveler Information System	SJTA - South Jersey Transportation Authority
	TRANSCOM Communications Center Servers	TRANSCOM
	TRANSCOM TRIPS123 Traveler Information System	TRANSCOM
Intermodal Freight Depot		
	PANYNJ Port Commerce Operations Centers	PANYNJ Port Commerce
Maintenance and Construction Management		
	DRJTBC District Operations	DRJTBC - Delaware River Joint Toll Bridge Commission
	DRJTBC Facility Operations Center	DRJTBC - Delaware River Joint Toll Bridge Commission
	DVRPC Region Counties/Municipalities PWD Operations	DVRPC Counties/Municipalities
	New York City Joint TMC	NYC Joint TMC
	NJDOT Construction Management System	NJDOT - New Jersey Department of Transportation
	NJDOT Maintenance	NJDOT - New Jersey Department of Transportation
	NJDOT REOC Central	NJDOT - New Jersey Department of Transportation
	NJDOT REOC North	NJDOT - New Jersey Department of Transportation
	NJDOT STOC	NJDOT - New Jersey Department of Transportation
	NJDOT TEOC	NJDOT - New Jersey Department of Transportation
	NJDOT TOC Central	NJDOT - New Jersey Department of Transportation
	NJDOT TOC North	NJDOT - New Jersey Department of Transportation
	NJDOT TOC South	NJDOT - New Jersey Department of Transportation
	NJTA Parkway Division Maintenance	NJTA - New Jersey Turnpike Authority
	NJTA Parkway Division TOC	NJTA - New Jersey Turnpike Authority
	NJTA Turnpike Maintenance	NJTA - New Jersey Turnpike Authority
	NJTA Turnpike TOC	NJTA - New Jersey Turnpike Authority

<i>Entity</i>	<i>ITS Element</i>	<i>Stakeholder</i>
Maintenance and Construction Management		
	NJTPA Counties PWD Operations	NJTPA Counties
	NJTPA Municipalities PWD Operations	NJTPA Municipalities
	Other NJTPA Counties PWD Operations	NJTPA Counties
	Other NJTPA Municipalities PWD Operations	NJTPA Municipalities
	PANYNJ Airports Communications Desk/Operations Center	PANYNJ Airports
	PANYNJ PATH Operations Center	PANYNJ PATH
	PANYNJ Port Commerce Operations Centers	PANYNJ Port Commerce
	PANYNJ TB/T Maintenance Unit	PANYNJ Tunnels/Bridges/Terminals
	PANYNJ TB/T Tunnels/Bridges Communications Desk/Operations Center	PANYNJ Tunnels/Bridges/Terminals
	RIMIS IEN	DVRPC - Delaware Valley Regional Planning Commission
	SJTA TOC	SJTA - South Jersey Transportation Authority
	SJTPO Counties PWD Operations	SJTPO Counties
	SJTPO Municipalities PWD Operations	SJTPO Municipalities
	TRANSCOM Communications Center Servers	TRANSCOM
Maintenance and Construction Vehicle		
	DRJTBC Maintenance Vehicle	DRJTBC - Delaware River Joint Toll Bridge Commission
	NJTA Parkway Division Maintenance Vehicles	NJTA - New Jersey Turnpike Authority
	NJTPA Counties PWD Vehicles	NJTPA Counties
	NJTPA Municipalities PWD Vehicles	NJTPA Municipalities
	PANYNJ TB/T Maintenance Vehicles	PANYNJ Tunnels/Bridges/Terminals
Map Update Provider		
	Regional GIS/Mapping Systems	Regional GIS and Map Providers
Media		
	Print and Broadcast Media	Media
Multimodal Crossings		
	NJTPA Counties Drawbridge Equipment	NJTPA Counties
Multimodal Transportation Service Provider		
	AMTRAK New Jersey Operations Centers	AMTRAK
	Multimodal Passenger Air and Water Terminals/Stations	Multimodal Transfer Terminal/Station Providers
	National Airline Information Centers	National and Regional Airlines
	Newark Pennsylvania Station Control Center	Newark Pennsylvania Station
	NJT Bus Operations North	NJ TRANSIT Bus
	NJT Rail Operations Center Systems	NJ TRANSIT Rail
	PANYNJ Airports AirTrain Operations Center	PANYNJ Airports
	PANYNJ Airports Communications Desk/Operations Center	PANYNJ Airports
	PANYNJ PATH Operations Center	PANYNJ PATH
	PANYNJ TB/T Bus Terminals/Stations Communications Desk/Operations Center	PANYNJ Tunnels/Bridges/Terminals
	Private Cruise Operators	Private Cruise Operators
	Regional Airline Operations	National and Regional Airlines
	Regional Airport Operations	Regional Airport Authorities
Other Emergency Management		
	New York City Joint TMC	NYC Joint TMC

<i>Entity</i>	<i>ITS Element</i>	<i>Stakeholder</i>
Other Emergency Management		
	NJ State Office of Emergency Management	NJSP - New Jersey State Police
	NJSP/NJDOT Statewide Dispatch Center	NJSP/NJDOT/NJDEP Statewide Dispatch Center
	NJT Police Dispatch / Command Center	NJ TRANSIT Police
	NJTPA Region Incident and Mutual Aid Network	NJTPA Public Safety Agencies
	TRANSCOM Communications Center Servers	TRANSCOM
Other MCM		
	TRANSCOM Communications Center Servers	TRANSCOM
Other Traffic Management		
	Atlantic City Area Joint Operations Center	Atlantic City Area Joint Operations Center
	Burlington County Bridge Commission Facility	Burlington County Bridge Commission
	DelDOT TMC	DelDOT - Delaware Department of Transportation
	DRJTBC Facility Operations Center	DRJTBC - Delaware River Joint Toll Bridge Commission
	DRPA TMC	DRPA - Delaware River Port Authority
	I-95 CC Information Exchange Network	I-95 CC - I-95 Corridor Coalition
	New York City Joint TMC	NYC Joint TMC
	NJDOT STOC	NJDOT - New Jersey Department of Transportation
	NJDOT TOC Central	NJDOT - New Jersey Department of Transportation
	NJDOT TOC North	NJDOT - New Jersey Department of Transportation
	NJDOT TOC South	NJDOT - New Jersey Department of Transportation
	NJTA Parkway Division TOC	NJTA - New Jersey Turnpike Authority
	NJTA Turnpike TOC	NJTA - New Jersey Turnpike Authority
	NJTPA Counties TOCs	NJTPA Counties
	NJTPA Municipalities TOCs	NJTPA Municipalities
	NYSTA Operations Center	NYSTA - New York State Thruway Authority
	PennDOT District 6 TCC	PennDOT - Pennsylvania Department of Transportation
	Private Passenger Rail	Private Passenger Rail Operators
	PTC Operations Center	PTC - Pennsylvania Turnpike Commission
	RIMIS IEN	DVRPC - Delaware Valley Regional Planning Commission
	SJTA TOC	SJTA - South Jersey Transportation Authority
	SJTPO Counties TOCs	SJTPO Counties
	SJTPO Municipalities TOCs	SJTPO Municipalities
	TRANSCOM Communications Center Servers	TRANSCOM
Other Transit Management		
	NJT Bus Operations North	NJ TRANSIT Bus
	NJTPA Region Transit Coordination Network	NJ TRANSIT Corporate
	TRANSCOM Communications Center Servers	TRANSCOM
	TRANSCOM TRIPS123 Traveler Information System	TRANSCOM
Parking Management		
	National Park Service Management Center	National Park Service
	NJDEP State Parks	NJDEP - New Jersey Department of Environmental Protection
	NJT Parking Facilities	NJ TRANSIT Corporate
	Parking Facility Operators	Parking Facility Operators
Personal Information Access		

<i>Entity</i>	<i>ITS Element</i>	<i>Stakeholder</i>
Personal Information Access		
	TRANSCOM TRIPS123 Subscriber Systems	TRANSCOM
	Travelers Personal Computing Devices	Travelers
Rail Operations		
	AMTRAK National Operations Center	AMTRAK
	AMTRAK New Jersey Operations Centers	AMTRAK
	NJT LRT - Hudson-Bergen Operations Center	NJ TRANSIT Rail
	NJT LRT - Newark City Subway Operations Center	NJ TRANSIT Rail
	NJT LRT - River Line Operations Center	NJ TRANSIT Rail
	NJT Rail Operations Center Systems	NJ TRANSIT Rail
	Railroad Operation Centers	Railroad Operators
Remote Traveler Support		
	Cross County Connection TMA Kiosks	Cross County Connection TMA
	Newark Pennsylvania Station Information Displays	Newark Pennsylvania Station
	NJT Corporate Customer Information / Display Systems	NJ TRANSIT Customer Service
	NJT Facility Security Equipment	NJ TRANSIT Police
	NJT Fare Point of Sale	NJ TRANSIT Corporate
	NJTPA Counties/Municipalities Transit Customer Information / Display Systems	NJTPA Transit Operators
	NJTPA Region TMA Kiosks	TMA - Transportation Management Association
	PANYNJ Airports In-Terminal Customer Information Systems	PANYNJ Airports
	PANYNJ PATH CCTV Cameras	PANYNJ PATH
	PANYNJ PATH Fare Point of Sale	PANYNJ PATH
	PANYNJ PATH PATHVISION	PANYNJ PATH
	PANYNJ TB/T Bus Terminals/Stations In-Terminal Customer Information Systems	PANYNJ Tunnels/Bridges/Terminals
	SJTA Kiosks	SJTA - South Jersey Transportation Authority
	TRANSCOM Kiosks	TRANSCOM
Roadway Subsystem		
	DRJTBC ITS Field Equipment	DRJTBC - Delaware River Joint Toll Bridge Commission
	NJDOT Central ITS Field Equipment	NJDOT - New Jersey Department of Transportation
	NJDOT North ITS Field Equipment	NJDOT - New Jersey Department of Transportation
	NJTA Turnpike ITS Field Equipment	NJTA - New Jersey Turnpike Authority
	NJTPA Counties ITS Field Equipment	NJTPA Counties
	NJTPA Municipalities ITS Field Equipment	NJTPA Municipalities
	Other Facility (Toll) ITS Field Equipment	IAG Agencies
	Palisades Interstate Parkway ITS Field Equipment	Palisades Interstate Park Commission
	PANYNJ Airports Field Equipment	PANYNJ Airports
	PANYNJ PATH Vehicle Detection System	PANYNJ PATH
	PANYNJ Port Commerce CCTV	PANYNJ Port Commerce
	PANYNJ Port Commerce Field Equipment	PANYNJ Port Commerce
	PANYNJ TB/T Bus Ramp Field Equipment	PANYNJ Tunnels/Bridges/Terminals
	PANYNJ TB/T Bus Terminals/Internal Roads Field Equipment	PANYNJ Tunnels/Bridges/Terminals
	PANYNJ TB/T Bus Terminals/Stations Field Equipment	PANYNJ Tunnels/Bridges/Terminals

<i>Entity</i>	<i>ITS Element</i>	<i>Stakeholder</i>
Roadway Subsystem		
	PANYNJ TB/T Tunnels/Bridges Field Equipment	PANYNJ Tunnels/Bridges/Terminals
	TRANSCOM XBL Corridor Field Equipment	TRANSCOM
Security Monitoring Subsystem		
	NJT Facility Security Equipment	NJ TRANSIT Police
	PANYNJ TB/T Infrastructure Security Equipment	PANYNJ Tunnels/Bridges/Terminals
Storage Facility		
	DRJTBC Storage Facilities	DRJTBC - Delaware River Joint Toll Bridge Commission
	NJTA Parkway Division Storage Facilities	NJTA - New Jersey Turnpike Authority
	NJTPA Counties PWD Storage Facilities	NJTPA Counties
	NJTPA Municipalities Storage Facilities	NJTPA Municipalities
Toll Administration		
	E-ZPass CSC	IAG Agencies
Toll Collection		
	Parking Facility Operators	Parking Facility Operators
Traffic Management		
	Atlantic City Area Joint Operations Center	Atlantic City Area Joint Operations Center
	Burlington County Bridge Commission Facility	Burlington County Bridge Commission
	DelDOT TMC	DelDOT - Delaware Department of Transportation
	DRJTBC Facility Operations Center	DRJTBC - Delaware River Joint Toll Bridge Commission
	DRPA TMC	DRPA - Delaware River Port Authority
	DVRPC Region Counties/Municipal TOCs	DVRPC Counties/Municipalities
	I-95 CC Information Exchange Network	I-95 CC - I-95 Corridor Coalition
	National Park Service Management Center	National Park Service
	New York City Joint TMC	NYC Joint TMC
	NJDEP State Parks	NJDEP - New Jersey Department of Environmental Protection
	NJDOT REOC Central	NJDOT - New Jersey Department of Transportation
	NJDOT REOC North	NJDOT - New Jersey Department of Transportation
	NJDOT STOC	NJDOT - New Jersey Department of Transportation
	NJDOT TEOC	NJDOT - New Jersey Department of Transportation
	NJDOT TOC Central	NJDOT - New Jersey Department of Transportation
	NJDOT TOC North	NJDOT - New Jersey Department of Transportation
	NJDOT TOC South	NJDOT - New Jersey Department of Transportation
	NJSP/NJDOT Statewide Dispatch Center	NJSP/NJDOT/NJDEP Statewide Dispatch Center
	NJTA Parkway Division TOC	NJTA - New Jersey Turnpike Authority
	NJTA Turnpike TOC	NJTA - New Jersey Turnpike Authority
	NJTPA Counties TOCs	NJTPA Counties
	NJTPA Municipalities TOCs	NJTPA Municipalities
	NYS DOT IEN	NYS DOT - New York State Department of Transportation
	NYS DOT Region 8 TMC	NYS DOT - New York State Department of Transportation
	NYSTA Operations Center	NYSTA - New York State Thruway Authority
	Other Facility (Toll) Operations Centers	IAG Agencies
	Other NJTPA Counties TOCs	NJTPA Counties
	Other NJTPA Municipalities TOCs	NJTPA Municipalities

<i>Entity</i>	<i>ITS Element</i>	<i>Stakeholder</i>
Traffic Management		
	Palisades Interstate Parkway HQ	Palisades Interstate Park Commission
	PANYNJ Airports Communications Desk/Operations Center	PANYNJ Airports
	PANYNJ Port Commerce Operations Centers	PANYNJ Port Commerce
	PANYNJ TB/T Bus Terminals/Stations Communications Desk/Operations Center	PANYNJ Tunnels/Bridges/Terminals
	PANYNJ TB/T Tunnels/Bridges Communications Desk/Operations Center	PANYNJ Tunnels/Bridges/Terminals
	PennDOT District 4 TOC	PennDOT - Pennsylvania Department of Transportation
	PennDOT District 5 TOC	PennDOT - Pennsylvania Department of Transportation
	PennDOT District 6 TCC	PennDOT - Pennsylvania Department of Transportation
	PennDOT Statewide TOC	PennDOT - Pennsylvania Department of Transportation
	Private Venues TOCs	Private Venues
	PTC Operations Center	PTC - Pennsylvania Turnpike Commission
	RIMIS IEN	DVRPC - Delaware Valley Regional Planning Commission
	SJTA TOC	SJTA - South Jersey Transportation Authority
	SJTPO Counties TOCs	SJTPO Counties
	SJTPO Municipalities TOCs	SJTPO Municipalities
	TRANSCOM Communications Center Servers	TRANSCOM
	TRANSMIT Agencies TRANSMIT Servers	TRANSMIT Agencies
Transit Management		
	AMTRAK National Operations Center	AMTRAK
	AMTRAK New Jersey Operations Centers	AMTRAK
	Cross County Connection TMA Systems	Cross County Connection TMA
	DRBA Cape May - Lewes Ferry System	DRBA - Delaware River and Bay Authority
	DRPA PATCO Operations Center	DRPA PATCO - Port Authority Transit Corporation
	DVRPC Transit Operators Systems	DVRPC Transit Providers
	NJDOT STOC	NJDOT - New Jersey Department of Transportation
	NJT Access Link Dispatch	NJ TRANSIT Paratransit
	NJT Bus Operations North	NJ TRANSIT Bus
	NJT Bus Operations South	NJ TRANSIT Bus
	NJT Bus PABT Management System (TRANSMIT)	NJ TRANSIT Bus
	NJT Corporate Customer Information Center Systems	NJ TRANSIT Customer Service
	NJT Fare Management System	NJ TRANSIT Corporate
	NJT LRT - Hudson-Bergen Operations Center	NJ TRANSIT Rail
	NJT LRT - Newark City Subway Operations Center	NJ TRANSIT Rail
	NJT LRT - River Line Operations Center	NJ TRANSIT Rail
	NJT Rail Operations Center Systems	NJ TRANSIT Rail
	NJTPA Counties/Municipalities Transit Fare Management Systems	NJTPA Transit Operators
	NJTPA Counties/Municipalities Transit Systems	NJTPA Transit Operators
	NJTPA Region TMA Fare Management Systems	TMA - Transportation Management Association
	NJTPA Region TMA Systems	TMA - Transportation Management Association
	NJTPA Region Transit Coordination Network	NJ TRANSIT Corporate
	NJTPA Regional Fare Reciprocity Network	Statewide Fare Reciprocity Administrator

<i>Entity</i>	<i>ITS Element</i>	<i>Stakeholder</i>
Transit Management		
	PANYNJ Airports AirTrain Operations Center	PANYNJ Airports
	PANYNJ Airports Communications Desk/Operations Center	PANYNJ Airports
	PANYNJ PATH Fare Management System	PANYNJ PATH
	PANYNJ PATH Operations Center	PANYNJ PATH
	PANYNJ PATH Vehicle Detection System	PANYNJ PATH
	PANYNJ TB/T Bus Terminals/Stations Communications Desk/Operations Center	PANYNJ Tunnels/Bridges/Terminals
	Private Demand Response Operators Central Systems	Private Transit Operators
	Private Demand Response Operators Fare Management Systems	Private Transit Operators
	Private Ferry Operators Fare Management Systems	Private Ferry Operators
	Private Ferry Operators Systems	Private Ferry Operators
	Private Fixed-Route Bus/Shuttle Operators Fare Management Systems	Private Transit Operators
	Private Fixed-Route Transit Bus/Shuttle Operators	Private Transit Operators
	Private Long-Distance Bus Operators Systems	Private Transit Operators
	Private Passenger Rail	Private Passenger Rail Operators
	RIMIS IEN	DVRPC - Delaware Valley Regional Planning Commission
	Rutgers Campus Shuttle System	Rutgers University
	School Bus Operators	School Districts
	SJTA Transportation Services Division	SJTA - South Jersey Transportation Authority
	SJTPO Counties/Municipalities Transit Systems	SJTPO Transit Operators
	TRANSCOM Communications Center Servers	TRANSCOM
	TRANSCOM TRIPS123 Traveler Information System	TRANSCOM
Transit Vehicle Subsystem		
	NJT Access Link Vehicles	NJ TRANSIT Paratransit
	NJT Bus Vehicles	NJ TRANSIT Bus
	NJT LRT - Hudson-Bergen Rail Vehicles	NJ TRANSIT Rail
	NJT LRT - Newark City Subway Vehicles	NJ TRANSIT Rail
	NJT Rail Trains	NJ TRANSIT Rail
	NJTPA Counties/Municipalities Transit Vehicles	NJTPA Transit Operators
	PANYNJ PATH Transit Vehicles	PANYNJ PATH
	Private Demand Response Operators Vehicles	Private Transit Operators
	Private Ferry Operators Ferries	Private Ferry Operators
	Private Ferry Operators Landside Shuttles	Private Ferry Operators
	Private Fixed-Route Transit Bus/Shuttle Operators Vehicles	Private Transit Operators
	Rutgers Campus Shuttles	Rutgers University
	School Buses	School Districts
	TMA Vehicles	TMA - Transportation Management Association
Traveler Card		
	NJ Universal Smart Card	Public or Private Smart Card Providers
	PANYNJ PATH SmartCard	PANYNJ PATH
Vehicle		
	Private Commercial and Fleet Vehicles	Private Commercial Vehicle and Fleet Operators

<i>Entity</i>	<i>ITS Element</i>	<i>Stakeholder</i>
Vehicle		
	Travelers Vehicles	Travelers
Wayside Equipment		
	NJT Rail Grade Crossing Protection	NJ TRANSIT Rail
	Railroad Operators Wayside Equipment	Railroad Operators
Weather Service		
	Weather Service Provider Systems	Weather Service Provider

Appendix 5.A

List of Customized Market Packages

Market Packages by Stakeholder

Stakeholder	Market Package	Name	Market Package Instance
AMTRAK			
	APTS7	Multi-modal Coordination	APTS7-2 (No)
	APTS7	Multi-modal Coordination	APTS7-4 (No)
	ATMS08	Traffic Incident Management System	ATMS08-06 (No)
	ATMS15	Railroad Operations Coordination	ATMS15-1 (No)
	MC10	Maintenance and Construction Activity Coordination	MC10-3 (No)
Atlantic City Area Joint Operations Center			
	ATMS07	Regional Traffic Control	ATMS07-02 (No-So)
	MC06	Winter Maintenance	MC06-2 (No-So)
Burlington County Bridge Commission			
	ATMS07	Regional Traffic Control	ATMS07-02 (No-So)
Cross County Connection TMA			
	MC04	Weather Information Processing and Distribution	MC04-3 (No-So)
	MC04	Weather Information Processing and Distribution	MC04-6 (No)
	MC06	Winter Maintenance	MC06-2 (No-So)
DelDOT - Delaware Department of Transportation			
	ATMS07	Regional Traffic Control	ATMS07-02 (No-So)
	ATMS16	Parking Facility Management	ATMS16-6 (No-So)
DRBA - Delaware River and Bay Authority			
	MC04	Weather Information Processing and Distribution	MC04-6 (No)
DRJTBC - Delaware River Joint Toll Bridge Commission			
	AD1	ITS Data Mart	AD1-21 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-01 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-04 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-05 (No)
	APTS3	Demand Response Transit Operations	APTS3-1 (No)
	APTS3	Demand Response Transit Operations	APTS3-5 (No)
	ATIS2	Interactive Traveler Information	ATIS2-03 (No)
	ATMS01	Network Surveillance	ATMS01-2 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-09 (No)
	ATMS07	Regional Traffic Control	ATMS07-01 (No)
	ATMS07	Regional Traffic Control	ATMS07-02 (No-So)
	ATMS07	Regional Traffic Control	ATMS07-03 (No)
	ATMS07	Regional Traffic Control	ATMS07-04 (No)
	ATMS07	Regional Traffic Control	ATMS07-05 (No)
	ATMS07	Regional Traffic Control	ATMS07-06 (No)
	ATMS07	Regional Traffic Control	ATMS07-07 (No)
	ATMS07	Regional Traffic Control	ATMS07-08 (No)
	ATMS08	Traffic Incident Management System	ATMS08-05 (No)
	ATMS08	Traffic Incident Management System	ATMS08-09 (No)
	ATMS08	Traffic Incident Management System	ATMS08-10 (No)

<i>Stakeholder</i>	<i>Market Package</i>	<i>Name</i>	<i>Market Package Instance</i>
DRJTBC - Delaware River Joint Toll Bridge Commission			
	CVO01	Fleet Administration	CVO01-2 (No)
	CVO03	Electronic Clearance	CVO03-3 (No)
	CVO06	Weigh-In-Motion	CVO06-1 (No)
	EM02	Emergency Routing	EM02-6 (No)
	EM06	Wide-Area Alert	EM06-1 (No)
	MC01	Maintenance and Construction Vehicle and Equipment Tracking	MC01-5 (No)
	MC02	Maintenance and Construction Vehicle Maintenance	MC02-2 (No)
	MC03	Road Weather Data Collection	MC03-4 (No)
	MC04	Weather Information Processing and Distribution	MC04-7 (No)
	MC05	Roadway Automated Treatment	MC05-2 (No)
	MC06	Winter Maintenance	MC06-1 (No)
	MC06	Winter Maintenance	MC06-2 (No-So)
	MC06	Winter Maintenance	MC06-3 (No)
	MC07	Roadway Maintenance and Construction	MC07-3 (No)
	MC10	Maintenance and Construction Activity Coordination	MC10-1 (No)
	MC10	Maintenance and Construction Activity Coordination	MC10-2 (No)
DRPA - Delaware River Port Authority			
	ATMS07	Regional Traffic Control	ATMS07-02 (No-So)
	MC06	Winter Maintenance	MC06-2 (No-So)
DRPA PATCO - Port Authority Transit Corporation			
	MC04	Weather Information Processing and Distribution	MC04-6 (No)
DVRPC - Delaware Valley Regional Planning Commission			
	AD3	ITS Virtual Data Warehouse	AD3-3 (No-So)
	APTS8	Transit Traveler Information	APTS8-08 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-02 (No-So)
	ATMS06	Traffic Information Dissemination	ATMS06-09 (No)
	ATMS07	Regional Traffic Control	ATMS07-02 (No-So)
	ATMS07	Regional Traffic Control	ATMS07-07 (No)
	ATMS07	Regional Traffic Control	ATMS07-08 (No)
	ATMS16	Parking Facility Management	ATMS16-6 (No-So)
	ATMS16	Parking Facility Management	ATMS16-9 (No-So)
	MC03	Road Weather Data Collection	MC03-4 (No)
	MC04	Weather Information Processing and Distribution	MC04-6 (No)
	MC06	Winter Maintenance	MC06-1 (No)
	MC06	Winter Maintenance	MC06-2 (No-So)
DVRPC Counties/Municipalities			
	APTS5	Transit Security	APTS5-01 (No)
	ATMS07	Regional Traffic Control	ATMS07-02 (No-So)
	ATMS07	Regional Traffic Control	ATMS07-03 (No)
	ATMS07	Regional Traffic Control	ATMS07-04 (No)
	ATMS08	Traffic Incident Management System	ATMS08-09 (No)
	ATMS08	Traffic Incident Management System	ATMS08-10 (No)

Stakeholder	Market Package	Name	Market Package Instance
DVRPC Counties/Municipalities			
	CVO10	HAZMAT Management	CVO10-1 (No-So)
DVRPC Transit Providers			
	MC06	Winter Maintenance	MC06-1 (No)
Event Promoters			
	ATMS08	Traffic Incident Management System	ATMS08-01 (No)
	ATMS08	Traffic Incident Management System	ATMS08-02 (No)
	ATMS08	Traffic Incident Management System	ATMS08-03 (No)
	ATMS08	Traffic Incident Management System	ATMS08-05 (No)
	ATMS08	Traffic Incident Management System	ATMS08-06 (No)
	ATMS08	Traffic Incident Management System	ATMS08-07 (No)
	ATMS08	Traffic Incident Management System	ATMS08-08 (No)
Financial Institution			
	APTS4	Transit Passenger and Fare Management	APTS4-2 (No)
I-95 CC - I-95 Corridor Coalition			
	ATMS07	Regional Traffic Control	ATMS07-01 (No)
	ATMS07	Regional Traffic Control	ATMS07-02 (No-So)
	ATMS07	Regional Traffic Control	ATMS07-05 (No)
	ATMS07	Regional Traffic Control	ATMS07-06 (No)
	ATMS07	Regional Traffic Control	ATMS07-07 (No)
	MC06	Winter Maintenance	MC06-1 (No)
	MC06	Winter Maintenance	MC06-2 (No-So)
	MC07	Roadway Maintenance and Construction	MC07-4 (No)
	MC08	Work Zone Management	MC08-1 (No)
IAG Agencies			
	AD1	ITS Data Mart	AD1-07 (No)
	AD1	ITS Data Mart	AD1-21 (No)
	CVO01	Fleet Administration	CVO01-4 (No-So)
	CVO03	Electronic Clearance	CVO03-5 (No-So)
	CVO06	Weigh-In-Motion	CVO06-3 (No-So)
Media			
	ATIS2	Interactive Traveler Information	ATIS2-01 (No)
	ATIS2	Interactive Traveler Information	ATIS2-03 (No)
	ATIS2	Interactive Traveler Information	ATIS2-10 (No)
	ATIS2	Interactive Traveler Information	ATIS2-11 (No-So)
	ATMS06	Traffic Information Dissemination	ATMS06-01 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-02 (No-So)
	ATMS06	Traffic Information Dissemination	ATMS06-03 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-06 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-07 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-08 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-09 (No)
	MC04	Weather Information Processing and Distribution	MC04-2 (No)
	MC04	Weather Information Processing and Distribution	MC04-4 (No-So)

Stakeholder	Market Package	Name	Market Package Instance
Media			
	MC04	Weather Information Processing and Distribution	MC04-5 (No)
	MC04	Weather Information Processing and Distribution	MC04-7 (No)
	MC08	Work Zone Management	MC08-1 (No)
	MC10	Maintenance and Construction Activity Coordination	MC10-3 (No)
Multimodal Transfer Terminal/Station Providers			
	APTS7	Multi-modal Coordination	APTS7-4 (No)
National and Regional Airlines			
	APTS7	Multi-modal Coordination	APTS7-4 (No)
National Park Service			
	AD1	ITS Data Mart	AD1-07 (No)
	ATMS07	Regional Traffic Control	ATMS07-01 (No)
	ATMS07	Regional Traffic Control	ATMS07-02 (No-So)
	ATMS07	Regional Traffic Control	ATMS07-03 (No)
	ATMS07	Regional Traffic Control	ATMS07-04 (No)
	ATMS07	Regional Traffic Control	ATMS07-05 (No)
	ATMS07	Regional Traffic Control	ATMS07-06 (No)
	ATMS07	Regional Traffic Control	ATMS07-08 (No)
	ATMS16	Parking Facility Management	ATMS16-10 (No)
	ATMS16	Parking Facility Management	ATMS16-2 (No)
	ATMS16	Parking Facility Management	ATMS16-6 (No-So)
	ATMS16	Parking Facility Management	ATMS16-8 (No)
	EM01	Emergency Call-Taking and Dispatch	EM01-1 (No)
	EM01	Emergency Call-Taking and Dispatch	EM01-3 (No)
	MC06	Winter Maintenance	MC06-1 (No)
	MC06	Winter Maintenance	MC06-2 (No-So)
Newark Pennsylvania Station			
	APTS5	Transit Security	APTS5-02 (No)
	APTS5	Transit Security	APTS5-04 (No)
	APTS8	Transit Traveler Information	APTS8-01 (No)
	APTS8	Transit Traveler Information	APTS8-02 (No-So)
	APTS8	Transit Traveler Information	APTS8-04 (No)
	APTS8	Transit Traveler Information	APTS8-09 (No)
NJ TRANSIT Bus			
	AD1	ITS Data Mart	AD1-21 (No)
	AD3	ITS Virtual Data Warehouse	AD3-1 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-01 (No)
	APTS5	Transit Security	APTS5-01 (No)
	APTS7	Multi-modal Coordination	APTS7-1 (No)
	APTS7	Multi-modal Coordination	APTS7-2 (No)
	APTS7	Multi-modal Coordination	APTS7-4 (No)
	APTS7	Multi-modal Coordination	APTS7-5 (No)
	APTS7	Multi-modal Coordination	APTS7-6 (No)
	APTS7	Multi-modal Coordination	APTS7-7 (No-So)

<i>Stakeholder</i>	<i>Market Package</i>	<i>Name</i>	<i>Market Package Instance</i>
NJ TRANSIT Bus			
	APTS8	Transit Traveler Information	APTS8-01 (No)
	ATMS02	Probe Surveillance	ATMS02-5 (No)
	MC04	Weather Information Processing and Distribution	MC04-1 (No)
	MC04	Weather Information Processing and Distribution	MC04-3 (No-So)
	MC04	Weather Information Processing and Distribution	MC04-6 (No)
	MC06	Winter Maintenance	MC06-1 (No)
	MC06	Winter Maintenance	MC06-2 (No-So)
	MC06	Winter Maintenance	MC06-3 (No-So)
	MC06	Winter Maintenance	MC06-5 (No)
	MC06	Winter Maintenance	MC06-7 (No)
	MC06	Winter Maintenance	MC06-9 (No)
	MC08	Work Zone Management	MC08-2 (No)
NJ TRANSIT Corporate			
	AD1	ITS Data Mart	AD1-07 (No)
	AD3	ITS Virtual Data Warehouse	AD3-1 (No)
	AD3	ITS Virtual Data Warehouse	AD3-2 (No)
	APTS4	Transit Passenger and Fare Management	APTS4-1 (No)
	APTS5	Transit Security	APTS5-01 (No)
	APTS7	Multi-modal Coordination	APTS7-1 (No)
	APTS8	Transit Traveler Information	APTS8-01 (No)
	APTS8	Transit Traveler Information	APTS8-02 (No-So)
	ATIS5	ISP Based Route Guidance	ATIS5-1 (No)
NJ TRANSIT Customer Service			
	APTS2	Transit Fixed-Route Operations	APTS2-01 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-02 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-03 (No)
	APTS5	Transit Security	APTS5-01 (No)
	APTS5	Transit Security	APTS5-02 (No)
	APTS5	Transit Security	APTS5-03 (No)
	APTS5	Transit Security	APTS5-04 (No)
	APTS8	Transit Traveler Information	APTS8-01 (No)
	APTS8	Transit Traveler Information	APTS8-02 (No-So)
	APTS8	Transit Traveler Information	APTS8-03 (No)
	APTS8	Transit Traveler Information	APTS8-04 (No)
	APTS8	Transit Traveler Information	APTS8-09 (No)
	ATMS16	Parking Facility Management	ATMS16-8 (No)
	ATMS16	Parking Facility Management	ATMS16-9 (No-So)
NJ TRANSIT Paratransit			
	APTS3	Demand Response Transit Operations	APTS3-1 (No)
	APTS7	Multi-modal Coordination	APTS7-1 (No)
	APTS7	Multi-modal Coordination	APTS7-2 (No)
	APTS7	Multi-modal Coordination	APTS7-4 (No)
	MC04	Weather Information Processing and Distribution	MC04-6 (No)

Stakeholder	Market Package	Name	Market Package Instance
NJ TRANSIT Police			
	APTS5	Transit Security	APTS5-01 (No)
	APTS5	Transit Security	APTS5-02 (No)
	APTS5	Transit Security	APTS5-03 (No)
	APTS5	Transit Security	APTS5-04 (No)
	ATMS08	Traffic Incident Management System	ATMS08-06 (No)
	EM01	Emergency Call-Taking and Dispatch	EM01-1 (No)
	MC06	Winter Maintenance	MC06-5 (No)
	MC08	Work Zone Management	MC08-2 (No)
NJ TRANSIT Rail			
	AD3	ITS Virtual Data Warehouse	AD3-1 (No)
	AD3	ITS Virtual Data Warehouse	AD3-2 (No)
	APTS1	Transit Vehicle Tracking	APTS1-1 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-02 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-03 (No)
	APTS5	Transit Security	APTS5-02 (No)
	APTS5	Transit Security	APTS5-03 (No)
	APTS5	Transit Security	APTS5-04 (No)
	APTS7	Multi-modal Coordination	APTS7-1 (No)
	APTS7	Multi-modal Coordination	APTS7-2 (No)
	APTS7	Multi-modal Coordination	APTS7-4 (No)
	APTS7	Multi-modal Coordination	APTS7-8 (No)
	APTS7	Multi-modal Coordination	APTS7-9 (No)
	APTS8	Transit Traveler Information	APTS8-02 (No-So)
	APTS8	Transit Traveler Information	APTS8-03 (No)
	APTS8	Transit Traveler Information	APTS8-04 (No)
	ATMS13	Standard Railroad Grade Crossing	ATMS13-1 (No)
	ATMS13	Standard Railroad Grade Crossing	ATMS13-2 (No)
	ATMS14	Advanced Railroad Grade Crossing	ATMS14-1 (No)
	ATMS14	Advanced Railroad Grade Crossing	ATMS14-2 (No-So)
	ATMS15	Railroad Operations Coordination	ATMS15-1 (No)
	EM06	Wide-Area Alert	EM06-1 (No)
	MC04	Weather Information Processing and Distribution	MC04-2 (No)
	MC04	Weather Information Processing and Distribution	MC04-4 (No-So)
	MC04	Weather Information Processing and Distribution	MC04-6 (No)
	MC06	Winter Maintenance	MC06-5 (No)
	MC08	Work Zone Management	MC08-2 (No)
	MC10	Maintenance and Construction Activity Coordination	MC10-3 (No)
NJDEP - New Jersey Department of Environmental Protection			
	AD1	ITS Data Mart	AD1-07 (No)
	ATMS07	Regional Traffic Control	ATMS07-01 (No)
	ATMS07	Regional Traffic Control	ATMS07-02 (No-So)
	ATMS07	Regional Traffic Control	ATMS07-08 (No)
	ATMS16	Parking Facility Management	ATMS16-10 (No)

<i>Stakeholder</i>	<i>Market Package</i>	<i>Name</i>	<i>Market Package Instance</i>
NJDEP - New Jersey Department of Environmental Protection			
	ATMS16	Parking Facility Management	ATMS16-2 (No)
	ATMS16	Parking Facility Management	ATMS16-6 (No-So)
	ATMS16	Parking Facility Management	ATMS16-8 (No)
	EM01	Emergency Call-Taking and Dispatch	EM01-1 (No)
	EM01	Emergency Call-Taking and Dispatch	EM01-3 (No)
	MC06	Winter Maintenance	MC06-1 (No)
	MC06	Winter Maintenance	MC06-2 (No-So)
NJDOT - New Jersey Department of Transportation			
	AD1	ITS Data Mart	AD1-08 (No)
	AD1	ITS Data Mart	AD1-21 (No)
	AD3	ITS Virtual Data Warehouse	AD3-1 (No)
	AD3	ITS Virtual Data Warehouse	AD3-2 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-02 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-03 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-04 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-05 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-08 (No-So)
	APTS2	Transit Fixed-Route Operations	APTS2-10 (No-So)
	APTS3	Demand Response Transit Operations	APTS3-2 (No)
	APTS3	Demand Response Transit Operations	APTS3-3 (No)
	APTS3	Demand Response Transit Operations	APTS3-4 (No)
	APTS3	Demand Response Transit Operations	APTS3-5 (No)
	APTS7	Multi-modal Coordination	APTS7-6 (No)
	APTS7	Multi-modal Coordination	APTS7-7 (No-So)
	APTS8	Transit Traveler Information	APTS8-06 (No)
	APTS8	Transit Traveler Information	APTS8-08 (No)
	ATIS1	Broadcast Traveler Information	ATIS1-1 (No-So)
	ATIS1	Broadcast Traveler Information	ATIS1-2 (No-So)
	ATMS06	Traffic Information Dissemination	ATMS06-01 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-02 (No-So)
	ATMS07	Regional Traffic Control	ATMS07-01 (No)
	ATMS07	Regional Traffic Control	ATMS07-02 (No-So)
	ATMS07	Regional Traffic Control	ATMS07-03 (No)
	ATMS07	Regional Traffic Control	ATMS07-04 (No)
	ATMS07	Regional Traffic Control	ATMS07-05 (No)
	ATMS07	Regional Traffic Control	ATMS07-06 (No)
	ATMS07	Regional Traffic Control	ATMS07-07 (No)
	ATMS07	Regional Traffic Control	ATMS07-08 (No)
	ATMS08	Traffic Incident Management System	ATMS08-01 (No)
	ATMS08	Traffic Incident Management System	ATMS08-02 (No)
	ATMS08	Traffic Incident Management System	ATMS08-03 (No)
	ATMS08	Traffic Incident Management System	ATMS08-06 (No)

<i>Stakeholder</i>	<i>Market Package</i>	<i>Name</i>	<i>Market Package Instance</i>
NJDOT - New Jersey Department of Transportation			
	ATMS08	Traffic Incident Management System	ATMS08-08 (No)
	ATMS08	Traffic Incident Management System	ATMS08-09 (No)
	ATMS08	Traffic Incident Management System	ATMS08-10 (No)
	ATMS13	Standard Railroad Grade Crossing	ATMS13-2 (No)
	ATMS14	Advanced Railroad Grade Crossing	ATMS14-1 (No)
	ATMS14	Advanced Railroad Grade Crossing	ATMS14-2 (No-So)
	ATMS15	Railroad Operations Coordination	ATMS15-1 (No)
	ATMS16	Parking Facility Management	ATMS16-10 (No)
	ATMS16	Parking Facility Management	ATMS16-6 (No-So)
	ATMS16	Parking Facility Management	ATMS16-8 (No)
	ATMS18	Reversible Lane Management	ATMS18-1 (No)
	ATMS19	Speed Monitoring	ATMS19-1 (No)
	EM02	Emergency Routing	EM02-3 (No)
	EM02	Emergency Routing	EM02-4 (No)
	EM06	Wide-Area Alert	EM06-1 (No)
	EM08	Disaster Response and Recovery	EM08-2 (No)
	MC03	Road Weather Data Collection	MC03-1 (No)
	MC03	Road Weather Data Collection	MC03-4 (No)
	MC03	Road Weather Data Collection	MC03-5 (No-So)
	MC04	Weather Information Processing and Distribution	MC04-1 (No)
	MC04	Weather Information Processing and Distribution	MC04-2 (No)
	MC04	Weather Information Processing and Distribution	MC04-3 (No-So)
	MC04	Weather Information Processing and Distribution	MC04-4 (No-So)
	MC04	Weather Information Processing and Distribution	MC04-6 (No)
	MC06	Winter Maintenance	MC06-1 (No)
	MC06	Winter Maintenance	MC06-2 (No-So)
	MC06	Winter Maintenance	MC06-3 (No)
	MC06	Winter Maintenance	MC06-3 (No-So)
	MC06	Winter Maintenance	MC06-5 (No)
	MC06	Winter Maintenance	MC06-6 (No)
	MC06	Winter Maintenance	MC06-8 (No)
	MC07	Roadway Maintenance and Construction	MC07-4 (No)
	MC08	Work Zone Management	MC08-1 (No)
	MC10	Maintenance and Construction Activity Coordination	MC10-1 (No)
	MC10	Maintenance and Construction Activity Coordination	MC10-2 (No)
NJSP - New Jersey State Police			
	AD3	ITS Virtual Data Warehouse	AD3-1 (No)
	ATMS08	Traffic Incident Management System	ATMS08-01 (No)
	ATMS08	Traffic Incident Management System	ATMS08-02 (No)
	ATMS08	Traffic Incident Management System	ATMS08-03 (No)
	ATMS21	Roadway Closure Management	ATMS21-2 (No)
	CVO03	Electronic Clearance	CVO03-3 (No)
	CVO03	Electronic Clearance	CVO03-5 (No-So)

Stakeholder	Market Package	Name	Market Package Instance
NJSP - New Jersey State Police			
	CVO06	Weigh-In-Motion	CVO06-1 (No)
	CVO06	Weigh-In-Motion	CVO06-3 (No-So)
	EM01	Emergency Call-Taking and Dispatch	EM01-1 (No)
	EM06	Wide-Area Alert	EM06-1 (No)
	EM07	Early Warning System	EM07-1 (No)
	EM08	Disaster Response and Recovery	EM08-1 (No)
	EM09	Evacuation and Reentry Management	EM09-1 (No)
	MC06	Winter Maintenance	MC06-3 (No-So)
	MC06	Winter Maintenance	MC06-5 (No)
	MC08	Work Zone Management	MC08-2 (No)
NJSP/NJDOT/NJDEP Statewide Dispatch Center			
	APTS5	Transit Security	APTS5-05 (No)
	APTS5	Transit Security	APTS5-06 (No)
	ATMS07	Regional Traffic Control	ATMS07-08 (No)
	ATMS08	Traffic Incident Management System	ATMS08-05 (No)
	ATMS08	Traffic Incident Management System	ATMS08-06 (No)
	ATMS08	Traffic Incident Management System	ATMS08-08 (No)
	CVO10	HAZMAT Management	CVO10-1 (No-So)
	EM01	Emergency Call-Taking and Dispatch	EM01-1 (No)
	EM01	Emergency Call-Taking and Dispatch	EM01-3 (No)
	EM02	Emergency Routing	EM02-6 (No)
	EM06	Wide-Area Alert	EM06-1 (No)
	EM09	Evacuation and Reentry Management	EM09-2 (No)
	MC04	Weather Information Processing and Distribution	MC04-1 (No)
	MC04	Weather Information Processing and Distribution	MC04-3 (No-So)
	MC04	Weather Information Processing and Distribution	MC04-7 (No)
	MC06	Winter Maintenance	MC06-1 (No)
	MC06	Winter Maintenance	MC06-2 (No-So)
	MC06	Winter Maintenance	MC06-5 (No)
	MC08	Work Zone Management	MC08-2 (No)
NJTA - New Jersey Turnpike Authority			
	AD3	ITS Virtual Data Warehouse	AD3-2 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-03 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-05 (No)
	APTS3	Demand Response Transit Operations	APTS3-2 (No)
	APTS3	Demand Response Transit Operations	APTS3-3 (No)
	APTS3	Demand Response Transit Operations	APTS3-5 (No)
	ATIS1	Broadcast Traveler Information	ATIS1-2 (No-So)
	ATMS07	Regional Traffic Control	ATMS07-01 (No)
	ATMS07	Regional Traffic Control	ATMS07-02 (No-So)
	ATMS07	Regional Traffic Control	ATMS07-03 (No)
	ATMS07	Regional Traffic Control	ATMS07-04 (No)
	ATMS07	Regional Traffic Control	ATMS07-05 (No)

Stakeholder	Market Package	Name	Market Package Instance
NJTA - New Jersey Turnpike Authority			
	ATMS07	Regional Traffic Control	ATMS07-06 (No)
	ATMS07	Regional Traffic Control	ATMS07-07 (No)
	ATMS08	Traffic Incident Management System	ATMS08-06 (No)
	ATMS08	Traffic Incident Management System	ATMS08-08 (No)
	ATMS08	Traffic Incident Management System	ATMS08-09 (No)
	ATMS08	Traffic Incident Management System	ATMS08-10 (No)
	ATMS16	Parking Facility Management	ATMS16-10 (No)
	ATMS16	Parking Facility Management	ATMS16-6 (No-So)
	ATMS16	Parking Facility Management	ATMS16-8 (No)
	ATMS21	Roadway Closure Management	ATMS21-2 (No)
	EM08	Disaster Response and Recovery	EM08-2 (No)
	EM09	Evacuation and Reentry Management	EM09-1 (No)
	MC04	Weather Information Processing and Distribution	MC04-6 (No)
	MC06	Winter Maintenance	MC06-1 (No)
	MC06	Winter Maintenance	MC06-3 (No-So)
	MC06	Winter Maintenance	MC06-5 (No)
	MC07	Roadway Maintenance and Construction	MC07-4 (No)
	MC08	Work Zone Management	MC08-1 (No)
	MC10	Maintenance and Construction Activity Coordination	MC10-1 (No)
	MC10	Maintenance and Construction Activity Coordination	MC10-2 (No)
NJTPA - North Jersey Transportation Planning Authority			
	AD1	ITS Data Mart	AD1-04 (No)
	AD1	ITS Data Mart	AD1-07 (No)
	AD1	ITS Data Mart	AD1-08 (No)
	AD1	ITS Data Mart	AD1-21 (No)
	AD3	ITS Virtual Data Warehouse	AD3-1 (No)
	AD3	ITS Virtual Data Warehouse	AD3-2 (No)
	AD3	ITS Virtual Data Warehouse	AD3-3 (No-So)
NJTPA Counties			
	AD1	ITS Data Mart	AD1-08 (No)
	AD1	ITS Data Mart	AD1-21 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-01 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-02 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-03 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-04 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-05 (No)
	APTS3	Demand Response Transit Operations	APTS3-1 (No)
	APTS3	Demand Response Transit Operations	APTS3-2 (No)
	APTS3	Demand Response Transit Operations	APTS3-3 (No)
	APTS3	Demand Response Transit Operations	APTS3-4 (No)
	APTS3	Demand Response Transit Operations	APTS3-5 (No)
	APTS5	Transit Security	APTS5-05 (No)
	APTS5	Transit Security	APTS5-06 (No)

<i>Stakeholder</i>	<i>Market Package</i>	<i>Name</i>	<i>Market Package Instance</i>
NJTPA Counties			
	APTS7	Multi-modal Coordination	APTS7-5 (No)
	APTS7	Multi-modal Coordination	APTS7-8 (No)
	APTS7	Multi-modal Coordination	APTS7-9 (No)
	APTS8	Transit Traveler Information	APTS8-06 (No)
	ATMS01	Network Surveillance	ATMS01-1 (No)
	ATMS03	Surface Street Control	ATMS03-1 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-07 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-08 (No)
	ATMS07	Regional Traffic Control	ATMS07-01 (No)
	ATMS07	Regional Traffic Control	ATMS07-02 (No-So)
	ATMS07	Regional Traffic Control	ATMS07-03 (No)
	ATMS07	Regional Traffic Control	ATMS07-04 (No)
	ATMS07	Regional Traffic Control	ATMS07-05 (No)
	ATMS07	Regional Traffic Control	ATMS07-06 (No)
	ATMS07	Regional Traffic Control	ATMS07-07 (No)
	ATMS07	Regional Traffic Control	ATMS07-08 (No)
	ATMS08	Traffic Incident Management System	ATMS08-01 (No)
	ATMS08	Traffic Incident Management System	ATMS08-02 (No)
	ATMS08	Traffic Incident Management System	ATMS08-03 (No)
	ATMS08	Traffic Incident Management System	ATMS08-08 (No)
	ATMS08	Traffic Incident Management System	ATMS08-09 (No)
	ATMS08	Traffic Incident Management System	ATMS08-10 (No)
	ATMS13	Standard Railroad Grade Crossing	ATMS13-1 (No)
	ATMS14	Advanced Railroad Grade Crossing	ATMS14-1 (No)
	ATMS15	Railroad Operations Coordination	ATMS15-1 (No)
	ATMS16	Parking Facility Management	ATMS16-10 (No)
	ATMS16	Parking Facility Management	ATMS16-2 (No)
	ATMS16	Parking Facility Management	ATMS16-8 (No)
	ATMS20	Drawbridge Management	ATMS20-1 (No)
	EM02	Emergency Routing	EM02-2 (No)
	EM06	Wide-Area Alert	EM06-1 (No)
	EM07	Early Warning System	EM07-1 (No)
	EM08	Disaster Response and Recovery	EM08-2 (No)
	EM09	Evacuation and Reentry Management	EM09-1 (No)
	MC01	Maintenance and Construction Vehicle and Equipment Tracking	MC01-1 (No)
	MC02	Maintenance and Construction Vehicle Maintenance	MC02-3 (No)
	MC03	Road Weather Data Collection	MC03-2 (No)
	MC04	Weather Information Processing and Distribution	MC04-5 (No)
	MC06	Winter Maintenance	MC06-1 (No)
	MC06	Winter Maintenance	MC06-3 (No)
	MC06	Winter Maintenance	MC06-3 (No-So)
	MC06	Winter Maintenance	MC06-5 (No)
	MC06	Winter Maintenance	MC06-6 (No)

Stakeholder	Market Package	Name	Market Package Instance
NJTPA Counties			
	MC06	Winter Maintenance	MC06-8 (No)
	MC06	Winter Maintenance	MC06-9 (No)
	MC07	Roadway Maintenance and Construction	MC07-1 (No)
	MC07	Roadway Maintenance and Construction	MC07-2 (No)
	MC07	Roadway Maintenance and Construction	MC07-4 (No)
	MC08	Work Zone Management	MC08-1 (No)
	MC10	Maintenance and Construction Activity Coordination	MC10-1 (No)
	MC10	Maintenance and Construction Activity Coordination	MC10-2 (No)
NJTPA Municipalities			
	AD1	ITS Data Mart	AD1-08 (No)
	AD1	ITS Data Mart	AD1-21 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-01 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-02 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-03 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-04 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-05 (No)
	APTS3	Demand Response Transit Operations	APTS3-1 (No)
	APTS3	Demand Response Transit Operations	APTS3-2 (No)
	APTS3	Demand Response Transit Operations	APTS3-3 (No)
	APTS3	Demand Response Transit Operations	APTS3-4 (No)
	APTS3	Demand Response Transit Operations	APTS3-5 (No)
	APTS7	Multi-modal Coordination	APTS7-5 (No)
	APTS7	Multi-modal Coordination	APTS7-8 (No)
	APTS7	Multi-modal Coordination	APTS7-9 (No)
	ATMS01	Network Surveillance	ATMS01-1 (No)
	ATMS03	Surface Street Control	ATMS03-1 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-07 (No)
	ATMS07	Regional Traffic Control	ATMS07-01 (No)
	ATMS07	Regional Traffic Control	ATMS07-02 (No-So)
	ATMS07	Regional Traffic Control	ATMS07-03 (No)
	ATMS07	Regional Traffic Control	ATMS07-04 (No)
	ATMS07	Regional Traffic Control	ATMS07-05 (No)
	ATMS07	Regional Traffic Control	ATMS07-06 (No)
	ATMS07	Regional Traffic Control	ATMS07-07 (No)
	ATMS07	Regional Traffic Control	ATMS07-08 (No)
	ATMS08	Traffic Incident Management System	ATMS08-01 (No)
	ATMS08	Traffic Incident Management System	ATMS08-02 (No)
	ATMS08	Traffic Incident Management System	ATMS08-03 (No)
	ATMS08	Traffic Incident Management System	ATMS08-08 (No)
	ATMS08	Traffic Incident Management System	ATMS08-09 (No)
	ATMS08	Traffic Incident Management System	ATMS08-10 (No)
	ATMS13	Standard Railroad Grade Crossing	ATMS13-1 (No)
	ATMS14	Advanced Railroad Grade Crossing	ATMS14-1 (No)

<i>Stakeholder</i>	<i>Market Package</i>	<i>Name</i>	<i>Market Package Instance</i>
NJTPA Municipalities			
	ATMS15	Railroad Operations Coordination	ATMS15-1 (No)
	ATMS16	Parking Facility Management	ATMS16-10 (No)
	ATMS16	Parking Facility Management	ATMS16-2 (No)
	ATMS16	Parking Facility Management	ATMS16-8 (No)
	EM02	Emergency Routing	EM02-1 (No)
	EM06	Wide-Area Alert	EM06-1 (No)
	EM07	Early Warning System	EM07-1 (No)
	EM08	Disaster Response and Recovery	EM08-2 (No)
	EM09	Evacuation and Reentry Management	EM09-1 (No)
	MC01	Maintenance and Construction Vehicle and Equipment Tracking	MC01-1 (No)
	MC02	Maintenance and Construction Vehicle Maintenance	MC02-3 (No)
	MC03	Road Weather Data Collection	MC03-3 (No)
	MC04	Weather Information Processing and Distribution	MC04-5 (No)
	MC06	Winter Maintenance	MC06-1 (No)
	MC06	Winter Maintenance	MC06-3 (No)
	MC06	Winter Maintenance	MC06-3 (No-So)
	MC06	Winter Maintenance	MC06-5 (No)
	MC06	Winter Maintenance	MC06-6 (No)
	MC06	Winter Maintenance	MC06-7 (No)
	MC06	Winter Maintenance	MC06-8 (No)
	MC07	Roadway Maintenance and Construction	MC07-1 (No)
	MC07	Roadway Maintenance and Construction	MC07-2 (No)
	MC07	Roadway Maintenance and Construction	MC07-4 (No)
	MC08	Work Zone Management	MC08-1 (No)
	MC10	Maintenance and Construction Activity Coordination	MC10-1 (No)
	MC10	Maintenance and Construction Activity Coordination	MC10-2 (No)
NJTPA Public Safety Agencies			
	AD1	ITS Data Mart	AD1-07 (No)
	APTS5	Transit Security	APTS5-01 (No)
	APTS5	Transit Security	APTS5-02 (No)
	APTS5	Transit Security	APTS5-03 (No)
	APTS5	Transit Security	APTS5-04 (No)
	APTS5	Transit Security	APTS5-05 (No)
	APTS5	Transit Security	APTS5-06 (No)
	APTS5	Transit Security	APTS5-08 (No)
	ATMS08	Traffic Incident Management System	ATMS08-01 (No)
	ATMS08	Traffic Incident Management System	ATMS08-02 (No)
	ATMS08	Traffic Incident Management System	ATMS08-03 (No)
	ATMS08	Traffic Incident Management System	ATMS08-06 (No)
	ATMS08	Traffic Incident Management System	ATMS08-08 (No)
	ATMS08	Traffic Incident Management System	ATMS08-11 (No)
	CVO10	HAZMAT Management	CVO10-1 (No-So)
	CVO12	CV Driver Security Authentication	CVO12-1 (No)

<i>Stakeholder</i>	<i>Market Package</i>	<i>Name</i>	<i>Market Package Instance</i>
NJTPA Public Safety Agencies			
	EM01	Emergency Call-Taking and Dispatch	EM01-1 (No)
	EM01	Emergency Call-Taking and Dispatch	EM01-2 (No)
	EM01	Emergency Call-Taking and Dispatch	EM01-3 (No)
	EM02	Emergency Routing	EM02-1 (No)
	EM02	Emergency Routing	EM02-2 (No)
	EM02	Emergency Routing	EM02-3 (No)
	EM02	Emergency Routing	EM02-4 (No)
	EM02	Emergency Routing	EM02-5 (No)
	EM07	Early Warning System	EM07-1 (No)
	EM08	Disaster Response and Recovery	EM08-1 (No)
	EM08	Disaster Response and Recovery	EM08-2 (No)
	EM09	Evacuation and Reentry Management	EM09-1 (No)
	EM09	Evacuation and Reentry Management	EM09-2 (No)
	MC04	Weather Information Processing and Distribution	MC04-1 (No)
	MC04	Weather Information Processing and Distribution	MC04-3 (No-So)
	MC06	Winter Maintenance	MC06-1 (No)
	MC06	Winter Maintenance	MC06-2 (No-So)
	MC06	Winter Maintenance	MC06-5 (No)
	MC06	Winter Maintenance	MC06-7 (No)
	MC06	Winter Maintenance	MC06-9 (No)
	MC07	Roadway Maintenance and Construction	MC07-1 (No)
	MC07	Roadway Maintenance and Construction	MC07-2 (No)
	MC08	Work Zone Management	MC08-2 (No)
NJTPA Transit Operators			
	AD1	ITS Data Mart	AD1-08 (No)
	APTS1	Transit Vehicle Tracking	APTS1-2 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-05 (No)
	APTS3	Demand Response Transit Operations	APTS3-3 (No)
	APTS4	Transit Passenger and Fare Management	APTS4-1 (No)
	APTS5	Transit Security	APTS5-06 (No)
	APTS7	Multi-modal Coordination	APTS7-1 (No)
	APTS7	Multi-modal Coordination	APTS7-2 (No)
	APTS7	Multi-modal Coordination	APTS7-4 (No)
	APTS8	Transit Traveler Information	APTS8-06 (No)
	EM06	Wide-Area Alert	EM06-1 (No)
	EM07	Early Warning System	EM07-1 (No)
	EM08	Disaster Response and Recovery	EM08-1 (No)
	EM09	Evacuation and Reentry Management	EM09-2 (No)
	MC04	Weather Information Processing and Distribution	MC04-1 (No)
	MC04	Weather Information Processing and Distribution	MC04-3 (No-So)
	MC06	Winter Maintenance	MC06-1 (No)
	MC06	Winter Maintenance	MC06-2 (No-So)
	MC06	Winter Maintenance	MC06-5 (No)

Stakeholder	Market Package	Name	Market Package Instance
NJTPA Transit Operators			
	MC06	Winter Maintenance	MC06-7 (No)
	MC06	Winter Maintenance	MC06-9 (No)
	MC08	Work Zone Management	MC08-2 (No)
NYC Joint TMC			
	ATMS07	Regional Traffic Control	ATMS07-07 (No)
	MC10	Maintenance and Construction Activity Coordination	MC10-2 (No)
NYMTC - New York Metropolitan Transportation Council			
	AD3	ITS Virtual Data Warehouse	AD3-3 (No-So)
NYSDOT - New York State Department of Transportation			
	APTS3	Demand Response Transit Operations	APTS3-2 (No)
	APTS3	Demand Response Transit Operations	APTS3-3 (No)
	ATMS07	Regional Traffic Control	ATMS07-01 (No)
	ATMS07	Regional Traffic Control	ATMS07-03 (No)
	ATMS07	Regional Traffic Control	ATMS07-04 (No)
	ATMS07	Regional Traffic Control	ATMS07-06 (No)
	ATMS07	Regional Traffic Control	ATMS07-07 (No)
NYSTA - New York State Thruway Authority			
	APTS3	Demand Response Transit Operations	APTS3-2 (No)
	APTS3	Demand Response Transit Operations	APTS3-3 (No)
	ATMS07	Regional Traffic Control	ATMS07-01 (No)
	ATMS07	Regional Traffic Control	ATMS07-06 (No)
	ATMS07	Regional Traffic Control	ATMS07-07 (No)
Other States Public Safety Departments			
	ATMS08	Traffic Incident Management System	ATMS08-05 (No)
	ATMS08	Traffic Incident Management System	ATMS08-06 (No)
	CVO10	HAZMAT Management	CVO10-1 (No-So)
	EM02	Emergency Routing	EM02-6 (No)
	EM09	Evacuation and Reentry Management	EM09-2 (No)
	MC04	Weather Information Processing and Distribution	MC04-7 (No)
Palisades Interstate Park Commission			
	ATMS01	Network Surveillance	ATMS01-3 (No)
	ATMS07	Regional Traffic Control	ATMS07-01 (No)
	ATMS07	Regional Traffic Control	ATMS07-05 (No)
	ATMS07	Regional Traffic Control	ATMS07-06 (No)
	ATMS07	Regional Traffic Control	ATMS07-07 (No)
	EM01	Emergency Call-Taking and Dispatch	EM01-1 (No)
	EM06	Wide-Area Alert	EM06-1 (No)
	MC07	Roadway Maintenance and Construction	MC07-4 (No)
	MC08	Work Zone Management	MC08-1 (No)
PANYNJ			
	ATIS2	Interactive Traveler Information	ATIS2-04 (No)
	ATIS2	Interactive Traveler Information	ATIS2-06 (No)

<i>Stakeholder</i>	<i>Market Package</i>	<i>Name</i>	<i>Market Package Instance</i>
PANYNJ Airports			
	APTS7	Multi-modal Coordination	APTS7-1 (No)
	APTS7	Multi-modal Coordination	APTS7-2 (No)
	ATIS2	Interactive Traveler Information	ATIS2-04 (No)
	ATIS2	Interactive Traveler Information	ATIS2-05 (No)
	ATMS01	Network Surveillance	ATMS01-5 (No)
	ATMS03	Surface Street Control	ATMS03-4 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-04 (No)
	ATMS07	Regional Traffic Control	ATMS07-07 (No)
	MC04	Weather Information Processing and Distribution	MC04-6 (No)
	MC08	Work Zone Management	MC08-1 (No)
	MC10	Maintenance and Construction Activity Coordination	MC10-2 (No)
PANYNJ PAPD			
	APTS5	Transit Security	APTS5-07 (No)
	ATMS05	HOV Lane Management	ATMS05-1 (No)
	CVO03	Electronic Clearance	CVO03-4 (No)
	CVO10	HAZMAT Management	CVO10-2 (No)
	EM05	Transportation Infrastructure Protection	EM05-6 (No)
PANYNJ PATH			
	AD1	ITS Data Mart	AD1-08 (No)
	APTS1	Transit Vehicle Tracking	APTS1-3 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-06 (No)
	APTS4	Transit Passenger and Fare Management	APTS4-1 (No)
	APTS4	Transit Passenger and Fare Management	APTS4-2 (No)
	APTS5	Transit Security	APTS5-07 (No)
	APTS7	Multi-modal Coordination	APTS7-1 (No)
	APTS7	Multi-modal Coordination	APTS7-2 (No)
	APTS8	Transit Traveler Information	APTS8-05 (No)
	ATIS2	Interactive Traveler Information	ATIS2-04 (No)
	ATIS2	Interactive Traveler Information	ATIS2-06 (No)
	MC04	Weather Information Processing and Distribution	MC04-6 (No)
	MC10	Maintenance and Construction Activity Coordination	MC10-2 (No)
PANYNJ Port Commerce			
	ATIS2	Interactive Traveler Information	ATIS2-04 (No)
	ATIS2	Interactive Traveler Information	ATIS2-09 (No)
	ATMS01	Network Surveillance	ATMS01-6 (No)
	ATMS02	Probe Surveillance	ATMS02-3 (No)
	ATMS03	Surface Street Control	ATMS03-4 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-05 (No)
	ATMS07	Regional Traffic Control	ATMS07-07 (No)
	ATMS08	Traffic Incident Management System	ATMS08-06 (No)
	CVO01	Fleet Administration	CVO01-3 (No)
	CVO03	Electronic Clearance	CVO03-4 (No)
	CVO04	CV Administrative Processes	CVO04-1 (No)

Stakeholder	Market Package	Name	Market Package Instance
PANYNJ Port Commerce			
	CVO10	HAZMAT Management	CVO10-2 (No)
	MC08	Work Zone Management	MC08-1 (No)
	MC10	Maintenance and Construction Activity Coordination	MC10-2 (No)
PANYNJ Tunnels/Bridges/Terminals			
	APTS7	Multi-modal Coordination	APTS7-2 (No)
	ATIS2	Interactive Traveler Information	ATIS2-04 (No)
	ATIS2	Interactive Traveler Information	ATIS2-07 (No)
	ATIS2	Interactive Traveler Information	ATIS2-08 (No)
	ATMS01	Network Surveillance	ATMS01-4 (No)
	ATMS01	Network Surveillance	ATMS01-7 (No)
	ATMS04	Freeway Control	ATMS04-2 (No)
	ATMS04	Freeway Control	ATMS04-3 (No)
	ATMS05	HOV Lane Management	ATMS05-1 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-03 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-06 (No)
	ATMS07	Regional Traffic Control	ATMS07-07 (No)
	ATMS08	Traffic Incident Management System	ATMS08-04 (No)
	ATMS08	Traffic Incident Management System	ATMS08-06 (No)
	ATMS08	Traffic Incident Management System	ATMS08-07 (No)
	ATMS08	Traffic Incident Management System	ATMS08-09 (No)
	ATMS08	Traffic Incident Management System	ATMS08-10 (No)
	ATMS08	Traffic Incident Management System	ATMS08-11 (No)
	ATMS18	Reversible Lane Management	ATMS18-2 (No)
	CVO06	Weigh-In-Motion	CVO06-2 (No)
	CVO10	HAZMAT Management	CVO10-2 (No)
	EM05	Transportation Infrastructure Protection	EM05-6 (No)
	MC01	Maintenance and Construction Vehicle and Equipment Tracking	MC01-5 (No)
	MC04	Weather Information Processing and Distribution	MC04-6 (No)
	MC06	Winter Maintenance	MC06-4 (No)
	MC06	Winter Maintenance	MC06-5 (No)
	MC07	Roadway Maintenance and Construction	MC07-4 (No)
	MC08	Work Zone Management	MC08-1 (No)
	MC10	Maintenance and Construction Activity Coordination	MC10-2 (No)
Parking Facility Operators			
	AD1	ITS Data Mart	AD1-07 (No)
	ATMS16	Parking Facility Management	ATMS16-10 (No)
	ATMS16	Parking Facility Management	ATMS16-11 (No-So)
PennDOT - Pennsylvania Department of Transportation			
	APTS3	Demand Response Transit Operations	APTS3-2 (No)
	APTS3	Demand Response Transit Operations	APTS3-3 (No)
	ATMS07	Regional Traffic Control	ATMS07-01 (No)
	ATMS07	Regional Traffic Control	ATMS07-02 (No-So)
	ATMS07	Regional Traffic Control	ATMS07-07 (No)

<i>Stakeholder</i>	<i>Market Package</i>	<i>Name</i>	<i>Market Package Instance</i>
PennDOT - Pennsylvania Department of Transportation			
	ATMS07	Regional Traffic Control	ATMS07-08 (No)
	MC03	Road Weather Data Collection	MC03-4 (No)
	MC06	Winter Maintenance	MC06-1 (No)
Private Commercial Vehicle and Fleet Operators			
	ATIS1	Broadcast Traveler Information	ATIS1-1 (No-So)
	ATIS1	Broadcast Traveler Information	ATIS1-2 (No-So)
	ATIS1	Broadcast Traveler Information	ATIS1-4 (No-So)
	ATIS2	Interactive Traveler Information	ATIS2-01 (No)
	ATIS2	Interactive Traveler Information	ATIS2-11 (No-So)
	ATIS5	ISP Based Route Guidance	ATIS5-1 (No)
	CVO01	Fleet Administration	CVO01-1 (No-So)
	CVO01	Fleet Administration	CVO01-2 (No)
	CVO01	Fleet Administration	CVO01-3 (No)
	CVO01	Fleet Administration	CVO01-4 (No-So)
	CVO03	Electronic Clearance	CVO03-3 (No)
	CVO03	Electronic Clearance	CVO03-4 (No)
	CVO03	Electronic Clearance	CVO03-5 (No-So)
	CVO06	Weigh-In-Motion	CVO06-1 (No)
	CVO06	Weigh-In-Motion	CVO06-3 (No-So)
	CVO10	HAZMAT Management	CVO10-1 (No-So)
	CVO10	HAZMAT Management	CVO10-2 (No)
	CVO12	CV Driver Security Authentication	CVO12-1 (No)
Private Cruise Operators			
	APTS7	Multi-modal Coordination	APTS7-4 (No)
Private Ferry Operators			
	AD1	ITS Data Mart	AD1-08 (No)
	APTS1	Transit Vehicle Tracking	APTS1-6 (No-So)
	APTS2	Transit Fixed-Route Operations	APTS2-10 (No-So)
	APTS4	Transit Passenger and Fare Management	APTS4-1 (No)
	APTS7	Multi-modal Coordination	APTS7-1 (No)
	APTS7	Multi-modal Coordination	APTS7-2 (No)
	EM07	Early Warning System	EM07-1 (No)
	EM08	Disaster Response and Recovery	EM08-1 (No)
	MC04	Weather Information Processing and Distribution	MC04-6 (No)
Private ISPs			
	APTS2	Transit Fixed-Route Operations	APTS2-04 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-05 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-08 (No-So)
	APTS2	Transit Fixed-Route Operations	APTS2-09 (No-So)
	APTS2	Transit Fixed-Route Operations	APTS2-10 (No-So)
	APTS8	Transit Traveler Information	APTS8-06 (No)
	APTS8	Transit Traveler Information	APTS8-07 (No)

Stakeholder	Market Package	Name	Market Package Instance
Private ISPs			
	APTS8	Transit Traveler Information	APTS8-08 (No)
	ATIS1	Broadcast Traveler Information	ATIS1-4 (No-So)
	ATIS2	Interactive Traveler Information	ATIS2-03 (No)
	ATIS2	Interactive Traveler Information	ATIS2-10 (No)
	ATIS2	Interactive Traveler Information	ATIS2-11 (No-So)
	ATMS06	Traffic Information Dissemination	ATMS06-01 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-02 (No-So)
	ATMS06	Traffic Information Dissemination	ATMS06-07 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-08 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-09 (No)
	ATMS16	Parking Facility Management	ATMS16-11 (No-So)
	ATMS16	Parking Facility Management	ATMS16-6 (No-So)
	ATMS16	Parking Facility Management	ATMS16-9 (No-So)
	ATMS20	Drawbridge Management	ATMS20-1 (No)
	CVO01	Fleet Administration	CVO01-4 (No-So)
Private Passenger Rail Operators			
	AD1	ITS Data Mart	AD1-08 (No)
	APTS7	Multi-modal Coordination	APTS7-1 (No)
Private Transit Operators			
	AD1	ITS Data Mart	AD1-08 (No)
	APTS1	Transit Vehicle Tracking	APTS1-5 (No-So)
	APTS2	Transit Fixed-Route Operations	APTS2-08 (No-So)
	APTS3	Demand Response Transit Operations	APTS3-5 (No)
	APTS4	Transit Passenger and Fare Management	APTS4-1 (No)
	APTS7	Multi-modal Coordination	APTS7-1 (No)
	APTS7	Multi-modal Coordination	APTS7-2 (No)
	APTS7	Multi-modal Coordination	APTS7-4 (No)
	ATMS02	Probe Surveillance	ATMS02-5 (No)
	EM07	Early Warning System	EM07-1 (No)
	EM08	Disaster Response and Recovery	EM08-1 (No)
	EM09	Evacuation and Reentry Management	EM09-2 (No)
Private Venues			
	ATMS07	Regional Traffic Control	ATMS07-01 (No)
	ATMS07	Regional Traffic Control	ATMS07-05 (No)
	ATMS07	Regional Traffic Control	ATMS07-06 (No)
	ATMS08	Traffic Incident Management System	ATMS08-08 (No)
PTC - Pennsylvania Turnpike Commission			
	MC03	Road Weather Data Collection	MC03-4 (No)
Public or Private Smart Card Providers			
	APTS4	Transit Passenger and Fare Management	APTS4-2 (No)
Railroad Operators			
	ATMS13	Standard Railroad Grade Crossing	ATMS13-1 (No)
	ATMS13	Standard Railroad Grade Crossing	ATMS13-2 (No)

Stakeholder	Market Package	Name	Market Package Instance
Railroad Operators			
	ATMS14	Advanced Railroad Grade Crossing	ATMS14-1 (No)
	ATMS14	Advanced Railroad Grade Crossing	ATMS14-2 (No-So)
	ATMS15	Railroad Operations Coordination	ATMS15-1 (No)
	MC10	Maintenance and Construction Activity Coordination	MC10-3 (No)
Regional Airport Authorities			
	APTS7	Multi-modal Coordination	APTS7-4 (No)
Regional GIS and Map Providers			
	AD1	ITS Data Mart	AD1-08 (No)
Regional Hospitals			
	EM02	Emergency Routing	EM02-1 (No)
	EM02	Emergency Routing	EM02-2 (No)
	EM02	Emergency Routing	EM02-3 (No)
	EM02	Emergency Routing	EM02-4 (No)
Regulatory Agencies			
	AD3	ITS Virtual Data Warehouse	AD3-1 (No)
Rutgers University			
	APTS1	Transit Vehicle Tracking	APTS1-4 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-07 (No)
	APTS3	Demand Response Transit Operations	APTS3-4 (No)
	APTS5	Transit Security	APTS5-08 (No)
	APTS7	Multi-modal Coordination	APTS7-1 (No)
School Districts			
	APTS1	Transit Vehicle Tracking	APTS1-6 (No-So)
	APTS2	Transit Fixed-Route Operations	APTS2-09 (No-So)
	APTS7	Multi-modal Coordination	APTS7-1 (No)
	EM07	Early Warning System	EM07-1 (No)
	EM08	Disaster Response and Recovery	EM08-1 (No)
SJTA - South Jersey Transportation Authority			
	ATMS07	Regional Traffic Control	ATMS07-02 (No-So)
	ATMS16	Parking Facility Management	ATMS16-6 (No-So)
	MC06	Winter Maintenance	MC06-2 (No-So)
SJTPO - South Jersey Transportation Planning Organization			
	AD3	ITS Virtual Data Warehouse	AD3-3 (No-So)
SJTPO Counties			
	ATMS07	Regional Traffic Control	ATMS07-02 (No-So)
	ATMS07	Regional Traffic Control	ATMS07-03 (No)
	ATMS07	Regional Traffic Control	ATMS07-04 (No)
	ATMS08	Traffic Incident Management System	ATMS08-09 (No)
	ATMS08	Traffic Incident Management System	ATMS08-10 (No)
	ATMS16	Parking Facility Management	ATMS16-6 (No-So)
	MC06	Winter Maintenance	MC06-2 (No-So)
	MC06	Winter Maintenance	MC06-3 (No-So)

Stakeholder	Market Package	Name	Market Package Instance
SJTPO Municipalities			
	ATMS07	Regional Traffic Control	ATMS07-02 (No-So)
	ATMS07	Regional Traffic Control	ATMS07-03 (No)
	ATMS07	Regional Traffic Control	ATMS07-04 (No)
	ATMS08	Traffic Incident Management System	ATMS08-09 (No)
	ATMS08	Traffic Incident Management System	ATMS08-10 (No)
	ATMS16	Parking Facility Management	ATMS16-6 (No-So)
	MC06	Winter Maintenance	MC06-2 (No-So)
	MC06	Winter Maintenance	MC06-3 (No-So)
SJTPO Public Safety Agencies			
	ATMS08	Traffic Incident Management System	ATMS08-06 (No)
	CVO10	HAZMAT Management	CVO10-1 (No-So)
	MC04	Weather Information Processing and Distribution	MC04-3 (No-So)
	MC06	Winter Maintenance	MC06-2 (No-So)
SJTPO Transit Operators			
	MC04	Weather Information Processing and Distribution	MC04-3 (No-So)
	MC06	Winter Maintenance	MC06-2 (No-So)
Statewide Fare Reciprocity Administrator			
	APTS4	Transit Passenger and Fare Management	APTS4-1 (No)
TMA - Transportation Management Association			
	AD1	ITS Data Mart	AD1-08 (No)
	APTS1	Transit Vehicle Tracking	APTS1-2 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-04 (No)
	APTS3	Demand Response Transit Operations	APTS3-2 (No)
	APTS3	Demand Response Transit Operations	APTS3-5 (No)
	APTS4	Transit Passenger and Fare Management	APTS4-1 (No)
	APTS5	Transit Security	APTS5-05 (No)
	APTS5	Transit Security	APTS5-06 (No)
	APTS7	Multi-modal Coordination	APTS7-1 (No)
	APTS7	Multi-modal Coordination	APTS7-2 (No)
	APTS7	Multi-modal Coordination	APTS7-4 (No)
	APTS8	Transit Traveler Information	APTS8-06 (No)
	APTS8	Transit Traveler Information	APTS8-07 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-01 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-02 (No-So)
	EM06	Wide-Area Alert	EM06-1 (No)
	EM07	Early Warning System	EM07-1 (No)
	EM08	Disaster Response and Recovery	EM08-1 (No)
	EM09	Evacuation and Reentry Management	EM09-2 (No)
	MC04	Weather Information Processing and Distribution	MC04-1 (No)
	MC04	Weather Information Processing and Distribution	MC04-3 (No-So)
	MC04	Weather Information Processing and Distribution	MC04-5 (No)
	MC04	Weather Information Processing and Distribution	MC04-6 (No)
	MC06	Winter Maintenance	MC06-1 (No)

Stakeholder	Market Package	Name	Market Package Instance
TMA - Transportation Management Association			
	MC06	Winter Maintenance	MC06-2 (No-So)
	MC06	Winter Maintenance	MC06-5 (No)
	MC06	Winter Maintenance	MC06-7 (No)
	MC06	Winter Maintenance	MC06-9 (No)
	MC08	Work Zone Management	MC08-2 (No)
TRANSCOM			
	AD1	ITS Data Mart	AD1-04 (No)
	AD1	ITS Data Mart	AD1-21 (No)
	AD3	ITS Virtual Data Warehouse	AD3-1 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-02 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-03 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-04 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-05 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-06 (No)
	APTS2	Transit Fixed-Route Operations	APTS2-08 (No-So)
	APTS2	Transit Fixed-Route Operations	APTS2-10 (No-So)
	APTS3	Demand Response Transit Operations	APTS3-2 (No)
	APTS3	Demand Response Transit Operations	APTS3-3 (No)
	APTS3	Demand Response Transit Operations	APTS3-4 (No)
	APTS3	Demand Response Transit Operations	APTS3-5 (No)
	APTS5	Transit Security	APTS5-01 (No)
	APTS5	Transit Security	APTS5-02 (No)
	APTS5	Transit Security	APTS5-03 (No)
	APTS5	Transit Security	APTS5-04 (No)
	APTS5	Transit Security	APTS5-05 (No)
	APTS5	Transit Security	APTS5-06 (No)
	APTS5	Transit Security	APTS5-07 (No)
	APTS7	Multi-modal Coordination	APTS7-2 (No)
	APTS7	Multi-modal Coordination	APTS7-4 (No)
	APTS8	Transit Traveler Information	APTS8-05 (No)
	APTS8	Transit Traveler Information	APTS8-06 (No)
	APTS8	Transit Traveler Information	APTS8-08 (No)
	APTS8	Transit Traveler Information	APTS8-09 (No)
	ATIS2	Interactive Traveler Information	ATIS2-01 (No)
	ATIS2	Interactive Traveler Information	ATIS2-05 (No)
	ATIS2	Interactive Traveler Information	ATIS2-06 (No)
	ATIS2	Interactive Traveler Information	ATIS2-07 (No)
	ATIS2	Interactive Traveler Information	ATIS2-08 (No)
	ATIS2	Interactive Traveler Information	ATIS2-09 (No)
	ATIS2	Interactive Traveler Information	ATIS2-10 (No)
	ATIS2	Interactive Traveler Information	ATIS2-11 (No-So)
	ATIS5	ISP Based Route Guidance	ATIS5-1 (No)
	ATMS02	Probe Surveillance	ATMS02-3 (No)

<i>Stakeholder</i>	<i>Market Package</i>	<i>Name</i>	<i>Market Package Instance</i>
TRANSCOM			
	ATMS02	Probe Surveillance	ATMS02-5 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-01 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-02 (No-So)
	ATMS06	Traffic Information Dissemination	ATMS06-03 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-04 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-05 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-06 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-07 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-08 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-09 (No)
	ATMS07	Regional Traffic Control	ATMS07-01 (No)
	ATMS07	Regional Traffic Control	ATMS07-02 (No-So)
	ATMS07	Regional Traffic Control	ATMS07-03 (No)
	ATMS07	Regional Traffic Control	ATMS07-04 (No)
	ATMS07	Regional Traffic Control	ATMS07-05 (No)
	ATMS07	Regional Traffic Control	ATMS07-06 (No)
	ATMS07	Regional Traffic Control	ATMS07-07 (No)
	ATMS07	Regional Traffic Control	ATMS07-08 (No)
	ATMS08	Traffic Incident Management System	ATMS08-01 (No)
	ATMS08	Traffic Incident Management System	ATMS08-02 (No)
	ATMS08	Traffic Incident Management System	ATMS08-03 (No)
	ATMS08	Traffic Incident Management System	ATMS08-04 (No)
	ATMS08	Traffic Incident Management System	ATMS08-06 (No)
	ATMS08	Traffic Incident Management System	ATMS08-07 (No)
	ATMS08	Traffic Incident Management System	ATMS08-08 (No)
	ATMS16	Parking Facility Management	ATMS16-11 (No-So)
	ATMS16	Parking Facility Management	ATMS16-2 (No)
	ATMS16	Parking Facility Management	ATMS16-6 (No-So)
	ATMS16	Parking Facility Management	ATMS16-9 (No-So)
	CVO01	Fleet Administration	CVO01-4 (No-So)
	EM05	Transportation Infrastructure Protection	EM05-6 (No)
	EM06	Wide-Area Alert	EM06-1 (No)
	EM07	Early Warning System	EM07-1 (No)
	EM09	Evacuation and Reentry Management	EM09-1 (No)
	MC04	Weather Information Processing and Distribution	MC04-1 (No)
	MC04	Weather Information Processing and Distribution	MC04-3 (No-So)
	MC04	Weather Information Processing and Distribution	MC04-6 (No)
	MC06	Winter Maintenance	MC06-1 (No)
	MC06	Winter Maintenance	MC06-3 (No)
	MC06	Winter Maintenance	MC06-3 (No-So)
	MC06	Winter Maintenance	MC06-5 (No)
	MC06	Winter Maintenance	MC06-6 (No)
	MC06	Winter Maintenance	MC06-8 (No)

Stakeholder	Market Package	Name	Market Package Instance
TRANSCOM			
	MC07	Roadway Maintenance and Construction	MC07-1 (No)
	MC07	Roadway Maintenance and Construction	MC07-2 (No)
	MC07	Roadway Maintenance and Construction	MC07-4 (No)
	MC08	Work Zone Management	MC08-1 (No)
	MC08	Work Zone Management	MC08-2 (No)
	MC10	Maintenance and Construction Activity Coordination	MC10-1 (No)
	MC10	Maintenance and Construction Activity Coordination	MC10-2 (No)
	MC10	Maintenance and Construction Activity Coordination	MC10-3 (No)
TRANSMIT Agencies			
	ATMS02	Probe Surveillance	ATMS02-3 (No)
	ATMS02	Probe Surveillance	ATMS02-5 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-03 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-04 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-05 (No)
	ATMS06	Traffic Information Dissemination	ATMS06-06 (No)
	ATMS07	Regional Traffic Control	ATMS07-07 (No)
Transportation Information Users			
	AD1	ITS Data Mart	AD1-04 (No)
	AD1	ITS Data Mart	AD1-07 (No)
	AD1	ITS Data Mart	AD1-21 (No)
	AD3	ITS Virtual Data Warehouse	AD3-1 (No)
	AD3	ITS Virtual Data Warehouse	AD3-2 (No)
Travelers			
	APTS8	Transit Traveler Information	APTS8-06 (No)
	APTS8	Transit Traveler Information	APTS8-07 (No)
	ATIS1	Broadcast Traveler Information	ATIS1-1 (No-So)
	ATIS1	Broadcast Traveler Information	ATIS1-2 (No-So)
	ATIS1	Broadcast Traveler Information	ATIS1-4 (No-So)
	ATIS2	Interactive Traveler Information	ATIS2-01 (No)
	ATIS2	Interactive Traveler Information	ATIS2-05 (No)
	ATIS2	Interactive Traveler Information	ATIS2-06 (No)
	ATIS2	Interactive Traveler Information	ATIS2-07 (No)
	ATIS2	Interactive Traveler Information	ATIS2-08 (No)
	ATIS2	Interactive Traveler Information	ATIS2-09 (No)
	ATIS2	Interactive Traveler Information	ATIS2-10 (No)
	ATIS2	Interactive Traveler Information	ATIS2-11 (No-So)
	ATIS5	ISP Based Route Guidance	ATIS5-1 (No)
	ATMS16	Parking Facility Management	ATMS16-11 (No-So)
	ATMS16	Parking Facility Management	ATMS16-6 (No-So)
	ATMS16	Parking Facility Management	ATMS16-9 (No-So)
Weather Service Provider			
	MC03	Road Weather Data Collection	MC03-1 (No)
	MC03	Road Weather Data Collection	MC03-2 (No)

<i>Stakeholder</i>	<i>Market Package</i>	<i>Name</i>	<i>Market Package Instance</i>
Weather Service Provider			
	MC03	Road Weather Data Collection	MC03-3 (No)
	MC03	Road Weather Data Collection	MC03-4 (No)
	MC03	Road Weather Data Collection	MC03-5 (No-So)
	MC06	Winter Maintenance	MC06-3 (No)
	MC06	Winter Maintenance	MC06-3 (No-So)
	MC06	Winter Maintenance	MC06-6 (No)
	MC06	Winter Maintenance	MC06-8 (No)
WILMAPCO			
	AD3	ITS Virtual Data Warehouse	AD3-3 (No-So)

Appendix 7.A

Functional Requirements

Functional Requirements

Northern New Jersey ITS Architecture

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Architecture

Northern New Jersey ITS Architecture

Element:AMTRAK Emergency Dispatch

Entity:Emergency Management

Functional Area: Emergency Call-Taking

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

- Requirement:* 1 The center shall support the interface to the Emergency Telecommunications System (e.g. 911 or 7-digit call routing) to receive emergency notification information and provide it to the emergency system operator.
-
- Requirement:* 2 The center shall receive emergency call information from 911 services and present the possible incident information to the emergency system operator.
-
- Requirement:* 3 The center shall receive emergency call information from motorist call-boxes and present the possible incident information to the emergency system operator.
-
- Requirement:* 4 The center shall receive emergency call information from mayday service providers and present the possible incident information to the emergency system operator.
-
- Requirement:* 5 The center shall receive emergency notification information from other public safety agencies and present the possible incident information to the emergency system operator.
-
- Requirement:* 6 The center shall receive emergency notification information from public transit systems and present the possible incident information to the emergency system operator.
-
- Requirement:* 7 The center shall receive emergency notification information from commercial vehicles, commercial vehicle check stations, or commercial fleet operators and present the possible incident information to the emergency system operator. This may include detection of non-permitted transport of security sensitive hazmat, hazardous cargo spills, etc.
-
- Requirement:* 8 The center shall receive details of the cargo being carried by commercial vehicles from their commercial fleet manager for incidents involving potential hazardous materials.
-
- Requirement:* 9 The center shall coordinate, correlate, and verify all emergency inputs, including those identified based on external calls and internal analysis of security sensor and surveillance data, and assign each a level of confidence.
-
- Requirement:* 10 The center shall send a request for remote control of CCTV systems from a traffic management center in order to verify the reported incident.
-
- Requirement:* 11 The center shall update the incident information log once the emergency system operator has verified the incident.
-
- Requirement:* 12 The center shall provide the capability for digitized map data to act as the background to the emergency information presented to the emergency system operator.
-
- Requirement:* 13 The center shall forward the verified emergency information to the responding agency based on the location and nature of the emergency.
-

Functional Area: Emergency Dispatch

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

- Requirement:* 1 The center shall dispatch emergency vehicles to respond to verified emergencies and provide suggested routing under center personnel control.
-

Architecture**Northern New Jersey ITS Architecture***Element:***AMTRAK Emergency Dispatch***Entity:***Emergency Management***Functional Area:* **Emergency Dispatch**

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

- | | | |
|---------------------|----|---|
| <i>Requirement:</i> | 2 | The center shall store the current status of all emergency vehicles available for dispatch and those that have been dispatched. |
| <i>Requirement:</i> | 3 | The center shall relay location and incident details to the responding vehicles. |
| <i>Requirement:</i> | 4 | The center shall provide the capability to request traffic control measures from traffic management centers such as signal preemption, traffic barriers and road closures. |
| <i>Requirement:</i> | 5 | The center shall track the location and status of emergency vehicles responding to an emergency and update the incident status based on information from the emergency vehicle. |
| <i>Requirement:</i> | 6 | The center shall receive status information from care facilities to determine the appropriate facility and its location. |
| <i>Requirement:</i> | 7 | The center shall store and maintain the emergency service responses in an action log. |
| <i>Requirement:</i> | 8 | The center shall receive asset restriction information from maintenance centers to support the dispatching of appropriate emergency resources. |
| <i>Requirement:</i> | 9 | The center shall receive traffic information, including closures, traffic conditions, etc. from traffic management centers. |
| <i>Requirement:</i> | 10 | The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator. |
| <i>Requirement:</i> | 11 | The center shall receive road network conditions and traffic images to support dispatch of emergency vehicles. |
| <i>Requirement:</i> | 12 | The center shall coordinate response to incidents with other Emergency Management centers to ensure appropriate resources are dispatched and utilized. |

Functional Area: **Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

- | | | |
|---------------------|---|--|
| <i>Requirement:</i> | 1 | The center shall provide strategic emergency response capabilities such as that of an Emergency Operations Center for large-scale incidents and disasters. |
| <i>Requirement:</i> | 2 | The center shall manage coordinated inter-agency responses to and recovery from large-scale emergencies. Such agencies include traffic management, transit, maintenance and construction management, rail operations, and other emergency management agencies. |
| <i>Requirement:</i> | 3 | The center shall provide the capability to implement response plans and track progress through the incident by exchanging incident information and distributing response status to allied agencies. |
| <i>Requirement:</i> | 4 | The center shall develop, coordinate with other agencies, and store emergency response plans. |
| <i>Requirement:</i> | 5 | The center shall track the availability of resources (including vehicles, roadway cleanup?, etc.), request additional resources from traffic, maintenance, or other emergency centers if needed. |
| <i>Requirement:</i> | 6 | The center shall allocate the appropriate emergency services, resources, and vehicle (s) to respond to incidents, and shall provide the capability to override the current allocation to suit the special needs of a current incident. |
| <i>Requirement:</i> | 7 | The center shall receive event scheduling information from Event Promoters. |
| <i>Requirement:</i> | 8 | The center shall receive hazardous materials incident information from commercial fleet operators. |
| <i>Requirement:</i> | 9 | The center shall provide the capability to request the safe disabling of a commercial vehicle during a hazardous materials incident. |

Architecture**Northern New Jersey ITS Architecture***Element:***AMTRAK Emergency Dispatch***Entity:***Emergency Management***Functional Area:* **Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

- Requirement:* 10 The center shall provide the capability to request transit resource availability from transit centers for use during disaster and evacuation operations.
- Requirement:* 11 The center shall assimilate the status of the transit, traffic, rail, maintenance, and other emergency center services and systems to create an overall transportation system status, and disseminate to each of these centers and the traveling public via traveler information providers.
- Requirement:* 12 The center shall provide information to the media concerning the status of an emergency response.
- Requirement:* 13 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.
- Requirement:* 14 The center shall provide the capability for center personnel to provide inputs to the management of incidents, disasters and evacuations.

Functional Area: **Incident Command**

Tactical decision support, resource coordination, and communications integration among emergency management agencies for Incident Commands that are established by first responders to support local management of an incident.

- Requirement:* 1 The center shall provide tactical decision support, resource coordination, and communications integration for Incident Commands that are established by first responders to support local management of an incident.
- Requirement:* 2 The center shall provide incident command communications with public safety, emergency management, transportation, and other allied response agency centers.
- Requirement:* 3 The center shall track and maintain resource information and action plans pertaining to the incident command.
- Requirement:* 4 The center shall share incident command information with other public safety agencies including resource deployment status, hazardous material information, rail incident information, evacuation advice as well as traffic, road, and weather conditions.
- Requirement:* 5 The center shall assess the status of responding emergency vehicles as part of an incident command.

Functional Area: **Center Secure Area Surveillance**

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 1 The center shall remotely monitor video images and audio surveillance data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The data may be raw or pre-processed in the field.
- Requirement:* 2 The center shall remotely monitor video images and audio surveillance data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The data may be raw or pre-processed in the field.
- Requirement:* 3 The center shall remotely monitor video images and audio surveillance data collected on-board transit vehicles. The data may be raw or pre-processed in the field.
- Requirement:* 4 The center shall exchange surveillance data with other emergency centers.
- Requirement:* 5 The center shall identify potential security threats based on collected security surveillance data.

Architecture**Northern New Jersey ITS Architecture***Element:AMTRAK Emergency Dispatch**Entity:Emergency Management**Functional Area: Center Secure Area Surveillance*

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 6 The center shall verify potential security threats by correlating security surveillance data from multiple sources.
- Requirement:* 7 The center shall remotely control security surveillance devices in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways).
- Requirement:* 8 The center shall remotely control security surveillance devices in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers).
- Requirement:* 9 The center shall remotely control security surveillance devices on-board transit vehicles.
- Requirement:* 10 The center shall match traveler video images against a database from the Alerting and Advisory Systems of known images that may represent criminals and terrorists.
- Requirement:* 11 The center shall exchange traveler images with other emergency management centers to support traveler image matching.
- Requirement:* 12 The center shall respond to control data from center personnel regarding security surveillance data collection, processing, threat detection, and image matching.

Functional Area: Center Secure Area Sensor Management

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 1 The center shall remotely monitor and control security sensor data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), infrastructure condition and integrity, intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 2 The center shall remotely monitor and control security sensor data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 3 The center shall remotely monitor and control security sensor data collected on-board transit vehicles. The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors) and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 4 The center shall exchange security sensor data with other emergency centers.
- Requirement:* 5 The center shall identify potential security threats based on collected security sensor data.
- Requirement:* 6 The center shall verify potential security threats by correlating security sensor data from multiple sources.
- Requirement:* 7 The center shall perform threat analysis based on correlations of security sensor and surveillance data.

Architecture

Northern New Jersey ITS Architecture

Element:AMTRAK Emergency Dispatch

Entity:Emergency Management

Functional Area: Center Secure Area Sensor Management

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

Requirement: 8 The center shall exchange threat analysis data with Alerting and Advisory Systems and use that data in local threat analysis processing.

Requirement: 9 The center shall disseminate threat information to other agencies, including traffic, transit, maintenance, rail operations, and other emergency management centers.

Requirement: 10 The center shall respond to control data from center personnel regarding security sensor data collection, processing, threat detection, and threat analysis.

Functional Area: Center Secure Area Alarm Support

Collection and response to silent and audible alarms received from travelers in secure areas (such as transit stops, rest areas, park-and-ride lots) and from on-board transit vehicles.

Requirement: 1 The center shall collect silent and audible alarms received from travelers in secure areas (such as transit stops, rest areas, park and ride lots, modal interchange facilities).

Requirement: 2 The center shall collect silent and audible alarms received from transit vehicles, originated by the traveler or the transit vehicle operator.

Requirement: 3 After the alarm message has been received, the center shall generate an alarm acknowledgment to the sender.

Requirement: 4 After the alarm message becomes a verified incident, the center shall determine the appropriate response.

Requirement: 5 The center shall determine whether the alarm message indicates an emergency that requires the attention of public safety agencies, and forward alarm message data to the appropriate agency as necessary.

Requirement: 6 The center shall forward the alarm message to center personnel and respond to the traveler or transit vehicle operator as directed by the personnel.

Element:AMTRAK National Operations Center

Entity:Transit Management

Functional Area: Transit Center Security

Monitor transit vehicle operator or traveler activated alarms; authenticate transit vehicle operators; remotely disable a transit vehicle; alert operators, travelers, and police to potential incidents identified by these security features.

Requirement: 1 The center shall monitor transit vehicle operational data to determine if the transit vehicle is off-route and assess whether a security incident is occurring.

Requirement: 2 The center shall receive reports of emergencies on-board transit vehicles entered directly by the transit vehicle operator or from a traveler through interfaces such as panic buttons or alarm switches.

Requirement: 3 The center shall support the back-office portion of functionality to authenticate transit vehicle operators.

Requirement: 4 The center shall exchange transit incident information along with other service data with other transit agencies.

Requirement: 5 The center shall receive information pertaining to a wide-area alert such as weather alerts, disaster situations, or child abductions. This information may come from Emergency Management or from other Alerting and Advisory Systems.

Architecture**Northern New Jersey ITS Architecture***Element:***AMTRAK National Operations Center***Entity:***Transit Management***Functional Area:* **Transit Center Security**

Monitor transit vehicle operator or traveler activated alarms; authenticate transit vehicle operators; remotely disable a transit vehicle; alert operators, travelers, and police to potential incidents identified by these security features.

Requirement: 6 The center shall send wide-area alert information to travelers (on-board transit vehicles or at stations/stops) and transit vehicle operators.

Requirement: 7 The center shall coordinate the response to security incidents involving transit with other agencies including Emergency Management, other transit agencies, media, traffic management, and traveler information service providers.

Requirement: 8 The center shall receive threat information and status on the integrity of the transit infrastructure.

Requirement: 9 The center shall provide support to remotely disable (or reset the disabling of) a transit vehicle in service.

Functional Area: **Transit Center Information Services**

Provide interactive traveler information to travelers (on-board transit vehicles, at stops/stations, using personal devices), traveler information service providers, media, and other transit organizations. Includes routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, yellow pages, and special events.

Requirement: 1 The center shall provide travelers using public transportation with traffic and advisory information upon request. Such information may include transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events.

Requirement: 2 The center shall provide transit information to the media including details of deviations from schedule of regular transit services.

Requirement: 3 The center shall exchange transit schedules, real-time arrival information, fare schedules, and general transit service information with other transit organizations to support transit traveler information systems.

Requirement: 4 The center shall provide transit service information to traveler information service providers including routes, schedules, schedule adherence, and fare information as well as transit service information during evacuation.

Requirement: 5 The center shall enable yellow pages (including non-motorized transportation) information to be output to the traveler.

Requirement: 6 The center shall broadcast transit advisory data, including alerts and advisories pertaining to major emergencies, or man made disasters.

Functional Area: **Transit Center Multi-Modal Coordination**

Generate requests for transit priority on routes and at certain intersections. Coordinate schedules with other agencies and modes, including transit transfer cluster and transfer point information.

Requirement: 1 The center shall analyze transit vehicle schedule performance to determine the need for priority along certain routes or at certain intersections.

Requirement: 2 The center shall send requests for priority along routes or at intersections to traffic management.

Requirement: 3 The center shall coordinate schedules and services between transit agencies, traffic management, maintenance and construction operations, parking management, and other surface or air transportation modes.

Requirement: 4 The center shall share transfer cluster and transfer point information with multimodal transportation service providers, other transit agencies, and traveler information service providers. A transfer cluster is a collection of stops, stations, or terminals where transfers can be made conveniently.

Architecture

Northern New Jersey ITS Architecture

Element: **AMTRAK New Jersey Operations Centers**

Entity: **Transit Management**

Functional Area: **Transit Center Fixed-Route Operations**

Planning and scheduling associated with fixed and flexible route transit services, automatically updates customer service operator systems, and provides current vehicle schedule adherence and optimum scenarios for schedule adjustment.

- Requirement:* 1 The center shall generate transit routes and schedules based on such factors as parameters input by the system operator, road network conditions, operational data on current routes and schedules, and digitized map data.
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- Requirement:* 2 The center shall provide the interface to the system operator to control the generation of new routes and schedules (transit services) including the ability to review and update the parameters used by the routes and schedules generation processes and to initiate these processes
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- Requirement:* 3 The center shall be able to generate special routes and schedules to support an incident, disaster, evacuation, or other emergency.
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- Requirement:* 4 The center shall accept requests from traffic management to change routes and schedules as part of the implementation of demand management strategies.
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- Requirement:* 5 The center shall collect transit operational data for use in the generation of routes and schedules.
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- Requirement:* 6 The center shall assign transit vehicle operators based on factors such as eligibility, route preferences, seniority, and transit vehicle availability.
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- Requirement:* 7 The center shall manage large deviations of individual transit vehicles, deviations in rural areas, and deviations of large numbers of vehicles.
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- Requirement:* 8 The center shall generate the necessary corrective actions which may involve more than the vehicles concerned and more far reaching action, such as, the introduction of extra vehicles, wide area signal priority by traffic management, the premature termination of some services, etc.
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- Requirement:* 9 The center shall exchange information with Maintenance and Construction Operations concerning work zones, roadway conditions, asset restrictions, work plans, etc.
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- Requirement:* 10 The center shall disseminate up-to-date schedules and route information to other centers for fixed and flexible route services.
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Functional Area: **Transit Garage Operations**

Assignment of transit vehicles and operators to routes or service areas in a fair manner while minimizing labor and overtime services, considering operator preferences, qualifications, accumulated work hours, and other information about each operator.

- Requirement:* 1 The center shall maintain records of a transit vehicle operator's performance. This may be done utilizing standardized performance evaluation criteria set forth by governmental regulations and transit operating company policies, assessing the transit vehicle operator's driving history, and assessing comments from the transit vehicle operator's supervisor(s) as well as noting any moving violations or accidents, supervisor comments, government regulations, and company policies.
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- Requirement:* 2 The center shall assess the transit vehicle operator's availability based on previous work assignments, accumulated hours, plus health and vacation commitments.
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- Requirement:* 3 The center shall assign transit vehicle operators to transit schedules based on their eligibility, route preferences, seniority, and transit vehicle availability.
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- Requirement:* 4 The center shall provide an interface through which the transit vehicle operator information can be maintained - either from the transit vehicle operator, a transit system operator (i.e. center personnel), or other functions.
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Functional Area: **Transit Center Information Services**

Architecture

Northern New Jersey ITS Architecture

*Element:***AMTRAK New Jersey Operations Centers**

*Entity:***Transit Management**

Functional Area: **Transit Center Information Services**

Provide interactive traveler information to travelers (on-board transit vehicles, at stops/stations, using personal devices), traveler information service providers, media, and other transit organizations. Includes routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, yellow pages, and special events.

- Requirement:* 1 The center shall provide travelers using public transportation with traffic and advisory information upon request. Such information may include transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events.
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- Requirement:* 2 The center shall provide transit information to the media including details of deviations from schedule of regular transit services.
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- Requirement:* 3 The center shall exchange transit schedules, real-time arrival information, fare schedules, and general transit service information with other transit organizations to support transit traveler information systems.
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- Requirement:* 4 The center shall provide transit service information to traveler information service providers including routes, schedules, schedule adherence, and fare information as well as transit service information during evacuation.
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- Requirement:* 5 The center shall enable yellow pages (including non-motorized transportation) information to be output to the traveler.
-
- Requirement:* 6 The center shall broadcast transit advisory data, including alerts and advisories pertaining to major emergencies, or man made disasters.
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Functional Area: **Transit Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and vehicle probes. The information is monitored and forwarded to other agencies to more effectively manage transit operations.

- Requirement:* 1 The center shall assimilate current and forecast road conditions and surface weather information to more effectively manage transit operations.
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- Requirement:* 2 The center shall collect current and forecast road and weather information from weather service providers and vehicle probes.
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- Requirement:* 3 The center shall receive road network probe information from its fleet of transit vehicles.
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- Requirement:* 4 The center shall provide road network probe information from its fleet of transit vehicles to traffic management as well as maintenance and construction management.
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Functional Area: **Transit Center Multi-Modal Coordination**

Generate requests for transit priority on routes and at certain intersections. Coordinate schedules with other agencies and modes, including transit transfer cluster and transfer point information.

- Requirement:* 1 The center shall analyze transit vehicle schedule performance to determine the need for priority along certain routes or at certain intersections.
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- Requirement:* 2 The center shall send requests for priority along routes or at intersections to traffic management.
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- Requirement:* 3 The center shall coordinate schedules and services between transit agencies, traffic management, maintenance and construction operations, parking management, and other surface or air transportation modes.
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- Requirement:* 4 The center shall share transfer cluster and transfer point information with multimodal transportation service providers, other transit agencies, and traveler information service providers. A transfer cluster is a collection of stops, stations, or terminals where transfers can be made conveniently.
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*Element:***DRJTBC District Operations**

Architecture

Northern New Jersey ITS Architecture

*Element:***DRJTBC District Operations**

*Entity:***Maintenance and Construction Management**

Functional Area: **MCM Vehicle Tracking**

Remotely tracks the location of maintenance and construction vehicles and other equipment; presented to the center personnel.

Requirement: 1 The center shall monitor the locations of all maintenance and construction vehicles and other equipment under its jurisdiction.

Requirement: 2 The center shall present location data to center personnel for the fleet of maintenance and construction vehicles and other equipment.

Requirement: 3 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for maintenance and construction vehicle tracking.

Functional Area: **MCM Vehicle and Equipment Maintenance Management**

Monitors vehicle and equipment condition, tracks maintenance history, and schedules routine and corrective maintenance.

Requirement: 1 The center shall collect and analyze vehicle diagnostics information from maintenance and construction vehicles. The information includes engine temperature, mileage, tire wear, brake wear, belt wear, and any warnings or alarms concerning the operational condition of the vehicle and ancillary equipment.

Requirement: 2 The center shall exchange information with equipment repair facilities including status and history of repairs concerning maintenance and construction vehicles. This information includes vehicle status and diagnostic information, vehicle utilization, and coordination of when vehicles will be available for preventative and corrective maintenance.

Requirement: 3 The center shall schedule preventive and corrective vehicle maintenance with the equipment repair facility based on fleet health reports, maintenance records, vehicle utilization and vehicle availability schedules.

Functional Area: **MCM Environmental Information Processing**

Processes current and forecast weather data, road condition information, local environmental data, and uses internal models to develop specialized detailed forecasts of local weather and surface conditions. Disseminates road weather information to other agencies and centers.

Requirement: 1 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.

Requirement: 2 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services) and local environmental sensor data.

Requirement: 3 The center shall use the various data inputs of environmental sensors and road weather data to develop a view of current and predicted road weather and road conditions.

Requirement: 4 The center shall disseminate current and forecasted road weather and road condition information to weather service providers (such as the National Weather Service and value-added sector specific meteorological services) as well as other agencies including traffic, emergency, and transit management, traveler information providers, rail operations centers, media, and other maintenance management centers.

Requirement: 5 The center shall provide value-added sector specific meteorological services with information on basic road facility and treatment information that supports forecasts for road conditions.

Functional Area: **MCM Automated Treatment System Control**

Remotely controls automated roadway treatment systems (to disperse anti-icing chemicals, etc.) directly, or via control of the environmental sensors that activate the treatment systems automatically in the field.

Architecture**Northern New Jersey ITS Architecture***Element:***DRJTBC District Operations***Entity:***Maintenance and Construction Management***Functional Area:* **MCM Automated Treatment System Control**

Remotely controls automated roadway treatment systems (to disperse anti-icing chemicals, etc.) directly, or via control of the environmental sensors that activate the treatment systems automatically in the field.

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| <i>Requirement:</i> | 1 The center shall remotely control automated roadway treatment systems. Treatments can be in the form of fog dispersion, anti-icing chemicals, etc. |
| <i>Requirement:</i> | 2 The center shall remotely control the environmental sensors that upon detecting changes in environmental or atmospheric conditions, automatically activate roadway treatment systems. |
| <i>Requirement:</i> | 3 The center shall collect automated roadway treatment system and associated environmental sensor operational status. |
| <i>Requirement:</i> | 4 The center shall collect automated roadway treatment system and associated environmental sensor fault data and request repair. |
| <i>Requirement:</i> | 5 The center shall accept requests for automated roadway treatment system activation from center personnel. |

Functional Area: **MCM Incident Management**

Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.

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| <i>Requirement:</i> | 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System. |
| <i>Requirement:</i> | 2 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, etc. |
| <i>Requirement:</i> | 3 The center shall exchange incident and threat information with emergency management centers as well as traffic management centers; including notification of existence of incident and expected severity, location, time and nature of incident. |
| <i>Requirement:</i> | 4 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations. |
| <i>Requirement:</i> | 5 The center shall respond to requests from emergency management to provide maintenance and construction resources to implement response plans, assist in clean up, verify an incident, etc. This may also involve coordination with traffic management centers and other maintenance centers. |
| <i>Requirement:</i> | 6 The center shall exchange road network status assessment information with emergency management and traffic management centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery. |
| <i>Requirement:</i> | 7 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts. |
| <i>Requirement:</i> | 8 The center shall receive information indicating the damage sustained by transportation assets, derived from aerial surveillance, field reports, inspections, tests, and analyses to support incident management. |

Functional Area: **MCM Maintenance Decision Support**

Architecture**Northern New Jersey ITS Architecture****Element:DRJTBC District Operations****Entity:Maintenance and Construction Management****Functional Area: MCM Maintenance Decision Support**

Maintenance Decision Support Systems recommend courses of action based on current and forecast environmental and road conditions (filtered and fused for specific time horizons) and additional application specific information. Recommendations and dispatch instructions are generated based on this integrated information.

- Requirement:* 1 The center shall provide the center personnel with tailored external information, including weather or road condition observations, forecasted weather information or road conditions, current usage of treatments and materials, available resources, equipment and vehicle availability, road network information, and source reliability information.
- Requirement:* 2 The center shall tailor the decision support information to include filtering (selection from a large amount of external information), error reduction ('smoothing' the information), fusion (combination of disparate information to match the decision needs), and analysis (creating the decision).
- Requirement:* 3 The center shall provide an interface to the center personnel to input control parameters for the decision support process and receive decisions or information presentation.
- Requirement:* 4 The center shall provide dispatch information to maintenance and construction vehicles based on the outputs of the decision support system, including recommended roadway treatment actions.

Functional Area: MCM Winter Maintenance Management

Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.

- Requirement:* 1 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other winter roadway maintenance.
- Requirement:* 2 The center shall exchange information with administrative systems to support the planning and scheduling of winter maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
- Requirement:* 3 The center shall provide status information about scheduled winter maintenance activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, and the media.
- Requirement:* 4 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of winter maintenance activities.
- Requirement:* 5 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of winter maintenance activities.
- Requirement:* 6 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
- Requirement:* 7 The center shall dispatch and route winter maintenance vehicle drivers and support them with route-specific environmental, incident, advisory, threat, alert, and traffic congestion information.
- Requirement:* 8 The center shall determine the need for roadway treatment based on current and forecasted weather information, current usage of treatments and materials, available resources, requests for action from other agencies, and recommendations from the Maintenance Decision Support system, specifically under winter conditions. This supports winter maintenance such as plowing, treating, anti-icing, etc.

Architecture**Northern New Jersey ITS Architecture****Element:DRJTBC District Operations****Entity:Maintenance and Construction Management****Functional Area: MCM Winter Maintenance Management**

Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.

- Requirement:* 9 The center shall provide dispatch instructions for vehicle operators based on input parameters from center personnel, specifically for winter conditions. This could include a treatment route, treatment application rates, start and end times, and other treatment instructions.
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- Requirement:* 10 The center shall support remote control of on-board maintenance and construction vehicle systems and field equipment that is remotely controlled by the vehicle such as adjusting material application rates and spread patterns.
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- Requirement:* 11 The center shall assess the current status of all winter maintenance activities, including actual work activities performed, current locations and operational conditions of vehicles, materials and equipment inventories, field equipment status, environmental information, etc.

Functional Area: MCM Roadway Maintenance and Construction

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

- Requirement:* 1 The center shall maintain an interface with asset management systems to track the inventory, restrictions, repair needs and status updates of transportation assets (pavement, bridges, signs, etc.) including location, installation and materials information, vendor/contractor, current maintenance status, standard height, width, and weight restrictions.
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- Requirement:* 2 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other roadway maintenance.
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- Requirement:* 3 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
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- Requirement:* 4 The center shall provide emergency management and traffic management centers with information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.
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- Requirement:* 5 The center shall collect the status and fault data from roadside equipment, such as traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
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- Requirement:* 6 The center shall collect the status and fault data from traffic management centers, including data for traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
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- Requirement:* 7 The center shall remotely control and collect data from infrastructure monitoring sensors located along the roadway infrastructure or on maintenance and construction vehicles.
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- Requirement:* 8 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of roadway maintenance and construction activities.
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- Requirement:* 9 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of roadway maintenance and construction activities.

Architecture**Northern New Jersey ITS Architecture***Element:***DRJTBC District Operations***Entity:***Maintenance and Construction Management***Functional Area:* **MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

- Requirement:* 10 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
- Requirement:* 11 The center shall dispatch and route maintenance and construction vehicle drivers and support them with route- specific environmental, incident, advisory, threat, alert, and traffic congestion information.
- Requirement:* 12 The center shall manage an interface with center personnel to accept vehicle systems control information and remotely control maintenance and construction vehicle on-board equipment.
- Requirement:* 13 The center shall track the status of roadway maintenance and construction activities by monitoring collected data from the dispatched vehicles and equipment.

Functional Area: **MCM Work Zone Management**

Remotely monitors and supports work zone activities, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).

- Requirement:* 1 The center shall generate new work zone activity schedules for use by maintenance and construction vehicles, maintenance and construction operators, and for information coordination purposes.
- Requirement:* 2 The center shall control the collection of work zone status information including video images from cameras located in or near the work zone.
- Requirement:* 3 The center shall disseminate work zone information to other agencies and centers including traffic, transit, emergency management centers, other maintenance centers, traveler information providers, and the media.
- Requirement:* 4 The center shall control traffic in work zones by providing remote control of dynamic message signs and highway advisory radio systems located in or near the work zone.
- Requirement:* 5 The center shall exchange information with administrative systems to support the planning and scheduling of work zone activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.

Functional Area: **MCM Work Activity Coordination**

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

- Requirement:* 1 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.
- Requirement:* 2 The center shall provide status information about scheduled maintenance and construction activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, multimodal transportation providers, rail operations, and the media.
- Requirement:* 3 The center shall collect and respond to feedback concerning scheduled maintenance and construction activities with other management centers such as traffic, emergency, transit, and rail operations.

Architecture**Northern New Jersey ITS Architecture***Element:DRJTBC District Operations**Entity:Maintenance and Construction Management**Functional Area: MCM Work Activity Coordination*

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

- Requirement:* 4 The center shall collect and disseminate asset restriction information levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.
- Requirement:* 5 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance and construction activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
- Requirement:* 6 The center shall exchange rail schedules and work plans with rail operations centers.

*Element:DRJTBC Emergency Vehicles**Entity:Emergency Vehicle Subsystem**Functional Area: On-board EV En Route Support*

On-board systems for gathering of dispatch and routing information for emergency vehicle personnel, vehicle tracking, communications with care facilities, and signal preemption via short range communication directly with traffic control equipment at the roadside.

- Requirement:* 1 The emergency vehicle, including roadway service patrols, shall compute the location of the emergency vehicle based on inputs from a vehicle location determination function.
- Requirement:* 2 The emergency vehicle, including roadway service patrols, shall send the vehicle's location and operational data to the center for emergency management and dispatch.
- Requirement:* 3 The emergency vehicle, including roadway service patrols, shall receive incident details and a suggested route when dispatched to a scene.
- Requirement:* 4 The emergency vehicle shall send the current en route status (including estimated time of arrival) and requests for emergency dispatch updates.
- Requirement:* 5 The emergency vehicle shall send requests to traffic signal control equipment at the roadside to preempt the signal.
- Requirement:* 6 The emergency vehicle shall provide the personnel on-board with dispatch information, including incident type and location, and forward an acknowledgment from personnel to the center that the vehicle is on its way to the incident scene.
- Requirement:* 7 The emergency vehicle shall send patient status information to the care facility along with a request for further information.
- Requirement:* 8 The emergency vehicle shall forward care facility status information to emergency vehicle personnel, including the location, specialized services, quality of care, waiting time, number of rooms available, and emergency room status of hospitals or emergency care providers.

*Element:DRJTBC Facility Commercial Vehicle Check**Entity:Commercial Vehicle Check**Functional Area: Roadside Electronic Screening*

Roadside check facility equipment to communicate with commercial vehicles at mainline speeds - reading tag data, identification, weight and vehicle characteristics, and credential checking. Determines whether a pull-in message should be generated, allowing for inspectors to override.

Architecture**Northern New Jersey ITS Architecture****Element: DRJTBC Facility Commercial Vehicle Check****Entity: Commercial Vehicle Check****Functional Area: Roadside Electronic Screening**

Roadside check facility equipment to communicate with commercial vehicles at mainline speeds - reading tag data, identification, weight and vehicle characteristics, and credential checking. Determines whether a pull-in message should be generated, allowing for inspectors to override.

- Requirement:* 1 The roadside check facility equipment shall detect the presence of commercial vehicles and freight equipment approaching a facility. Sensors can differentiate between different types of vehicles and determine the number of axles, gross vehicle weight, and the identification of the vehicle and its cargo.
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- Requirement:* 2 The roadside check facility equipment shall receive the credential and credentials status information (e.g. snapshots) from the commercial vehicle administration center to maintain an up to date list of which vehicles have been cleared (enrolled) to potentially pass through without stopping.
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- Requirement:* 3 The roadside check facility equipment shall receive violation records from appropriate law enforcement agencies pertaining to commercial vehicles.
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- Requirement:* 4 The roadside check facility equipment shall provide an interface to inspectors in the field to allow them to monitor and if necessary override the pull-in decisions made by the system.
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- Requirement:* 5 The roadside check facility equipment shall request and input electronic screening data from the commercial vehicle's electronic tag data.
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- Requirement:* 6 The roadside check facility equipment shall send a pass/pull-in notification to the commercial vehicle and its driver based on the information received from the vehicle, the administration center, enforcement agencies, and the inspector. The message may be sent to the on-board equipment in the commercial vehicle or transmitted to the driver using equipment such as dynamic message signs, red-green lights, flashing signs, etc.
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- Requirement:* 7 The roadside check facility equipment shall send a record of daily activities at the facility including summaries of screening events and inspections to the commercial vehicle administration center.

Functional Area: Roadside WIM

Roadside check facility equipment to detect and measure the weight commercial vehicles at high speed. Can include an interface to the credential checking or it can be a stand alone package with display.

- Requirement:* 1 The roadside check facility equipment shall detect the presence of commercial vehicles and freight equipment approaching a facility. Sensors can differentiate between different types of vehicles and determine the number of axles, gross vehicle weight, weight per axle, and the identification of the vehicle and its cargo.
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- Requirement:* 2 The roadside check facility equipment shall request and input electronic screening data from the commercial vehicle's electronic tag data.
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- Requirement:* 3 The roadside check facility equipment shall send a pass/pull-in notification to the commercial vehicle and its driver based on the information received from the vehicle and the measurements taken. The message may be sent to the on-board equipment in the commercial vehicle or transmitted to the driver using equipment such as dynamic message signs, red-green lights, flashing signs, etc.

Functional Area: Citation and Accident Electronic Recording

Roadside check facility equipment to records results of roadside inspections and forwards information to the commercial vehicle administration center. Includes accident reports, violations, citations, and the daily site activity data.

- Requirement:* 1 The roadside check facility equipment shall record the results of roadside inspections carried using an inspector's hand held terminal interface.
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- Requirement:* 2 The roadside check facility equipment shall provide an interface for an inspector to add comments to the inspection results.

Architecture

Northern New Jersey ITS Architecture

*Element:***DRJTBC Facility Commercial Vehicle Check**

*Entity:***Commercial Vehicle Check**

Functional Area: **Citation and Accident Electronic Recording**

Roadside check facility equipment to records results of roadside inspections and forwards information to the commercial vehicle administration center. Includes accident reports, violations, citations, and the daily site activity data.

- Requirement:* 3 The roadside check facility equipment shall forward results of the roadside inspections to the commercial vehicle administration center either as needed or on a periodic (e.g. basis). These reports include accident reports, violation notifications, citations, and daily site activity logs.
-

*Element:***DRJTBC Facility Operations Center**

*Entity:***Commercial Vehicle Administration**

Functional Area: **CV Safety Administration**

Provides commercial vehicle safety criteria to roadside check facilities, collects and reviews safety data from the field and distributes safety information to other centers, carriers, and enforcement agencies.

- Requirement:* 1 The center shall provide commercial vehicle safety data to roadside check facilities.
- Requirement:* 2 The center shall collect and review safety inspection reports and violations from the roadside check facilities and pass on appropriate portions to other commercial vehicle administrative centers and commercial vehicle fleet operators.
- Requirement:* 3 The center shall notify enforcement agencies of commercial vehicle safety violations by individual commercial vehicles, drivers, or carriers.
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Functional Area: **CV Information Exchange**

Exchange information concerning safety, credentialing, and operations of commercial vehicles between the center and the roadside check stations, across jurisdictions, with fleet operators, enforcement agencies, and other information requestors.

- Requirement:* 1 The center shall exchange information with roadside check facilities, including credentials and credentials status information, safety status information, daily site activity data, and citations.
- Requirement:* 2 The center shall exchange safety and credentials data among other commercial vehicle administration centers; includes border clearance status, credentials information, credentials status information, and safety status information.
- Requirement:* 3 The center shall package data concerning commercial vehicle safety and credentials into snapshots (top-level summary and critical status information).
- Requirement:* 4 The center shall package data concerning commercial vehicle safety and credentials into profiles (detailed and historical data).
- Requirement:* 5 The center shall provide commercial vehicle accident reports and citations to enforcement agencies.
- Requirement:* 6 The center shall provide commercial vehicle credentials and safety status information to authorized requestors such as insurance agencies.
- Requirement:* 7 The center shall provide reports to the commercial vehicle fleet manager regarding fleet activity through roadside facilities including accident reports, citations, credentials status information, and safety status information.
-

Functional Area: **CV Data Collection**

Collects and stores information related to Commercial Vehicle Operations. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall receive operational data from the roadside check systems as well as administration and credentials data.
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Architecture

Northern New Jersey ITS Architecture

*Element:***DRJTBC Facility Operations Center**

*Entity:***Commercial Vehicle Administration**

Functional Area: **CV Data Collection**

Collects and stores information related to Commercial Vehicle Operations. For use by operations personnel or data archives in the region.

- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.
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- Requirement:* 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the commercial vehicle operations data or for the data itself.
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- Requirement:* 4 The center shall be able to produce sample products of the data available.
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*Entity:***Maintenance and Construction Management**

Functional Area: **MCM Environmental Information Collection**

Remotely controls environmental sensors and assimilates collected data with other current and forecast road conditions and surface weather information from weather service providers and transportation operations.

- Requirement:* 1 The center shall remotely control environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures.
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- Requirement:* 2 The center shall remotely control environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.
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- Requirement:* 3 The center shall remotely control environmental sensors on-board maintenance and construction vehicles that measure road and weather conditions including air and surface temperatures, wind speed, humidity, precipitation, visibility and other measures.
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- Requirement:* 4 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services), data from traffic, emergency, and transit management, traveler information providers, and environmental data collected from sensors deployed on and about the roadway as well as the fleet of maintenance and construction vehicles.
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- Requirement:* 5 The center shall provide weather and road condition information to weather service providers and center personnel.
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- Requirement:* 6 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.
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- Requirement:* 7 The center shall collect operational status for the roadside and vehicle-based environmental sensor equipment.
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- Requirement:* 8 The center shall collect fault data for the roadside and vehicle-based environmental sensor equipment for repair.
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Functional Area: **MCM Environmental Information Processing**

Processes current and forecast weather data, road condition information, local environmental data, and uses internal models to develop specialized detailed forecasts of local weather and surface conditions. Disseminates road weather information to other agencies and centers.

- Requirement:* 1 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.
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- Requirement:* 2 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services) and local environmental sensor data.
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- Requirement:* 3 The center shall use the various data inputs of environmental sensors and road weather data to develop a view of current and predicted road weather and road conditions.
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Architecture**Northern New Jersey ITS Architecture****Element:DRJTBC Facility Operations Center****Entity:Maintenance and Construction Management****Functional Area: MCM Environmental Information Processing**

Processes current and forecast weather data, road condition information, local environmental data, and uses internal models to develop specialized detailed forecasts of local weather and surface conditions. Disseminates road weather information to other agencies and centers.

Requirement: 4 The center shall disseminate current and forecasted road weather and road condition information to weather service providers (such as the National Weather Service and value-added sector specific meteorological services) as well as other agencies including traffic, emergency, and transit management, traveler information providers, rail operations centers, media, and other maintenance management centers.

Requirement: 5 The center shall provide value-added sector specific meteorological services with information on basic road facility and treatment information that supports forecasts for road conditions.

Functional Area: MCM Incident Management

Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.

Requirement: 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.

Requirement: 2 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, etc.

Requirement: 3 The center shall exchange incident and threat information with emergency management centers as well as traffic management centers; including notification of existence of incident and expected severity, location, time and nature of incident.

Requirement: 4 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.

Requirement: 5 The center shall respond to requests from emergency management to provide maintenance and construction resources to implement response plans, assist in clean up, verify an incident, etc. This may also involve coordination with traffic management centers and other maintenance centers.

Requirement: 6 The center shall exchange road network status assessment information with emergency management and traffic management centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.

Requirement: 7 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

Requirement: 8 The center shall receive information indicating the damage sustained by transportation assets, derived from aerial surveillance, field reports, inspections, tests, and analyses to support incident management.

Functional Area: MCM Maintenance Decision Support

Maintenance Decision Support Systems recommend courses of action based on current and forecast environmental and road conditions (filtered and fused for specific time horizons) and additional application specific information. Recommendations and dispatch instructions are generated based on this integrated information.

Architecture**Northern New Jersey ITS Architecture****Element:DRJTBC Facility Operations Center****Entity:Maintenance and Construction Management****Functional Area: MCM Maintenance Decision Support**

Maintenance Decision Support Systems recommend courses of action based on current and forecast environmental and road conditions (filtered and fused for specific time horizons) and additional application specific information. Recommendations and dispatch instructions are generated based on this integrated information.

- Requirement:* 1 The center shall provide the center personnel with tailored external information, including weather or road condition observations, forecasted weather information or road conditions, current usage of treatments and materials, available resources, equipment and vehicle availability, road network information, and source reliability information.
- Requirement:* 2 The center shall tailor the decision support information to include filtering (selection from a large amount of external information), error reduction ('smoothing' the information), fusion (combination of disparate information to match the decision needs), and analysis (creating the decision).
- Requirement:* 3 The center shall provide an interface to the center personnel to input control parameters for the decision support process and receive decisions or information presentation.
- Requirement:* 4 The center shall provide dispatch information to maintenance and construction vehicles based on the outputs of the decision support system, including recommended roadway treatment actions.

Functional Area: MCM Winter Maintenance Management

Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.

- Requirement:* 1 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other winter roadway maintenance.
- Requirement:* 2 The center shall exchange information with administrative systems to support the planning and scheduling of winter maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
- Requirement:* 3 The center shall provide status information about scheduled winter maintenance activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, and the media.
- Requirement:* 4 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of winter maintenance activities.
- Requirement:* 5 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of winter maintenance activities.
- Requirement:* 6 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
- Requirement:* 7 The center shall dispatch and route winter maintenance vehicle drivers and support them with route-specific environmental, incident, advisory, threat, alert, and traffic congestion information.
- Requirement:* 8 The center shall determine the need for roadway treatment based on current and forecasted weather information, current usage of treatments and materials, available resources, requests for action from other agencies, and recommendations from the Maintenance Decision Support system, specifically under winter conditions. This supports winter maintenance such as plowing, treating, anti-icing, etc.

Architecture**Northern New Jersey ITS Architecture****Element:DRJTBC Facility Operations Center****Entity:Maintenance and Construction Management****Functional Area: MCM Winter Maintenance Management**

Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.

- Requirement:* 9 The center shall provide dispatch instructions for vehicle operators based on input parameters from center personnel, specifically for winter conditions. This could include a treatment route, treatment application rates, start and end times, and other treatment instructions.
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- Requirement:* 10 The center shall support remote control of on-board maintenance and construction vehicle systems and field equipment that is remotely controlled by the vehicle such as adjusting material application rates and spread patterns.
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- Requirement:* 11 The center shall assess the current status of all winter maintenance activities, including actual work activities performed, current locations and operational conditions of vehicles, materials and equipment inventories, field equipment status, environmental information, etc.

Functional Area: MCM Roadway Maintenance and Construction

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

- Requirement:* 1 The center shall maintain an interface with asset management systems to track the inventory, restrictions, repair needs and status updates of transportation assets (pavement, bridges, signs, etc.) including location, installation and materials information, vendor/contractor, current maintenance status, standard height, width, and weight restrictions.
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- Requirement:* 2 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other roadway maintenance.
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- Requirement:* 3 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
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- Requirement:* 4 The center shall provide emergency management and traffic management centers with information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.
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- Requirement:* 5 The center shall collect the status and fault data from roadside equipment, such as traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
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- Requirement:* 6 The center shall collect the status and fault data from traffic management centers, including data for traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
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- Requirement:* 7 The center shall remotely control and collect data from infrastructure monitoring sensors located along the roadway infrastructure or on maintenance and construction vehicles.
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- Requirement:* 8 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of roadway maintenance and construction activities.
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- Requirement:* 9 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of roadway maintenance and construction activities.

Architecture**Northern New Jersey ITS Architecture****Element: DRJTBC Facility Operations Center****Entity: Maintenance and Construction Management****Functional Area: MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

- Requirement:* 10 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
- Requirement:* 11 The center shall dispatch and route maintenance and construction vehicle drivers and support them with route- specific environmental, incident, advisory, threat, alert, and traffic congestion information.
- Requirement:* 12 The center shall manage an interface with center personnel to accept vehicle systems control information and remotely control maintenance and construction vehicle on-board equipment.
- Requirement:* 13 The center shall track the status of roadway maintenance and construction activities by monitoring collected data from the dispatched vehicles and equipment.

Functional Area: MCM Work Activity Coordination

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

- Requirement:* 1 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.
- Requirement:* 2 The center shall provide status information about scheduled maintenance and construction activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, multimodal transportation providers, rail operations, and the media.
- Requirement:* 3 The center shall collect and respond to feedback concerning scheduled maintenance and construction activities with other management centers such as traffic, emergency, transit, and rail operations.
- Requirement:* 4 The center shall collect and disseminate asset restriction information levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.
- Requirement:* 5 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance and construction activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
- Requirement:* 6 The center shall exchange rail schedules and work plans with rail operations centers.

Functional Area: MCM Data Collection

Collection and storage of maintenance and construction information. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect maintenance and construction data (such as field equipment status, infrastructure status, maintenance and construction activity data) gathered from roadway, traffic, and other maintenance and construction sources.
- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

Architecture

Northern New Jersey ITS Architecture

*Element:***DRJTBC Facility Operations Center**

*Entity:***Maintenance and Construction Management**

Functional Area: **MCM Data Collection**

Collection and storage of maintenance and construction information. For use by operations personnel or data archives in the region.

Requirement: 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the maintenance and construction data or for the data itself.

Requirement: 4 The center shall be able to produce sample products of the data available.

Requirement: 5 The center shall provide data to Asset Management to be used in updating the status of assets in the inventory.

*Entity:***Traffic Management**

Functional Area: **Collect Traffic Surveillance**

Management of traffic sensors and surveillance (CCTV) equipment, and distribution of the collected information to other centers and operators.

Requirement: 1 The center shall monitor, analyze, and store traffic sensor data (speed, volume, occupancy) collected from field elements under remote control of the center.

Requirement: 2 The center shall monitor, analyze, and distribute traffic images from CCTV systems under remote control of the center.

Requirement: 3 The center shall monitor, analyze, and store pedestrian sensor data collected from field elements under remote control of the center.

Requirement: 4 The center shall monitor, analyze, and distribute pedestrian images from CCTV systems under remote control of the center.

Requirement: 5 The center shall monitor, analyze, and store multimodal crossing and high occupancy vehicle (HOV) lane sensor data under remote control of the center.

Requirement: 6 The center shall maintain a database of surveillance and sensors and the freeways, surface street and rural roadways, e.g. where they are located, to which part(s) of the network their data applies, the type of data, and the ownership of each link (that is, the agency or entity responsible for collecting and storing surveillance of the link) in the network.

Requirement: 7 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic data.

Requirement: 8 The center shall distribute road network conditions data (raw or processed) based on collected and analyzed traffic sensor and surveillance data to other centers.

Requirement: 9 The center shall respond to control data from center personnel regarding sensor and surveillance data collection, analysis, storage, and distribution.

Functional Area: **TMC Probe Information Collection**

Collects, assimilates, and disseminates vehicle probe data collected from roadside beacons and centers controlling transit vehicles, emergency vehicles, toll collection points, and route-guided vehicles.

Requirement: 1 The center shall collect probe data including traffic and road conditions from vehicles via roadside beacon field elements; the data may be aggregated and initial link time calculations performed in the field.

Requirement: 2 The center shall collect road condition data from probe-equipped transit vehicles via transit management centers; the data may be aggregated and preliminarily processed at the sending center.

Requirement: 3 The center shall collect traffic data from probe-equipped emergency vehicles via emergency management centers; the data may be aggregated and initial link time calculations performed at the sending center.

Architecture**Northern New Jersey ITS Architecture****Element: DRJTBC Facility Operations Center****Entity: Traffic Management****Functional Area: TMC Probe Information Collection**

Collects, assimilates, and disseminates vehicle probe data collected from roadside beacons and centers controlling transit vehicles, emergency vehicles, toll collection points, and route-guided vehicles.

Requirement: 4 The center shall collect traffic data from traveler information centers based on data from their subscriber vehicles; the data may be aggregated and initial link time calculations performed at the sending center.

Requirement: 5 The center shall collect traffic data from toll administrative centers containing journey times between toll collection points for those vehicles equipped for electronic toll collection; the data may be aggregated and processed at the sending center.

Requirement: 6 The center shall assimilate current and forecast traffic and road conditions based on collected probe data and distribute to other centers for dissemination to travelers.

Requirement: 7 The center shall collect operational status for the roadside probe data collection equipment.

Requirement: 8 The center shall collect fault data for the roadside probe data collection equipment for repair.

Functional Area: TMC Signal Control

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

Requirement: 1 The center shall remotely control traffic signal controllers.

Requirement: 2 The center shall accept notifications of right-of-way requests from pedestrians.

Requirement: 3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center.

Requirement: 4 The center shall collect traffic signal controller fault data from the field.

Requirement: 5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.

Functional Area: TMC Freeway Management

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

Requirement: 1 The center shall remotely control systems to manage use of the freeways, including ramp meters, mainline metering, and lane controls.

Requirement: 2 The center shall collect operational status from ramp meters, mainline metering, and lane controls and compare against the control information sent by the center.

Requirement: 3 The center shall collect fault data from ramp meters, mainline metering, and lane controls.

Requirement: 4 The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, mainline metering, and lane controls), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the ramps themselves.

Functional Area: TMC Traffic Information Dissemination

Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.

Requirement: 1 The center shall remotely control dynamic messages signs for dissemination of traffic and other information to drivers.

Architecture**Northern New Jersey ITS Architecture****Element: DRJTBC Facility Operations Center****Entity: Traffic Management****Functional Area: TMC Traffic Information Dissemination**

Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.

- Requirement:* 2 The center shall remotely control driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers.
- Requirement:* 3 The center shall collect operational status for the driver information systems equipment (DMS, HAR, etc.).
- Requirement:* 4 The center shall collect fault data for the driver information systems equipment (DMS, HAR, etc.) for repair.
- Requirement:* 5 The center shall retrieve locally stored traffic information, including current and forecasted traffic information, road and weather conditions, traffic incident information, information on diversions and alternate routes, closures, and special traffic restrictions (lane/shoulder use, weight restrictions, width restrictions, HOV requirements), etc.
- Requirement:* 6 The center shall distribute traffic data to maintenance and construction centers, transit centers, emergency management centers, and traveler information providers.
- Requirement:* 7 The center shall distribute traffic data to the media upon request; the capability to provide the information in both data stream and graphical display shall be supported.
- Requirement:* 8 The center shall provide the capability for center personnel to control the nature of the data that is available to non-traffic operations centers and the media.

Functional Area: TMC Regional Traffic Control

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

- Requirement:* 1 The center shall exchange traffic information with other traffic management centers, includes incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.
- Requirement:* 2 The center shall exchange traffic control information with other traffic management centers, includes remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).

Functional Area: TMC Incident Detection

Remotely controls traffic and video sensors to support incident detection and verification; exchange information with other agencies including emergency management, maintenance and construction, alerting and advisory systems, event promoters, intermodal freight depots, and traveler information systems.

- Requirement:* 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.
- Requirement:* 2 The center shall collect and store traffic flow and image data from the field equipment to detect and verify incidents.
- Requirement:* 3 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, and intermodal freight depots.
- Requirement:* 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.

Architecture**Northern New Jersey ITS Architecture****Element:DRJTBC Facility Operations Center****Entity:Traffic Management****Functional Area: TMC Incident Detection**

Remotely controls traffic and video sensors to support incident detection and verification; exchange information with other agencies including emergency management, maintenance and construction, alerting and advisory systems, event promoters, intermodal freight depots, and traveler information systems.

Requirement: 5 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field.

Requirement: 6 The center shall provide road network conditions and traffic images to emergency management centers to support the detection, verification, and classification of incidents.

Requirement: 7 The center shall provide video and traffic sensor control commands to the field equipment to detect and verify incidents.

Functional Area: TMC Incident Dispatch Coordination/Communication

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

Requirement: 1 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction for distribution to the public. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, and information and instructions necessary for the public to respond to the alert. This may also identify specific information that should not be released to the public.

Requirement: 2 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.

Requirement: 3 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field, provide special routing for emergency vehicles, and to provide responding emergency vehicles with signal preemption.

Requirement: 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.

Requirement: 5 The center shall respond to requests from emergency management to provide traffic management resources to implement special traffic control measures, assist in clean up, verify an incident, etc. This may also involve coordination with maintenance centers.

Requirement: 6 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, media, and rail operations centers.

Requirement: 7 The center shall provide road network conditions and traffic images to emergency management centers, maintenance and construction centers, and traveler information service providers.

Requirement: 8 The center shall exchange road network status assessment information with emergency management and maintenance centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.

Requirement: 9 The center shall coordinate information and controls with other traffic management centers.

Requirement: 10 The center shall receive inputs from emergency management and transit management centers to develop an overall status of the transportation system including emergency transit schedules in effect and current status and condition of the transportation infrastructure.

Architecture

Northern New Jersey ITS Architecture

Element: **DRJTBC Facility Operations Center**

Entity: **Traffic Management**

Functional Area: **TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

- Requirement:* 11 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic incident management.
-

Functional Area: **TMC Environmental Monitoring**

Management of environmental sensors and assimilation of collected data with other current and forecast road conditions and surface weather information from weather service providers and roadway maintenance operations.

- Requirement:* 1 The center shall remotely control environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures.
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- Requirement:* 2 The center shall remotely control environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.
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- Requirement:* 3 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services), data from roadway maintenance operations, and environmental data collected from sensors deployed on and about the roadway.
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- Requirement:* 4 The center shall provide weather and road condition information to weather service providers and center personnel.
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- Requirement:* 5 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.
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Functional Area: **Traffic Maintenance**

Monitoring and remote diagnostics of field equipment - detect failures, issue problem reports, and track the repair or replacement of the failed equipment.

- Requirement:* 1 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) operational status.
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- Requirement:* 2 The center shall collect and store CCTV surveillance system (traffic, pedestrian) operational status.
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- Requirement:* 3 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) fault data and send to the maintenance center for repair.
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- Requirement:* 4 The center shall collect and store CCTV surveillance system (traffic, pedestrian) fault data send to the maintenance center for repair.
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- Requirement:* 5 The center shall collect environmental sensor operational status.
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- Requirement:* 6 The center shall collect environmental sensor equipment fault data and send to the maintenance center for repair.
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- Requirement:* 7 The center shall exchange data with maintenance centers concerning the reporting of faulty equipment and the schedule/status of their repair. Information exchanged includes details of new equipment faults, and clearances when the faults are cleared.
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- Requirement:* 8 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic maintenance data.
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Functional Area: **TMC Work Zone Traffic Management**

Architecture**Northern New Jersey ITS Architecture****Element:DRJTBC Facility Operations Center****Entity:Traffic Management****Functional Area: TMC Work Zone Traffic Management**

Coordination with maintenance systems using work zone images and traveler information systems (such as DMS), and distribution of work plans so that work zones are established that have minimum traffic impact.

- Requirement:* 1 The center shall receive work zone images from a maintenance center.
- Requirement:* 2 The center shall analyze work zone images for indications of a possible incident.
- Requirement:* 3 The center shall remotely control driver information systems (such as dynamic messages signs, highway advisory radios) to advise drivers of activity around a work zone.
- Requirement:* 4 The center shall collect operational status for the driver information systems equipment in work zones.
- Requirement:* 5 The center shall collect fault data for the driver information systems equipment in work zones for repair.
- Requirement:* 6 The center shall receive proposed maintenance and construction work plans, analyze the activity as a possible incident, and provide work plan feedback to the sending center.

Functional Area: Traffic Data Collection

Collection and storage of traffic management data. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect traffic management data such as operational data, event logs, etc.
- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.
- Requirement:* 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the traffic data or for the data itself.
- Requirement:* 4 The center shall be able to produce sample products of the data available.

Element:DRJTBC ITS Field Equipment**Entity:Roadway Subsystem****Functional Area: Roadway Basic Surveillance**

Field elements that monitor traffic conditions using loop detectors and CCTV cameras.

- Requirement:* 1 The field element shall collect, process, digitize, and send traffic sensor data (speed, volume, and occupancy) to the center for further analysis and storage, under center control.
- Requirement:* 2 The field element shall collect, process, and send traffic images to the center for further analysis and distribution.
- Requirement:* 3 The field element shall collect, digitize, and send pedestrian sensor data to the center for further analysis and storage.
- Requirement:* 4 The field element shall collect, process, and send pedestrian images to the center for further analysis and distribution.
- Requirement:* 5 The field element shall collect, digitize, and send multimodal crossing and high occupancy vehicle (HOV) lane sensor data to the center for further analysis and storage.
- Requirement:* 6 The field element shall return sensor and CCTV system operational status to the controlling center.
- Requirement:* 7 The field element shall return sensor and CCTV system fault data to the controlling center for repair.

Functional Area: Roadway Probe Beacons

Field elements to collect traffic and road conditions from passing vehicles; both anonymous toll/parking tag readings for link time calculations and smart probe data supported.

Architecture**Northern New Jersey ITS Architecture****Element: DRJTBC ITS Field Equipment****Entity: Roadway Subsystem****Functional Area: Roadway Probe Beacons**

Field elements to collect traffic and road conditions from passing vehicles; both anonymous toll/parking tag readings for link time calculations and smart probe data supported.

- Requirement:* 1 The field element shall use toll and parking tags on passing vehicles for traffic data link time calculations and send to the controlling center; tag identities will be removed to ensure anonymity.
- Requirement:* 2 The field element shall include equipment that monitors traffic conditions (e.g., average speed) by communicating with passing vehicles equipped with a transponder or other short range communications device; also called smart probes.
- Requirement:* 3 The field element shall include equipment that monitors road conditions by communicating with passing vehicles equipped with a transponder or other short range communications device; also called smart probes.
- Requirement:* 4 The field element shall aggregate, format, and store collected vehicle smart probe data (traffic and road conditions data), calculate link travel times and processed road condition data, and send to future passing vehicles.
- Requirement:* 5 The field element shall provide roadside beacon equipment operational status to the center.
- Requirement:* 6 The field element shall provide roadside beacon equipment fault indication to the center for repair.

Functional Area: Roadway Traffic Information Dissemination

Driver information systems, such as dynamic message signs and Highway Advisory Radio (HAR).

- Requirement:* 1 The field element shall include dynamic message signs for dissemination of traffic and other information to drivers, under center control; the DMS may be either those that display variable text messages, or those that have fixed format display(s) (e.g. vehicle restrictions, or lane open/close).
- Requirement:* 2 The field element shall include driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers, under center control.
- Requirement:* 3 The field element shall include pedestrian information systems under center control (e.g. warning pedestrians of a potential hazard, or providing mandatory instructions as to the availability of pedestrian access).
- Requirement:* 4 The field element shall provide operational status for the driver information systems equipment (DMS, HAR, etc.) to the center.
- Requirement:* 5 The field element shall provide fault data for the driver information systems equipment (DMS, HAR, etc.) to the center for repair.

Functional Area: Roadway Equipment Coordination

Field elements that control and send data to other field elements (such as environmental sensors that send data to a DMS or coordination between traffic controllers on adjacent intersections), without center control.

- Requirement:* 1 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that provide data and status information to other field element devices (such as dynamic message signs, ramp meters, traffic signals, work zone intrusion alert systems), without center control.
- Requirement:* 2 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that receive control information from other field element devices, without center control.
- Requirement:* 3 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that provide data and status information to other field element devices (such as dynamic message signs, traffic controllers on adjacent intersections), without center control.

Architecture**Northern New Jersey ITS Architecture***Element:DRJTBC ITS Field Equipment**Entity:Roadway Subsystem**Functional Area: Roadway Equipment Coordination*

Field elements that control and send data to other field elements (such as environmental sensors that send data to a DMS or coordination between traffic controllers on adjacent intersections), without center control.

- Requirement:* 4 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that receive control information from other field element devices, without center control.

Functional Area: Roadway Environmental Monitoring

Environmental sensors, surface and sub-surface, that collect weather and road surface information. Weather conditions measured include temperature, wind, humidity, precipitation, and visibility. Sensors measure road surface temperature, moisture, icing, salinity, etc.

- Requirement:* 1 The field element shall include surface and sub-surface environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures.
- Requirement:* 2 The field element shall include environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.
- Requirement:* 3 The field element's environmental sensors shall be remotely controlled by a maintenance center.
- Requirement:* 4 The field element's environmental sensors shall be remotely controlled by a traffic management center.
- Requirement:* 5 The field element's environmental sensors shall be remotely controlled by weather service providers such as the National Weather Service or value-added sector specific meteorological services.
- Requirement:* 6 The field element's environmental sensors shall be remotely controlled by a maintenance and construction vehicle.
- Requirement:* 7 The field element shall provide environmental sensor equipment operational status to the controlling center or maintenance vehicle.
- Requirement:* 8 The field element shall provide environmental sensor equipment fault indication to the controlling center or maintenance vehicle.
- Requirement:* 9 The field element shall remotely aggregate environmental sensor data with environmental data collected from maintenance and construction vehicles.
- Requirement:* 10 The field element shall provide weather and road surface condition data to centers.
- Requirement:* 11 The field element shall provide weather and road surface condition data to maintenance and construction vehicles.

Functional Area: Roadway Automated Treatment

Field elements that activate automated roadway treatment systems (to disperse anti-icing chemicals, etc.) based on environmental or atmospheric conditions, or under center control.

- Requirement:* 1 The field element shall activate automated roadway treatment systems based on environmental or atmospheric conditions. Treatments can be in the form of fog dispersion, anti-icing chemicals, etc.
- Requirement:* 2 The field element shall activate automated roadway treatment systems under center control. Treatments can be in the form of fog dispersion, anti-icing chemicals, etc.
- Requirement:* 3 The field element shall return automated roadway treatment system and associated environmental sensor operational status to the maintenance center.
- Requirement:* 4 The field element shall return automated roadway treatment system and associated environmental sensor fault data to the maintenance center for repair.

*Element:DRJTBC Maintenance Vehicle**Entity:Maintenance and Construction Vehicle*

Architecture**Northern New Jersey ITS Architecture***Element:***DRJTBC Maintenance Vehicle***Entity:***Maintenance and Construction Vehicle***Functional Area:* **MCV Vehicle Location Tracking**

On-board systems to track vehicle location and reports the position and timestamp information to the dispatch center.

Requirement: 1 The maintenance and construction vehicle shall compute the location of the vehicle based on inputs from a vehicle location determination function.

Requirement: 2 The maintenance and construction vehicle shall send the timestamped vehicle location to the controlling center.

Functional Area: **MCV Vehicle System Monitoring and Diagnostics**

On-board sensors capable of monitoring the condition of each of the vehicle systems and diagnostics that can be used to support vehicle maintenance.

Requirement: 1 The maintenance and construction vehicle shall collect vehicle diagnostics and operating status data from the maintenance vehicle platform including engine temperature, mileage, tire wear, brake wear, belt wear, and other operational status measures as well as the status of maintenance and construction-specific systems on the vehicle.

Requirement: 2 The maintenance and construction vehicle shall use the diagnostic and status information to support scheduling vehicle maintenance, monitoring safety status, and informing the vehicle operator of the conditions.

Requirement: 3 The maintenance and construction vehicle shall the vehicle diagnostic and safety information to an equipment repair facility.

Requirement: 4 The maintenance and construction vehicle shall send the vehicle diagnostic and safety information to the controlling maintenance center.

Functional Area: **MCV Winter Maintenance**

On-board systems that support snow plow operations and other roadway treatments (e.g., salt spraying and other material applications). Supports platooning of snow plows.

Requirement: 1 The maintenance and construction vehicle shall track the location and status of safety systems on-board the vehicle.

Requirement: 2 The maintenance and construction vehicle shall respond to control information from the center to allow remote operation of the on-board vehicle systems. These systems include winter maintenance equipment for plowing, treating, and anti-icing.

Requirement: 3 The maintenance and construction vehicle shall monitor materials information including remaining quantity and current application rate of materials on the vehicle.

Requirement: 4 The maintenance and construction vehicle shall respond to dispatch information from the center, presented to the vehicle operator for acknowledgement and returning status.

Requirement: 5 The maintenance and construction vehicle shall send operational data to the center including the operational state of the maintenance equipment (e.g., blade up/down, spreader pattern), types and quantities of materials used for construction and maintenance activities, and a record of the actual work performed.

Requirement: 6 The maintenance and construction vehicle shall exchange operational and environmental data with other maintenance and construction vehicles. Operational data includes operational state of the maintenance equipment (e.g., blade up/down, spreader pattern, equipment configuration) and a record of the actual work performed while the environmental data includes environmental sensor data collected on-board a maintenance and construction vehicle, either raw or processed data.

Functional Area: **MCV Infrastructure Monitoring**

Architecture**Northern New Jersey ITS Architecture***Element:***DRJTBC Maintenance Vehicle***Entity:***Maintenance and Construction Vehicle***Functional Area:* **MCV Infrastructure Monitoring**

On-board systems to monitor the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts). Includes vehicle-based sensors and communications with roadway-based infrastructure monitoring sensors.

- Requirement:*
- 1 The maintenance and construction vehicle shall collect infrastructure data from on-board sensors relating to the physical characteristics of the roadway infrastructure, including pavement, bridges, culverts, signs, etc.

Functional Area: **MCV Roadway Maintenance and Construction**

On-board systems that support routine non-winter maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of equipment on the roadway.

- Requirement:*
- 1 The maintenance and construction vehicle shall track the location and status of safety systems on-board the vehicle.

Functional Area: **MCV Infrastructure Monitoring**

On-board systems to monitor the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts). Includes vehicle-based sensors and communications with roadway-based infrastructure monitoring sensors.

- Requirement:*
- 2 The maintenance and construction vehicle shall collect infrastructure data from sensors located along the roadway relating to the physical characteristics of the roadway infrastructure, including pavement, bridges, culverts, signs, etc.

Functional Area: **MCV Roadway Maintenance and Construction**

On-board systems that support routine non-winter maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of equipment on the roadway.

- Requirement:*
- 2 The maintenance and construction vehicle shall respond to control information from the center to allow remote operation of the on-board vehicle systems. These systems include routine maintenance equipment for cutting, repairs, hazard removal, etc.

- Requirement:*
- 3 The maintenance and construction vehicle shall monitor materials information including remaining quantity and current application rate of materials on the vehicle.

Functional Area: **MCV Infrastructure Monitoring**

On-board systems to monitor the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts). Includes vehicle-based sensors and communications with roadway-based infrastructure monitoring sensors.

- Requirement:*
- 3 The maintenance and construction vehicle shall provide control signals to infrastructure monitoring sensors located at the roadway.

- Requirement:*
- 4 The maintenance and construction vehicle shall send current condition of pavement, bridges, culverts, signs, and other roadway infrastructure as measured by on-board sensors or read from infrastructure-based sensors to the center. The data may include raw data or images (e.g., photo logs) that indicate the current status of the infrastructure.

Functional Area: **MCV Roadway Maintenance and Construction**

On-board systems that support routine non-winter maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of equipment on the roadway.

- Requirement:*
- 4 The maintenance and construction vehicle shall respond to dispatch information from the center, presented to the vehicle operator for acknowledgement and returning status.

Architecture**Northern New Jersey ITS Architecture***Element:***DRJTBC Maintenance Vehicle***Entity:***Maintenance and Construction Vehicle***Functional Area:* **MCV Roadway Maintenance and Construction**

On-board systems that support routine non-winter maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of equipment on the roadway.

- Requirement:* 5 The maintenance and construction vehicle shall send operational data to the center including the operational state of the maintenance equipment (e.g., blade up/down, spreader pattern), types and quantities of materials used for construction and maintenance activities, and a record of the actual work performed.

Functional Area: **MCV Infrastructure Monitoring**

On-board systems to monitor the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts). Includes vehicle-based sensors and communications with roadway-based infrastructure monitoring sensors.

- Requirement:* 5 The maintenance and construction vehicle shall provide infrastructure sensor equipment operational status to the center.

*Element:***DRJTBC Website***Entity:***Information Service Provider***Functional Area:* **Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

- Requirement:* 1 The center shall collect, process, store, and disseminate customized traffic and highway condition information to travelers, including incident information, detours and road closures, recommended routes, and current speeds on specific routes upon request.
- Requirement:* 2 The center shall collect, process, store, and disseminate customized maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities upon request.
- Requirement:* 3 The center shall collect, process, store, and disseminate customized transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers upon request.
- Requirement:* 4 The center shall collect, process, store, and disseminate customized parking information to travelers, including location, availability, and fees upon request.
- Requirement:* 5 The center shall collect, process, store, and disseminate customized toll fee information to travelers upon request.
- Requirement:* 6 The center shall collect, process, store, and disseminate customized weather information to travelers upon request.
- Requirement:* 7 The center shall collect, process, store, and disseminate customized multimodal transportation service information (for example, from ferry and airline operators), including transfer points and other information, to travelers upon request.
- Requirement:* 8 The center shall collect, process, store, and disseminate customized event information to travelers upon request.
- Requirement:* 9 The center shall collect, process, store, and disseminate customized air quality information to travelers upon request.
- Requirement:* 10 The center shall provide all traveler information based on the traveler's current location or a specific location identified by the traveler, and filter or customize the provided information accordingly.
- Requirement:* 11 The center shall accept traveler profiles for determining the type of personalized data to send to the traveler.

Architecture**Northern New Jersey ITS Architecture***Element:***DRJTBC Website***Entity:***Information Service Provider***Functional Area:* **Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

Requirement: 12 The center shall manage payment for services, such as tolls, transit fares, parking lot charges, map updates, and advanced payment for tolls, and provide transaction success or failure details.

Requirement: 13 The center shall support requests for traveler information and advanced payment for traveler services from commercial fleet operators.

Requirement: 14 The center shall provide the capability to exchange information with another traveler information service provider current or predicted data for road links that are outside the area served by the local supplier.

Requirement: 15 The center shall manage updates of digitized map data and provide updates to traveler interface systems upon request.

Requirement: 16 The center shall provide the capability to support requests from the media for traffic and incident data.

Requirement: 17 The center shall provide the capability for a system operator to control the type and update frequency of traveler information.

Functional Area: **Traveler Telephone Information**

Collection and distribution of traveler information and wide-area alerts to traveler telephone information systems such as 511, based on voice-based traveler requests.

Requirement: 1 The center shall provide the capability to process voice-formatted requests for traveler information from a traveler telephone information system, and return the information in the requested format.

Requirement: 2 The center shall provide the capability to process dual-tone multifrequency (DTMF)-based requests (touch-tone) for traveler information from a traveler telephone information system.

Requirement: 3 The center shall provide the capability to process traveler information requests from a traveler telephone information system.

Requirement: 4 The center shall collect and provide information on traffic conditions in the requested voice format and for the requested location.

Requirement: 5 The center shall collect and provide work zone and roadway maintenance information in the requested voice format and for the requested location.

Requirement: 6 The center shall collect and provide roadway environment conditions information in the requested voice format and for the requested location.

Requirement: 7 The center shall collect and provide weather and event information in the requested voice format and for the requested location.

Requirement: 8 The center shall collect and provide transit service information in the requested voice format and for the requested location.

Requirement: 9 The center shall collect and provide yellow pages services information in the requested voice format and for the requested location.

Requirement: 10 The center shall collect and provide current ferry and rail schedule and airport status information in the requested voice format and for the requested location.

Requirement: 11 The center shall provide the capability to support both specific caller requests as well as bulk upload of regional traveler information.

Requirement: 12 The center shall receive and forward region-specific wide-area alert and advisory information to the traveler telephone information system, including major emergencies such as a natural or man-made disaster, civil emergency, child abductions, severe weather watches and warnings, military activities, and law enforcement warnings.

Architecture**Northern New Jersey ITS Architecture***Element:***DRJTBC Website***Entity:***Information Service Provider***Element:***E-ZPass Plus Systems***Entity:***Parking Management***Functional Area:* **Parking Surveillance**

Field elements that detect and classify vehicles entering and exiting a parking facility.

- Requirement:*
- 1 The parking element shall provide the capability to detect and classify vehicles entering and exiting a parking facility (vehicle size, type, identifiable features, etc.).

Functional Area: **Parking Management**

Maintain and distribute parking lot information including static (spaces, hours, charges, etc.) and dynamic (availability, open/closed, etc.) data. Interface to traffic, transit, and traveler information providers.

- Requirement:*
- 1 The parking element shall maintain parking lot information including static information such as hours of operation, rates, location, entrance locations, capacity, type, and constraints; as well as dynamic information such as current state of the lot, occupancy, arrival rates, and departure rates.
 - 2 The parking element shall distribute parking lot information upon request to traffic management centers, transit management centers for park and ride facilities, and to traveler information providers.
 - 3 The parking element manage local dynamic message signs that display messages to travelers such as the parking lot state, number of spaces available, location of entrances, and current charges.
 - 4 The parking element shall support requests for parking reservations.

Functional Area: **Parking Electronic Payment**

Parking payment collection using in-vehicle equipment (tags) or contact or proximity traveler cards used for electronic payment. Includes field elements and back-office functionality.

- Requirement:*
- 1 The parking element shall detect and classify vehicles entering and exiting a parking facility (vehicle size, type, identifiable features, etc.).
 - 2 The parking element shall read data from the traveler card / payment instrument carried on-board the vehicle (tag) or by the traveler.
 - 3 The parking element shall provide an interface to the driver informing them of the success or failure of the financial transaction. This may involve a request for the driver to pull aside so the operator can resolve an issue.
 - 4 The parking element shall collect data on payment violations and send the data, including images of the violator and the vehicle registration data obtained from the Department of Motor Vehicles (DMV) office, to the appropriate enforcement agency.
 - 5 The parking element shall manage the parking lot charges, considering such factors as location, vehicle types, and times of day.
 - 6 The parking element shall process the financial requests and manage an interface to a Financial Institution.
 - 7 The parking element shall support the payment of parking lot transactions using data provided by the traveler cards / payment instruments.
 - 8 The parking element shall process requests for parking lot charges to be paid in advance.
 - 9 The parking element shall process requests for the advanced payment of tolls and transit fares as well as other non-transportation services, e.g. yellow-pages services.
 - 10 The parking element shall maintain a list of invalid traveler credit identities, or bad tag lists.

*Element:***I-95 CC Information Exchange Network***Entity:***Traffic Management**

Architecture

Northern New Jersey ITS Architecture

Element: I-95 CC Information Exchange Network

Entity: Traffic Management

Functional Area: TMC Signal Control

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

- Requirement:* 1 The center shall remotely control traffic signal controllers.
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- Requirement:* 2 The center shall accept notifications of right-of-way requests from pedestrians.
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- Requirement:* 3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center.
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- Requirement:* 4 The center shall collect traffic signal controller fault data from the field.
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- Requirement:* 5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.
-

Functional Area: TMC Freeway Management

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

- Requirement:* 1 The center shall remotely control systems to manage use of the freeways, including ramp meters, mainline metering, and lane controls.
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- Requirement:* 2 The center shall collect operational status from ramp meters, mainline metering, and lane controls and compare against the control information sent by the center.
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- Requirement:* 3 The center shall collect fault data from ramp meters, mainline metering, and lane controls.
-
- Requirement:* 4 The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, mainline metering, and lane controls), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the ramps themselves.
-

Functional Area: TMC Regional Traffic Control

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

- Requirement:* 1 The center shall exchange traffic information with other traffic management centers, includes incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.
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- Requirement:* 2 The center shall exchange traffic control information with other traffic management centers, includes remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).
-

Functional Area: TMC Incident Dispatch Coordination/Communication

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

- Requirement:* 1 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction for distribution to the public. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, and information and instructions necessary for the public to respond to the alert. This may also identify specific information that should not be released to the public.
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Architecture**Northern New Jersey ITS Architecture****Element: I-95 CC Information Exchange Network****Entity: Traffic Management****Functional Area: TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

- Requirement:* 2 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.
- Requirement:* 3 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field, provide special routing for emergency vehicles, and to provide responding emergency vehicles with signal preemption.
- Requirement:* 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.
- Requirement:* 5 The center shall respond to requests from emergency management to provide traffic management resources to implement special traffic control measures, assist in clean up, verify an incident, etc. This may also involve coordination with maintenance centers.
- Requirement:* 6 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, media, and rail operations centers.
- Requirement:* 7 The center shall provide road network conditions and traffic images to emergency management centers, maintenance and construction centers, and traveler information service providers.
- Requirement:* 8 The center shall exchange road network status assessment information with emergency management and maintenance centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.
- Requirement:* 9 The center shall coordinate information and controls with other traffic management centers.
- Requirement:* 10 The center shall receive inputs from emergency management and transit management centers to develop an overall status of the transportation system including emergency transit schedules in effect and current status and condition of the transportation infrastructure.
- Requirement:* 11 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic incident management.

Functional Area: Traffic Maintenance

Monitoring and remote diagnostics of field equipment - detect failures, issue problem reports, and track the repair or replacement of the failed equipment.

- Requirement:* 1 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) operational status.
- Requirement:* 2 The center shall collect and store CCTV surveillance system (traffic, pedestrian) operational status.
- Requirement:* 3 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) fault data and send to the maintenance center for repair.
- Requirement:* 4 The center shall collect and store CCTV surveillance system (traffic, pedestrian) fault data send to the maintenance center for repair.
- Requirement:* 5 The center shall collect environmental sensor operational status.
- Requirement:* 6 The center shall collect environmental sensor equipment fault data and send to the maintenance center for repair.

Architecture**Northern New Jersey ITS Architecture****Element: I-95 CC Information Exchange Network****Entity: Traffic Management****Functional Area: Traffic Maintenance**

Monitoring and remote diagnostics of field equipment - detect failures, issue problem reports, and track the repair or replacement of the failed equipment.

Requirement: 7 The center shall exchange data with maintenance centers concerning the reporting of faulty equipment and the schedule/status of their repair. Information exchanged includes details of new equipment faults, and clearances when the faults are cleared.

Requirement: 8 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic maintenance data.

Functional Area: TMC Work Zone Traffic Management

Coordination with maintenance systems using work zone images and traveler information systems (such as DMS), and distribution of work plans so that work zones are established that have minimum traffic impact.

Requirement: 1 The center shall receive work zone images from a maintenance center.

Requirement: 2 The center shall analyze work zone images for indications of a possible incident.

Requirement: 3 The center shall remotely control driver information systems (such as dynamic messages signs, highway advisory radios) to advise drivers of activity around a work zone.

Requirement: 4 The center shall collect operational status for the driver information systems equipment in work zones.

Requirement: 5 The center shall collect fault data for the driver information systems equipment in work zones for repair.

Requirement: 6 The center shall receive proposed maintenance and construction work plans, analyze the activity as a possible incident, and provide work plan feedback to the sending center.

Element: National Park Service ITS Field Equipment**Entity: Roadway Subsystem****Functional Area: Roadway Traffic Information Dissemination**

Driver information systems, such as dynamic message signs and Highway Advisory Radio (HAR).

Requirement: 1 The field element shall include dynamic messages signs for dissemination of traffic and other information to drivers, under center control; the DMS may be either those that display variable text messages, or those that have fixed format display(s) (e.g. vehicle restrictions, or lane open/close).

Requirement: 2 The field element shall include driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers, under center control.

Requirement: 3 The field element shall include pedestrian information systems under center control (e.g. warning pedestrians of a potential hazard, or providing mandatory instructions as to the availability of pedestrian access).

Requirement: 4 The field element shall provide operational status for the driver information systems equipment (DMS, HAR, etc.) to the center.

Requirement: 5 The field element shall provide fault data for the driver information systems equipment (DMS, HAR, etc.) to the center for repair.

Functional Area: Roadway Equipment Coordination

Field elements that control and send data to other field elements (such as environmental sensors that send data to a DMS or coordination between traffic controllers on adjacent intersections), without center control.

Architecture

Northern New Jersey ITS Architecture

*Element:***National Park Service ITS Field Equipment**

*Entity:***Roadway Subsystem**

Functional Area: **Roadway Equipment Coordination**

Field elements that control and send data to other field elements (such as environmental sensors that send data to a DMS or coordination between traffic controllers on adjacent intersections), without center control.

- | | |
|---------------------|--|
| <i>Requirement:</i> | 1 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that provide data and status information to other field element devices (such as dynamic message signs, ramp meters, traffic signals, work zone intrusion alert systems), without center control. |
| <i>Requirement:</i> | 2 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that receive control information from other field element devices, without center control. |
| <i>Requirement:</i> | 3 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that provide data and status information to other field element devices (such as dynamic message signs, traffic controllers on adjacent intersections), without center control. |
| <i>Requirement:</i> | 4 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that receive control information from other field element devices, without center control. |
-

*Element:***National Park Service Management Center**

*Entity:***Emergency Management**

Functional Area: **Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

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| <i>Requirement:</i> | 1 The center shall support the interface to the Emergency Telecommunications System (e.g. 911 or 7-digit call routing) to receive emergency notification information and provide it to the emergency system operator. |
| <i>Requirement:</i> | 2 The center shall receive emergency call information from 911 services and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 3 The center shall receive emergency call information from motorist call-boxes and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 4 The center shall receive emergency call information from mayday service providers and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 5 The center shall receive emergency notification information from other public safety agencies and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 6 The center shall receive emergency notification information from public transit systems and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 7 The center shall receive emergency notification information from commercial vehicles, commercial vehicle check stations, or commercial fleet operators and present the possible incident information to the emergency system operator. This may include detection of non-permitted transport of security sensitive hazmat, hazardous cargo spills, etc. |
| <i>Requirement:</i> | 8 The center shall receive details of the cargo being carried by commercial vehicles from their commercial fleet manager for incidents involving potential hazardous materials. |
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Architecture

Northern New Jersey ITS Architecture

Element: **National Park Service Management Center**

Entity: **Emergency Management**

Functional Area: **Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

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| <i>Requirement:</i> | 9 The center shall coordinate, correlate, and verify all emergency inputs, including those identified based on external calls and internal analysis of security sensor and surveillance data, and assign each a level of confidence. |
| <i>Requirement:</i> | 10 The center shall send a request for remote control of CCTV systems from a traffic management center in order to verify the reported incident. |
| <i>Requirement:</i> | 11 The center shall update the incident information log once the emergency system operator has verified the incident. |
| <i>Requirement:</i> | 12 The center shall provide the capability for digitized map data to act as the background to the emergency information presented to the emergency system operator. |
| <i>Requirement:</i> | 13 The center shall forward the verified emergency information to the responding agency based on the location and nature of the emergency. |
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Functional Area: **Emergency Dispatch**

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

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| <i>Requirement:</i> | 1 The center shall dispatch emergency vehicles to respond to verified emergencies and provide suggested routing under center personnel control. |
| <i>Requirement:</i> | 2 The center shall store the current status of all emergency vehicles available for dispatch and those that have been dispatched. |
| <i>Requirement:</i> | 3 The center shall relay location and incident details to the responding vehicles. |
| <i>Requirement:</i> | 4 The center shall provide the capability to request traffic control measures from traffic management centers such as signal preemption, traffic barriers and road closures. |
| <i>Requirement:</i> | 5 The center shall track the location and status of emergency vehicles responding to an emergency and update the incident status based on information from the emergency vehicle. |
| <i>Requirement:</i> | 6 The center shall receive status information from care facilities to determine the appropriate facility and its location. |
| <i>Requirement:</i> | 7 The center shall store and maintain the emergency service responses in an action log. |
| <i>Requirement:</i> | 8 The center shall receive asset restriction information from maintenance centers to support the dispatching of appropriate emergency resources. |
| <i>Requirement:</i> | 9 The center shall receive traffic information, including closures, traffic conditions, etc. from traffic management centers. |
| <i>Requirement:</i> | 10 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator. |
| <i>Requirement:</i> | 11 The center shall receive road network conditions and traffic images to support dispatch of emergency vehicles. |
| <i>Requirement:</i> | 12 The center shall coordinate response to incidents with other Emergency Management centers to ensure appropriate resources are dispatched and utilized. |
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Functional Area: **Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

Architecture**Northern New Jersey ITS Architecture****Element: National Park Service Management Center****Entity: Emergency Management****Functional Area: Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

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| <i>Requirement:</i> | 1 The center shall provide strategic emergency response capabilities such as that of an Emergency Operations Center for large-scale incidents and disasters. |
| <i>Requirement:</i> | 2 The center shall manage coordinated inter-agency responses to and recovery from large-scale emergencies. Such agencies include traffic management, transit, maintenance and construction management, rail operations, and other emergency management agencies. |
| <i>Requirement:</i> | 3 The center shall provide the capability to implement response plans and track progress through the incident by exchanging incident information and distributing response status to allied agencies. |
| <i>Requirement:</i> | 4 The center shall develop, coordinate with other agencies, and store emergency response plans. |
| <i>Requirement:</i> | 5 The center shall track the availability of resources (including vehicles, roadway cleanup?, etc.), request additional resources from traffic, maintenance, or other emergency centers if needed. |
| <i>Requirement:</i> | 6 The center shall allocate the appropriate emergency services, resources, and vehicle (s) to respond to incidents, and shall provide the capability to override the current allocation to suit the special needs of a current incident. |
| <i>Requirement:</i> | 7 The center shall receive event scheduling information from Event Promoters. |
| <i>Requirement:</i> | 8 The center shall receive hazardous materials incident information from commercial fleet operators. |
| <i>Requirement:</i> | 9 The center shall provide the capability to request the safe disabling of a commercial vehicle during a hazardous materials incident. |
| <i>Requirement:</i> | 10 The center shall provide the capability to request transit resource availability from transit centers for use during disaster and evacuation operations. |
| <i>Requirement:</i> | 11 The center shall assimilate the status of the transit, traffic, rail, maintenance, and other emergency center services and systems to create an overall transportation system status, and disseminate to each of these centers and the traveling public via traveler information providers. |
| <i>Requirement:</i> | 12 The center shall provide information to the media concerning the status of an emergency response. |
| <i>Requirement:</i> | 13 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator. |
| <i>Requirement:</i> | 14 The center shall provide the capability for center personnel to provide inputs to the management of incidents, disasters and evacuations. |

Functional Area: Incident Command

Tactical decision support, resource coordination, and communications integration among emergency management agencies for Incident Commands that are established by first responders to support local management of an incident.

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| <i>Requirement:</i> | 1 The center shall provide tactical decision support, resource coordination, and communications integration for Incident Commands that are established by first responders to support local management of an incident. |
| <i>Requirement:</i> | 2 The center shall provide incident command communications with public safety, emergency management, transportation, and other allied response agency centers. |
| <i>Requirement:</i> | 3 The center shall track and maintain resource information and action plans pertaining to the incident command. |
| <i>Requirement:</i> | 4 The center shall share incident command information with other public safety agencies including resource deployment status, hazardous material information, rail incident information, evacuation advice as well as traffic, road, and weather conditions. |

Architecture**Northern New Jersey ITS Architecture****Element: National Park Service Management Center****Entity: Emergency Management****Functional Area: Incident Command**

Tactical decision support, resource coordination, and communications integration among emergency management agencies for Incident Commands that are established by first responders to support local management of an incident.

Requirement: 5 The center shall assess the status of responding emergency vehicles as part of an incident command.

Functional Area: Emergency Data Collection

Collection and storage of information related to Emergency Management. For use by operations personnel or data archives in the region.

Requirement: 1 The center shall collect emergency service data, emergency vehicle management data, emergency vehicle data, sensor and surveillance data, threat data, and incident data.

Requirement: 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

Requirement: 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the emergency management data or for the data itself.

Requirement: 4 The center shall be able to produce sample products of the data available.

Entity: Information Service Provider**Functional Area: Infrastructure Provided Route Selection**

Generation of pre-trip and enroute trip plans for travelers (and vehicles) based on current traffic conditions, work zones, weather, and travelers constraints and preferences. Includes end-to-end trips using multiple modes, such as bicycle, transit, etc.

Requirement: 1 The center shall provide the capability to provide specific pre-trip and enroute directions to travelers (and drivers), including costs, arrival times, and transfer points.

Requirement: 2 The center shall include bicycle routes, walkways, skyways, and multi-use trails in the pre-trip and enroute directions it provides to travelers.

Requirement: 3 The center shall support on-line route guidance for travelers using personal devices (such as PDAs).

Requirement: 4 The center shall support on-line route guidance for drivers in vehicles.

Requirement: 5 The center shall support on-line route guidance for specialty vehicles, such as commercial vehicles.

Requirement: 6 The center shall generate route plans based on current and/or predicted conditions of the road network, scheduled maintenance and construction work activities, and work zone activities.

Requirement: 7 The center shall generate route plans based on transit services, including fares, schedules, and requirements for travelers with special needs.

Requirement: 8 The center shall generate route plans based on current asset restrictions, such as height and weight restrictions on tunnels or bridges.

Requirement: 9 The center shall generate route plans based on current or forecasted weather.

Requirement: 10 The center shall generate route plans based on ferry, rail, air, or other multimodal transportation data.

Requirement: 11 The center shall exchange route segment information with other centers outside the area served by the local center.

Requirement: 12 The center shall generate trips based on the use of more than one mode of transport.

Requirement: 13 The center shall use the preferences and constraints specified by the traveler in the trip request to select the most appropriate mode of transport.

Requirement: 14 The center shall provide the capability for the traveler to confirm the proposed trip plan.

Architecture

Northern New Jersey ITS Architecture

Element: **National Park Service Management Center**

Entity: **Information Service Provider**

Functional Area: **Infrastructure Provided Route Selection**

Generation of pre-trip and enroute trip plans for travelers (and vehicles) based on current traffic conditions, work zones, weather, and travelers constraints and preferences. Includes end-to-end trips using multiple modes, such as bicycle, transit, etc.

Requirement: 15 The center shall log route plans, particularly for special vehicles such as those containing hazardous materials, over-sized vehicles, or motorcades, with a traffic center.

Requirement: 16 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used to determine vehicle and non-vehicle routes, trip planning, and on-line vehicle guidance.

Requirement: 17 The center shall provide the capability for center personnel to control route calculation parameters.

Functional Area: **ISP Data Collection**

Collection and storage of information supporting the operations of traveler information service providers. For use by operations personnel or data archives in the region.

Requirement: 1 The center shall collect traveler information data, such as parking lot data, rideshare data, road network use data, vehicle probe data, and other data from traveler information system operations.

Requirement: 2 The center shall collect traveler requests, confirmations, and payment transaction data for traveler services provided.

Requirement: 3 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

Requirement: 4 The center shall receive and respond to requests from ITS Archives for either a catalog of the traveler information data or for the data itself.

Requirement: 5 The center shall be able to produce sample products of the data available.

Entity: **Parking Management**

Functional Area: **Parking Surveillance**

Field elements that detect and classify vehicles entering and exiting a parking facility.

Requirement: 1 The parking element shall provide the capability to detect and classify vehicles entering and exiting a parking facility (vehicle size, type, identifiable features, etc.).

Functional Area: **Parking Management**

Maintain and distribute parking lot information including static (spaces, hours, charges, etc.) and dynamic (availability, open/closed, etc.) data. Interface to traffic, transit, and traveler information providers.

Requirement: 1 The parking element shall maintain parking lot information including static information such as hours of operation, rates, location, entrance locations, capacity, type, and constraints; as well as dynamic information such as current state of the lot, occupancy, arrival rates, and departure rates.

Requirement: 2 The parking element shall distribute parking lot information upon request to traffic management centers, transit management centers for park and ride facilities, and to traveler information providers.

Requirement: 3 The parking element manage local dynamic message signs that display messages to travelers such as the parking lot state, number of spaces available, location of entrances, and current charges.

Requirement: 4 The parking element shall support requests for parking reservations.

Functional Area: **Parking Electronic Payment**

Parking payment collection using in-vehicle equipment (tags) or contact or proximity traveler cards used for electronic payment. Includes field elements and back-office functionality.

Architecture**Northern New Jersey ITS Architecture****Element: National Park Service Management Center****Entity: Parking Management****Functional Area: Parking Electronic Payment**

Parking payment collection using in-vehicle equipment (tags) or contact or proximity traveler cards used for electronic payment. Includes field elements and back-office functionality.

- Requirement:* 1 The parking element shall detect and classify vehicles entering and exiting a parking facility (vehicle size, type, identifiable features, etc.).
- Requirement:* 2 The parking element shall read data from the traveler card / payment instrument carried on-board the vehicle (tag) or by the traveler.
- Requirement:* 3 The parking element shall provide an interface to the driver informing them of the success or failure of the financial transaction. This may involve a request for the driver to pull aside so the operator can resolve an issue.
- Requirement:* 4 The parking element shall collect data on payment violations and send the data, including images of the violator and the vehicle registration data obtained from the Department of Motor Vehicles (DMV) office, to the appropriate enforcement agency.
- Requirement:* 5 The parking element shall manage the parking lot charges, considering such factors as location, vehicle types, and times of day.
- Requirement:* 6 The parking element shall process the financial requests and manage an interface to a Financial Institution.
- Requirement:* 7 The parking element shall support the payment of parking lot transactions using data provided by the traveler cards / payment instruments.
- Requirement:* 8 The parking element shall process requests for parking lot charges to be paid in advance.
- Requirement:* 9 The parking element shall process requests for the advanced payment of tolls and transit fares as well as other non-transportation services, e.g. yellow-pages services.
- Requirement:* 10 The parking element shall maintain a list of invalid traveler credit identities, or bad tag lists.

Functional Area: Parking Data Collection

Collection and storage of parking management information. For use by operations personnel or data archives in the region.

- Requirement:* 1 The parking element shall collect parking management data including lot usage and charging information.
- Requirement:* 2 The parking element shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.
- Requirement:* 3 The parking element shall receive and respond to requests from ITS Archives for either a catalog of the parking management data or for the data itself.
- Requirement:* 4 The parking element shall be able to produce sample products of the data available.

Entity: Traffic Management**Functional Area: TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

- Requirement:* 1 The center shall remotely control traffic signal controllers.
- Requirement:* 2 The center shall accept notifications of right-of-way requests from pedestrians.
- Requirement:* 3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center.

Architecture

Northern New Jersey ITS Architecture

Element: **National Park Service Management Center**

Entity: **Traffic Management**

Functional Area: **TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

Requirement: 4 The center shall collect traffic signal controller fault data from the field.

Requirement: 5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.

Functional Area: **TMC Freeway Management**

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

Requirement: 1 The center shall remotely control systems to manage use of the freeways, including ramp meters, mainline metering, and lane controls.

Requirement: 2 The center shall collect operational status from ramp meters, mainline metering, and lane controls and compare against the control information sent by the center.

Requirement: 3 The center shall collect fault data from ramp meters, mainline metering, and lane controls.

Requirement: 4 The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, mainline metering, and lane controls), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the ramps themselves.

Functional Area: **TMC Traffic Information Dissemination**

Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.

Requirement: 1 The center shall remotely control dynamic messages signs for dissemination of traffic and other information to drivers.

Requirement: 2 The center shall remotely control driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers.

Requirement: 3 The center shall collect operational status for the driver information systems equipment (DMS, HAR, etc.).

Requirement: 4 The center shall collect fault data for the driver information systems equipment (DMS, HAR, etc.) for repair.

Requirement: 5 The center shall retrieve locally stored traffic information, including current and forecasted traffic information, road and weather conditions, traffic incident information, information on diversions and alternate routes, closures, and special traffic restrictions (lane/shoulder use, weight restrictions, width restrictions, HOV requirements), etc.

Requirement: 6 The center shall distribute traffic data to maintenance and construction centers, transit centers, emergency management centers, and traveler information providers.

Requirement: 7 The center shall distribute traffic data to the media upon request; the capability to provide the information in both data stream and graphical display shall be supported.

Requirement: 8 The center shall provide the capability for center personnel to control the nature of the data that is available to non-traffic operations centers and the media.

Functional Area: **TMC Regional Traffic Control**

Architecture**Northern New Jersey ITS Architecture****Element: National Park Service Management Center****Entity: Traffic Management****Functional Area: TMC Regional Traffic Control**

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

- Requirement:* 1 The center shall exchange traffic information with other traffic management centers, includes incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.
- Requirement:* 2 The center shall exchange traffic control information with other traffic management centers, includes remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).

Functional Area: TMC Incident Detection

Remotely controls traffic and video sensors to support incident detection and verification; exchange information with other agencies including emergency management, maintenance and construction, alerting and advisory systems, event promoters, intermodal freight depots, and traveler information systems.

- Requirement:* 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.
- Requirement:* 2 The center shall collect and store traffic flow and image data from the field equipment to detect and verify incidents.
- Requirement:* 3 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, and intermodal freight depots.
- Requirement:* 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.
- Requirement:* 5 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field.
- Requirement:* 6 The center shall provide road network conditions and traffic images to emergency management centers to support the detection, verification, and classification of incidents.
- Requirement:* 7 The center shall provide video and traffic sensor control commands to the field equipment to detect and verify incidents.

Functional Area: TMC Incident Dispatch Coordination/Communication

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

- Requirement:* 1 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction for distribution to the public. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, and information and instructions necessary for the public to respond to the alert. This may also identify specific information that should not be released to the public.
- Requirement:* 2 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.
- Requirement:* 3 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field, provide special routing for emergency vehicles, and to provide responding emergency vehicles with signal preemption.

Architecture**Northern New Jersey ITS Architecture****Element: National Park Service Management Center****Entity: Traffic Management****Functional Area: TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

- Requirement:* 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.
- Requirement:* 5 The center shall respond to requests from emergency management to provide traffic management resources to implement special traffic control measures, assist in clean up, verify an incident, etc. This may also involve coordination with maintenance centers.
- Requirement:* 6 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, media, and rail operations centers.
- Requirement:* 7 The center shall provide road network conditions and traffic images to emergency management centers, maintenance and construction centers, and traveler information service providers.
- Requirement:* 8 The center shall exchange road network status assessment information with emergency management and maintenance centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.
- Requirement:* 9 The center shall coordinate information and controls with other traffic management centers.
- Requirement:* 10 The center shall receive inputs from emergency management and transit management centers to develop an overall status of the transportation system including emergency transit schedules in effect and current status and condition of the transportation infrastructure.
- Requirement:* 11 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic incident management.

Functional Area: Traffic Data Collection

Collection and storage of traffic management data. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect traffic management data such as operational data, event logs, etc.
- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.
- Requirement:* 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the traffic data or for the data itself.
- Requirement:* 4 The center shall be able to produce sample products of the data available.

Element: National Park Service Traveler Information Systems**Entity: Information Service Provider****Functional Area: Infrastructure Provided Route Selection**

Generation of pre-trip and enroute trip plans for travelers (and vehicles) based on current traffic conditions, work zones, weather, and travelers constraints and preferences. Includes end-to-end trips using multiple modes, such as bicycle, transit, etc.

- Requirement:* 1 The center shall provide the capability to provide specific pre-trip and enroute directions to travelers (and drivers), including costs, arrival times, and transfer points.

Architecture**Northern New Jersey ITS Architecture***Element:***National Park Service Traveler Information Systems***Entity:***Information Service Provider***Functional Area:* **Infrastructure Provided Route Selection**

Generation of pre-trip and enroute trip plans for travelers (and vehicles) based on current traffic conditions, work zones, weather, and travelers constraints and preferences. Includes end-to-end trips using multiple modes, such as bicycle, transit, etc.

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| <i>Requirement:</i> | 2 | The center shall include bicycle routes, walkways, skyways, and multi-use trails in the pre-trip and enroute directions it provides to travelers. |
| <i>Requirement:</i> | 3 | The center shall support on-line route guidance for travelers using personal devices (such as PDAs). |
| <i>Requirement:</i> | 4 | The center shall support on-line route guidance for drivers in vehicles. |
| <i>Requirement:</i> | 5 | The center shall support on-line route guidance for specialty vehicles, such as commercial vehicles. |
| <i>Requirement:</i> | 6 | The center shall generate route plans based on current and/or predicted conditions of the road network, scheduled maintenance and construction work activities, and work zone activities. |
| <i>Requirement:</i> | 7 | The center shall generate route plans based on transit services, including fares, schedules, and requirements for travelers with special needs. |
| <i>Requirement:</i> | 8 | The center shall generate route plans based on current asset restrictions, such as height and weight restrictions on tunnels or bridges. |
| <i>Requirement:</i> | 9 | The center shall generate route plans based on current or forecasted weather. |
| <i>Requirement:</i> | 10 | The center shall generate route plans based on ferry, rail, air, or other multimodal transportation data. |
| <i>Requirement:</i> | 11 | The center shall exchange route segment information with other centers outside the area served by the local center. |
| <i>Requirement:</i> | 12 | The center shall generate trips based on the use of more than one mode of transport. |
| <i>Requirement:</i> | 13 | The center shall use the preferences and constraints specified by the traveler in the trip request to select the most appropriate mode of transport. |
| <i>Requirement:</i> | 14 | The center shall provide the capability for the traveler to confirm the proposed trip plan. |
| <i>Requirement:</i> | 15 | The center shall log route plans, particularly for special vehicles such as those containing hazardous materials, over-sized vehicles, or motorcades, with a traffic center. |
| <i>Requirement:</i> | 16 | The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used to determine vehicle and non-vehicle routes, trip planning, and on-line vehicle guidance. |
| <i>Requirement:</i> | 17 | The center shall provide the capability for center personnel to control route calculation parameters. |

*Element:***New York City Joint TMC***Entity:***Emergency Management***Functional Area:* **Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

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| <i>Requirement:</i> | 1 | The center shall provide strategic emergency response capabilities such as that of an Emergency Operations Center for large-scale incidents and disasters. |
| <i>Requirement:</i> | 2 | The center shall manage coordinated inter-agency responses to and recovery from large-scale emergencies. Such agencies include traffic management, transit, maintenance and construction management, rail operations, and other emergency management agencies. |
| <i>Requirement:</i> | 3 | The center shall provide the capability to implement response plans and track progress through the incident by exchanging incident information and distributing response status to allied agencies. |
| <i>Requirement:</i> | 4 | The center shall develop, coordinate with other agencies, and store emergency response plans. |

Architecture**Northern New Jersey ITS Architecture***Element:***New York City Joint TMC***Entity:***Emergency Management***Functional Area:* **Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

- Requirement:* 5 The center shall track the availability of resources (including vehicles, roadway cleanup?, etc.), request additional resources from traffic, maintenance, or other emergency centers if needed.
- Requirement:* 6 The center shall allocate the appropriate emergency services, resources, and vehicle (s) to respond to incidents, and shall provide the capability to override the current allocation to suit the special needs of a current incident.
- Requirement:* 7 The center shall receive event scheduling information from Event Promoters.
- Requirement:* 8 The center shall receive hazardous materials incident information from commercial fleet operators.
- Requirement:* 9 The center shall provide the capability to request the safe disabling of a commercial vehicle during a hazardous materials incident.
- Requirement:* 10 The center shall provide the capability to request transit resource availability from transit centers for use during disaster and evacuation operations.
- Requirement:* 11 The center shall assimilate the status of the transit, traffic, rail, maintenance, and other emergency center services and systems to create an overall transportation system status, and disseminate to each of these centers and the traveling public via traveler information providers.
- Requirement:* 12 The center shall provide information to the media concerning the status of an emergency response.
- Requirement:* 13 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.
- Requirement:* 14 The center shall provide the capability for center personnel to provide inputs to the management of incidents, disasters and evacuations.

*Entity:***Maintenance and Construction Management***Functional Area:* **MCM Work Activity Coordination**

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

- Requirement:* 1 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.
- Requirement:* 2 The center shall provide status information about scheduled maintenance and construction activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, multimodal transportation providers, rail operations, and the media.
- Requirement:* 3 The center shall collect and respond to feedback concerning scheduled maintenance and construction activities with other management centers such as traffic, emergency, transit, and rail operations.
- Requirement:* 4 The center shall collect and disseminate asset restriction information levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.

Architecture

Northern New Jersey ITS Architecture

*Element:***New York City Joint TMC**

*Entity:***Maintenance and Construction Management**

Functional Area: **MCM Work Activity Coordination**

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

- Requirement:* 5 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance and construction activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
-

- Requirement:* 6 The center shall exchange rail schedules and work plans with rail operations centers.
-

*Entity:***Traffic Management**

Functional Area: **TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

- Requirement:* 1 The center shall remotely control traffic signal controllers.
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- Requirement:* 2 The center shall accept notifications of right-of-way requests from pedestrians.
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- Requirement:* 3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center.
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- Requirement:* 4 The center shall collect traffic signal controller fault data from the field.
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- Requirement:* 5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.
-

Functional Area: **TMC Freeway Management**

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

- Requirement:* 1 The center shall remotely control systems to manage use of the freeways, including ramp meters, mainline metering, and lane controls.
-

- Requirement:* 2 The center shall collect operational status from ramp meters, mainline metering, and lane controls and compare against the control information sent by the center.
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- Requirement:* 3 The center shall collect fault data from ramp meters, mainline metering, and lane controls.
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- Requirement:* 4 The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, mainline metering, and lane controls), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the ramps themselves.
-

Functional Area: **TMC Regional Traffic Control**

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

- Requirement:* 1 The center shall exchange traffic information with other traffic management centers, includes incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.
-

- Requirement:* 2 The center shall exchange traffic control information with other traffic management centers, includes remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).
-

Architecture**Northern New Jersey ITS Architecture***Element:***New York City Joint TMC***Entity:***Traffic Management***Functional Area:* **TMC Work Zone Traffic Management**

Coordination with maintenance systems using work zone images and traveler information systems (such as DMS), and distribution of work plans so that work zones are established that have minimum traffic impact.

- Requirement:* 1 The center shall receive work zone images from a maintenance center.
- Requirement:* 2 The center shall analyze work zone images for indications of a possible incident.
- Requirement:* 3 The center shall remotely control driver information systems (such as dynamic messages signs, highway advisory radios) to advise drivers of activity around a work zone.
- Requirement:* 4 The center shall collect operational status for the driver information systems equipment in work zones.
- Requirement:* 5 The center shall collect fault data for the driver information systems equipment in work zones for repair.
- Requirement:* 6 The center shall receive proposed maintenance and construction work plans, analyze the activity as a possible incident, and provide work plan feedback to the sending center.

*Element:***Newark Pennsylvania Station Information Displays***Entity:***Remote Traveler Support***Functional Area:* **Traveler Secure Area Surveillance**

Security surveillance devices that monitor traveler-frequented areas such as transit stops and rest stops.

- Requirement:* 1 The field element shall include video and/or audio surveillance of traveler secure areas including transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and traveler information centers).
- Requirement:* 2 The field element shall be remotely controlled by a center.
- Requirement:* 3 The field element shall provide equipment status and fault indication of surveillance equipment to a center.
- Requirement:* 4 The field element shall provide raw video or audio data.
- Requirement:* 5 The field element shall remotely process video and audio data and provide an indication of potential incidents or threats to a center.

Functional Area: **Traveler Secure Area Sensor Monitoring**

Security sensors monitoring traveler-frequented areas such as transit stops, park-and-ride lots, and rest stops for environmental threats, intrusion and motion, and object detection.

- Requirement:* 1 The field element shall include security sensors that monitor conditions in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers).
- Requirement:* 2 The field element shall be remotely controlled by a center.
- Requirement:* 3 The field element shall provide equipment status and fault indication of security sensor equipment to a center.
- Requirement:* 4 The field element shall include environmental threat sensors (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological).
- Requirement:* 5 The field element shall include motion and intrusion detection sensors.
- Requirement:* 6 The field element shall include object detection sensors (such as metal detectors).
- Requirement:* 7 The field element shall provide raw security sensor data.
- Requirement:* 8 The field element shall remotely process security sensor data and provide an indication of potential incidents or threats to a center.

Architecture

Northern New Jersey ITS Architecture

*Element:***Newark Pennsylvania Station Information Displays**

*Entity:***Remote Traveler Support**

Functional Area: **Remote Traveler Security**

Public traveler interface that provides the capability for travelers to report an emergency or activate a panic button to summon assistance in areas such as transit stops, park-and-ride areas, etc.

- Requirement:* 1 The public interface for travelers shall provide the capability for a traveler to report an emergency and summon assistance from secure areas such as transit stops, transit stations, modal transfer facilities, rest stops, park-and-ride areas, travel information areas, and emergency pull off areas.
-
- Requirement:* 2 When initiated by a traveler, the public interface for travelers shall forward a request for assistance to an emergency management function and acknowledge the request.
-
- Requirement:* 3 The public interface for travelers shall provide the capability to broadcast a message to advise or warn a traveler.
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- Requirement:* 4 The public interface for travelers shall accept input and provide information to the traveler in a form suitable for travelers with physical disabilities.
-

Functional Area: **Remote Transit Information Services**

Public traveler interface that provides real-time travel-related information at transit stops and multi-modal transfer points, including general annunciation, display of imminent arrival information, the latest available information on transit routes, schedules, transfer options, bicycle accessibility, fares, real-time schedule adherence, current incidents, weather conditions, and special events

- Requirement:* 1 The public interface for travelers shall collect and provide real-time travel-related information at transit stops, multi-modal transfer points, and other public transportation areas.
-
- Requirement:* 2 The public interface for travelers shall collect and present to the transit traveler information on transit routes, schedules, and real-time schedule adherence.
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- Requirement:* 3 The public interface for travelers shall provide support for general annunciation and/or display of imminent arrival information and other information of general interest to transit users.
-
- Requirement:* 4 The public interface for travelers shall present information to the traveler in a form suitable for travelers with physical disabilities.
-

*Element:***NJDEP State Parks**

*Entity:***Emergency Management**

Functional Area: **Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

- Requirement:* 1 The center shall support the interface to the Emergency Telecommunications System (e.g. 911 or 7-digit call routing) to receive emergency notification information and provide it to the emergency system operator.
-
- Requirement:* 2 The center shall receive emergency call information from 911 services and present the possible incident information to the emergency system operator.
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- Requirement:* 3 The center shall receive emergency call information from motorist call-boxes and present the possible incident information to the emergency system operator.
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- Requirement:* 4 The center shall receive emergency call information from mayday service providers and present the possible incident information to the emergency system operator.
-
- Requirement:* 5 The center shall receive emergency notification information from other public safety agencies and present the possible incident information to the emergency system operator.
-

Architecture**Northern New Jersey ITS Architecture***Element:***NJDEP State Parks***Entity:***Emergency Management***Functional Area:* **Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

- Requirement:* 6 The center shall receive emergency notification information from public transit systems and present the possible incident information to the emergency system operator.
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- Requirement:* 7 The center shall receive emergency notification information from commercial vehicles, commercial vehicle check stations, or commercial fleet operators and present the possible incident information to the emergency system operator. This may include detection of non-permitted transport of security sensitive hazmat, hazardous cargo spills, etc.
-
- Requirement:* 8 The center shall receive details of the cargo being carried by commercial vehicles from their commercial fleet manager for incidents involving potential hazardous materials.
-
- Requirement:* 9 The center shall coordinate, correlate, and verify all emergency inputs, including those identified based on external calls and internal analysis of security sensor and surveillance data, and assign each a level of confidence.
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- Requirement:* 10 The center shall send a request for remote control of CCTV systems from a traffic management center in order to verify the reported incident.
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- Requirement:* 11 The center shall update the incident information log once the emergency system operator has verified the incident.
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- Requirement:* 12 The center shall provide the capability for digitized map data to act as the background to the emergency information presented to the emergency system operator.
-
- Requirement:* 13 The center shall forward the verified emergency information to the responding agency based on the location and nature of the emergency.

Functional Area: **Emergency Dispatch**

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

- Requirement:* 1 The center shall dispatch emergency vehicles to respond to verified emergencies and provide suggested routing under center personnel control.
-
- Requirement:* 2 The center shall store the current status of all emergency vehicles available for dispatch and those that have been dispatched.
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- Requirement:* 3 The center shall relay location and incident details to the responding vehicles.
-
- Requirement:* 4 The center shall provide the capability to request traffic control measures from traffic management centers such as signal preemption, traffic barriers and road closures.
-
- Requirement:* 5 The center shall track the location and status of emergency vehicles responding to an emergency and update the incident status based on information from the emergency vehicle.
-
- Requirement:* 6 The center shall receive status information from care facilities to determine the appropriate facility and its location.
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- Requirement:* 7 The center shall store and maintain the emergency service responses in an action log.
-
- Requirement:* 8 The center shall receive asset restriction information from maintenance centers to support the dispatching of appropriate emergency resources.
-
- Requirement:* 9 The center shall receive traffic information, including closures, traffic conditions, etc. from traffic management centers.

Architecture

Northern New Jersey ITS Architecture

Element: **NJDEP State Parks**

Entity: **Emergency Management**

Functional Area: **Emergency Dispatch**

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

Requirement: 10 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.

Requirement: 11 The center shall receive road network conditions and traffic images to support dispatch of emergency vehicles.

Requirement: 12 The center shall coordinate response to incidents with other Emergency Management centers to ensure appropriate resources are dispatched and utilized.

Functional Area: **Emergency Data Collection**

Collection and storage of information related to Emergency Management. For use by operations personnel or data archives in the region.

Requirement: 1 The center shall collect emergency service data, emergency vehicle management data, emergency vehicle data, sensor and surveillance data, threat data, and incident data.

Requirement: 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

Requirement: 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the emergency management data or for the data itself.

Requirement: 4 The center shall be able to produce sample products of the data available.

Entity: **Parking Management**

Functional Area: **Parking Surveillance**

Field elements that detect and classify vehicles entering and exiting a parking facility.

Requirement: 1 The parking element shall provide the capability to detect and classify vehicles entering and exiting a parking facility (vehicle size, type, identifiable features, etc.).

Functional Area: **Parking Management**

Maintain and distribute parking lot information including static (spaces, hours, charges, etc.) and dynamic (availability, open/closed, etc.) data. Interface to traffic, transit, and traveler information providers.

Requirement: 1 The parking element shall maintain parking lot information including static information such as hours of operation, rates, location, entrance locations, capacity, type, and constraints; as well as dynamic information such as current state of the lot, occupancy, arrival rates, and departure rates.

Requirement: 2 The parking element shall distribute parking lot information upon request to traffic management centers, transit management centers for park and ride facilities, and to traveler information providers.

Requirement: 3 The parking element manage local dynamic message signs that display messages to travelers such as the parking lot state, number of spaces available, location of entrances, and current charges.

Requirement: 4 The parking element shall support requests for parking reservations.

Functional Area: **Parking Electronic Payment**

Parking payment collection using in-vehicle equipment (tags) or contact or proximity traveler cards used for electronic payment. Includes field elements and back-office functionality.

Requirement: 1 The parking element shall detect and classify vehicles entering and exiting a parking facility (vehicle size, type, identifiable features, etc.).

Requirement: 2 The parking element shall read data from the traveler card / payment instrument carried on-board the vehicle (tag) or by the traveler.

Architecture**Northern New Jersey ITS Architecture***Element:***NJDEP State Parks***Entity:***Parking Management***Functional Area:* **Parking Electronic Payment**

Parking payment collection using in-vehicle equipment (tags) or contact or proximity traveler cards used for electronic payment. Includes field elements and back-office functionality.

- Requirement:* 3 The parking element shall provide an interface to the driver informing them of the success or failure of the financial transaction. This may involve a request for the driver to pull aside so the operator can resolve an issue.
- Requirement:* 4 The parking element shall collect data on payment violations and send the data, including images of the violator and the vehicle registration data obtained from the Department of Motor Vehicles (DMV) office, to the appropriate enforcement agency.
- Requirement:* 5 The parking element shall manage the parking lot charges, considering such factors as location, vehicle types, and times of day.
- Requirement:* 6 The parking element shall process the financial requests and manage an interface to a Financial Institution.
- Requirement:* 7 The parking element shall support the payment of parking lot transactions using data provided by the traveler cards / payment instruments.
- Requirement:* 8 The parking element shall process requests for parking lot charges to be paid in advance.
- Requirement:* 9 The parking element shall process requests for the advanced payment of tolls and transit fares as well as other non-transportation services, e.g. yellow-pages services.
- Requirement:* 10 The parking element shall maintain a list of invalid traveler credit identities, or bad tag lists.

Functional Area: **Parking Data Collection**

Collection and storage of parking management information. For use by operations personnel or data archives in the region.

- Requirement:* 1 The parking element shall collect parking management data including lot usage and charging information.
- Requirement:* 2 The parking element shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.
- Requirement:* 3 The parking element shall receive and respond to requests from ITS Archives for either a catalog of the parking management data or for the data itself.
- Requirement:* 4 The parking element shall be able to produce sample products of the data available.

*Entity:***Traffic Management***Functional Area:* **TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

- Requirement:* 1 The center shall remotely control traffic signal controllers.
- Requirement:* 2 The center shall accept notifications of right-of-way requests from pedestrians.
- Requirement:* 3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center.
- Requirement:* 4 The center shall collect traffic signal controller fault data from the field.

Architecture

Northern New Jersey ITS Architecture

Element: **NJDEP State Parks**

Entity: **Traffic Management**

Functional Area: **TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

- Requirement:* 5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.
-

Functional Area: **TMC Freeway Management**

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

- Requirement:* 1 The center shall remotely control systems to manage use of the freeways, including ramp meters, mainline metering, and lane controls.
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- Requirement:* 2 The center shall collect operational status from ramp meters, mainline metering, and lane controls and compare against the control information sent by the center.
-
- Requirement:* 3 The center shall collect fault data from ramp meters, mainline metering, and lane controls.
-
- Requirement:* 4 The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, mainline metering, and lane controls), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the ramps themselves.
-

Functional Area: **TMC Traffic Information Dissemination**

Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.

- Requirement:* 1 The center shall remotely control dynamic messages signs for dissemination of traffic and other information to drivers.
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- Requirement:* 2 The center shall remotely control driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers.
-
- Requirement:* 3 The center shall collect operational status for the driver information systems equipment (DMS, HAR, etc.).
-
- Requirement:* 4 The center shall collect fault data for the driver information systems equipment (DMS, HAR, etc.) for repair.
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- Requirement:* 5 The center shall retrieve locally stored traffic information, including current and forecasted traffic information, road and weather conditions, traffic incident information, information on diversions and alternate routes, closures, and special traffic restrictions (lane/shoulder use, weight restrictions, width restrictions, HOV requirements), etc.
-
- Requirement:* 6 The center shall distribute traffic data to maintenance and construction centers, transit centers, emergency management centers, and traveler information providers.
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- Requirement:* 7 The center shall distribute traffic data to the media upon request; the capability to provide the information in both data stream and graphical display shall be supported.
-
- Requirement:* 8 The center shall provide the capability for center personnel to control the nature of the data that is available to non-traffic operations centers and the media.
-

Functional Area: **TMC Regional Traffic Control**

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDEP State Parks***Entity:* **Traffic Management***Functional Area:* **TMC Regional Traffic Control**

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

- Requirement:* 1 The center shall exchange traffic information with other traffic management centers, includes incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.
- Requirement:* 2 The center shall exchange traffic control information with other traffic management centers, includes remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).

Functional Area: **TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

- Requirement:* 1 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction for distribution to the public. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, and information and instructions necessary for the public to respond to the alert. This may also identify specific information that should not be released to the public.
- Requirement:* 2 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.
- Requirement:* 3 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field, provide special routing for emergency vehicles, and to provide responding emergency vehicles with signal preemption.
- Requirement:* 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.
- Requirement:* 5 The center shall respond to requests from emergency management to provide traffic management resources to implement special traffic control measures, assist in clean up, verify an incident, etc. This may also involve coordination with maintenance centers.
- Requirement:* 6 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, media, and rail operations centers.
- Requirement:* 7 The center shall provide road network conditions and traffic images to emergency management centers, maintenance and construction centers, and traveler information service providers.
- Requirement:* 8 The center shall exchange road network status assessment information with emergency management and maintenance centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.
- Requirement:* 9 The center shall coordinate information and controls with other traffic management centers.
- Requirement:* 10 The center shall receive inputs from emergency management and transit management centers to develop an overall status of the transportation system including emergency transit schedules in effect and current status and condition of the transportation infrastructure.

Architecture

Northern New Jersey ITS Architecture

*Element:***NJDEP State Parks**

*Entity:***Traffic Management**

Functional Area: **TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

- Requirement:* 11 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic incident management.
-

Functional Area: **TMC Work Zone Traffic Management**

Coordination with maintenance systems using work zone images and traveler information systems (such as DMS), and distribution of work plans so that work zones are established that have minimum traffic impact.

- Requirement:* 1 The center shall receive work zone images from a maintenance center.
- Requirement:* 2 The center shall analyze work zone images for indications of a possible incident.
- Requirement:* 3 The center shall remotely control driver information systems (such as dynamic messages signs, highway advisory radios) to advise drivers of activity around a work zone.
- Requirement:* 4 The center shall collect operational status for the driver information systems equipment in work zones.
- Requirement:* 5 The center shall collect fault data for the driver information systems equipment in work zones for repair.
- Requirement:* 6 The center shall receive proposed maintenance and construction work plans, analyze the activity as a possible incident, and provide work plan feedback to the sending center.
-

Functional Area: **Traffic Data Collection**

Collection and storage of traffic management data. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect traffic management data such as operational data, event logs, etc.
- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.
- Requirement:* 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the traffic data or for the data itself.
- Requirement:* 4 The center shall be able to produce sample products of the data available.
-

*Element:***NJDOT Accident Reporting System**

*Entity:***Archived Data Management Subsystem**

Functional Area: **ITS Data Repository**

Collect and maintain data and data catalogs from one or more data sources. May include quality checks, error notification, and archive coordination.

- Requirement:* 1 The center shall collect data to be archived from one or more data sources.
- Requirement:* 2 The center shall collect data catalogs from one or more data sources. A catalog describes the data contained in the collection of archived data and may include descriptions of the schema or structure of the data, a description of the contents of the data; e.g., time range of entries, number of entries; or a sample of the data (e. g. a thumbnail).
- Requirement:* 3 The center shall store the archived data in a focused repository that is suited to a particular set of ITS data users.
- Requirement:* 4 The center shall include capabilities for performing quality checks on the incoming archived data.
-

Architecture**Northern New Jersey ITS Architecture****Element: NJDOT Accident Reporting System****Entity: Archived Data Management Subsystem****Functional Area: ITS Data Repository**

Collect and maintain data and data catalogs from one or more data sources. May include quality checks, error notification, and archive coordination.

- Requirement:* 5 The center shall include capabilities for error notification on the incoming archived data.
- Requirement:* 6 The center shall include capabilities for archive to archive coordination.
- Requirement:* 7 The center shall support a broad range of archived data management implementations, ranging from simple data marts that collect a focused set of data and serve a particular user community to large-scale data warehouses that collect, integrate, and summarize transportation data from multiple sources and serve a broad array of users within a region.
- Requirement:* 8 The center shall perform quality checks on received data.
- Requirement:* 9 The center shall provide the capability to execute methods on the incoming data such as cleansing, summarizations, aggregations, or transformations applied to the data before it is stored in the archive.
- Requirement:* 10 The center shall respond to requests from the administrator interface function to maintain the archive data.
- Requirement:* 11 When data or a catalog of data is received from the archive, the center shall generate the requested data product for the users systems.
- Requirement:* 12 For archive data requiring financial payment, the center shall process the financial requests and manage an interface to a Financial Institution.

Functional Area: Traffic and Roadside Data Archival

Collects and archives traffic and environmental information directly from the roadside for use in off-line planning, research, and analysis.

- Requirement:* 1 The center shall manage the collection of archive data directly from collection equipment located at the roadside.
- Requirement:* 2 The center shall collect traffic sensor information from roadside devices.
- Requirement:* 3 The center shall collect environmental sensor information that from roadside devices.
- Requirement:* 4 The center shall respond to requests from the Archive Data Administer to input the parameters that control the collection process.
- Requirement:* 5 The center shall send the request for data and control parameters to the field equipment where the information is collected and returned.
- Requirement:* 6 The center shall record the status about the imported traffic and roadside data.
- Requirement:* 7 The center shall use the status information to adjust the collection of traffic and roadside data.

Functional Area: Government Reporting Systems Support

Selects and formats data residing in an ITS archive to facilitate local, state, and federal government data reporting requirements.

- Requirement:* 1 The center shall provide data from an ITS archive to federal, state, or local government reporting systems.
- Requirement:* 2 The center shall provide the capability to select data from an ITS archive for use in government reports.
- Requirement:* 3 The center shall provide the capability to format data from an ITS archive suitable for input into government reports.
- Requirement:* 4 The center shall support requests for ITS archived data from Government Reporting Systems.

Architecture

Northern New Jersey ITS Architecture

Element: **NJDOT Accident Reporting System**

Entity: **Archived Data Management Subsystem**

Functional Area: **Government Reporting Systems Support**

Selects and formats data residing in an ITS archive to facilitate local, state, and federal government data reporting requirements.

- Requirement:* 5 The center shall provide the applicable meta-data for any ITS archived data to satisfy government reporting system requests. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.
-

Functional Area: **Virtual Data Warehouse Services**

Provides access to data from geographically dispersed archives and coordinates information exchange with a local data warehouse. Also provides the specialized publishing, directory services, and transaction management functions associated with coordinating remote archives.

- Requirement:* 1 The center shall provide capabilities to access "in-place" data from geographically dispersed archives. These capabilities may include analysis, data fusion, or data mining.
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- Requirement:* 2 The center shall coordinate information exchange with a local data warehouse.
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- Requirement:* 3 The center shall provide the specialized publishing, directory services, and transaction management functions associated with coordinating remote archives.
-

- Requirement:* 4 The center shall support the collection of archived data from other archives on an as-needed basis. (This minimizes the need to duplicate the comprehensive set of data from the remote archives in the local data warehouse.)
-

- Requirement:* 5 The center shall use data collected from different archives to build a set of global schema including the data archive definitions for the local archive plus any archives known to the local archive.
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- Requirement:* 6 The center shall provide the local archived data schema to other archive systems.
-

Element: **NJDOT Central ITS Field Equipment**

Entity: **Roadway Subsystem**

Functional Area: **Roadway Basic Surveillance**

Field elements that monitor traffic conditions using loop detectors and CCTV cameras.

- Requirement:* 1 The field element shall collect, process, digitize, and send traffic sensor data (speed, volume, and occupancy) to the center for further analysis and storage, under center control.
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- Requirement:* 2 The field element shall collect, process, and send traffic images to the center for further analysis and distribution.
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- Requirement:* 3 The field element shall collect, digitize, and send pedestrian sensor data to the center for further analysis and storage.
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- Requirement:* 4 The field element shall collect, process, and send pedestrian images to the center for further analysis and distribution.
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- Requirement:* 5 The field element shall collect, digitize, and send multimodal crossing and high occupancy vehicle (HOV) lane sensor data to the center for further analysis and storage.
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- Requirement:* 6 The field element shall return sensor and CCTV system operational status to the controlling center.
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- Requirement:* 7 The field element shall return sensor and CCTV system fault data to the controlling center for repair.
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Functional Area: **Roadway Probe Beacons**

Field elements to collect traffic and road conditions from passing vehicles; both anonymous toll/parking tag readings for link time calculations and smart probe data supported.

- Requirement:* 1 The field element shall use toll and parking tags on passing vehicles for traffic data link time calculations and send to the controlling center; tag identities will be removed to ensure anonymity.
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Architecture**Northern New Jersey ITS Architecture****Element: NJDOT Central ITS Field Equipment****Entity: Roadway Subsystem****Functional Area: Roadway Probe Beacons**

Field elements to collect traffic and road conditions from passing vehicles; both anonymous toll/parking tag readings for link time calculations and smart probe data supported.

- Requirement:* 2 The field element shall include equipment that monitors traffic conditions (e.g., average speed) by communicating with passing vehicles equipped with a transponder or other short range communications device; also called smart probes.
- Requirement:* 3 The field element shall include equipment that monitors road conditions by communicating with passing vehicles equipped with a transponder or other short range communications device; also called smart probes.
- Requirement:* 4 The field element shall aggregate, format, and store collected vehicle smart probe data (traffic and road conditions data), calculate link travel times and processed road condition data, and send to future passing vehicles.
- Requirement:* 5 The field element shall provide roadside beacon equipment operational status to the center.
- Requirement:* 6 The field element shall provide roadside beacon equipment fault indication to the center for repair.

Functional Area: Roadway Signal Controls

Field elements including traffic signal controllers for use at major intersections and on main highways for urban areas; also supports pedestrian crossings.

- Requirement:* 1 The field element shall control traffic signals at intersections and on main highways for urban and rural areas, under center control.
- Requirement:* 2 The field element shall collect pedestrian images and pedestrian sensor data, and respond to pedestrian crossing requests via display, audio signal, or other manner.
- Requirement:* 3 The field element shall provide the capability to notify the traffic management center that a pedestrian has requested right-of-way and when the request was or will be granted (request for right-of-way).
- Requirement:* 4 The field element shall monitor operation of traffic signal controllers and report to the center any instances in which the indicator response does not match that expected from the indicator control information.
- Requirement:* 5 The field element shall monitor operation of traffic signal controllers and report to the center any instances in which the indicator response does not match that expected from known indicator preemptions.
- Requirement:* 6 The field element shall return traffic signal controller operational status to the controlling center.
- Requirement:* 7 The field element shall return traffic signal controller fault data to the maintenance center for repair.

Functional Area: Roadway Signal Priority

Field elements that provide the capability to receive vehicle signal priority requests and control traffic signals accordingly.

- Requirement:* 1 The field element shall respond to requests for indicator (e.g., signal) preemption requests from emergency vehicles at intersections, pedestrian crossings, and multimodal crossings.
- Requirement:* 2 The field element shall respond to requests for indicator (e.g., signal) priority requests from transit vehicles at intersections, pedestrian crossings, and multimodal crossings.
- Requirement:* 3 The field element shall notify controlling traffic management center and maintenance center that the signal timing has changed based on a signal preemption/priority request to help those centers determine whether a fault detected at the signal is a true malfunction or due to a signal override.

Functional Area: Roadway Freeway Control

Freeway control equipment including ramp meters, mainline metering, and lane control equipment which controls traffic on freeways, including indicators to drivers.

Architecture**Northern New Jersey ITS Architecture****Element: NJDOT Central ITS Field Equipment****Entity: Roadway Subsystem****Functional Area: Roadway Freeway Control**

Freeway control equipment including ramp meters, mainline metering, and lane control equipment which controls traffic on freeways, including indicators to drivers.

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| <i>Requirement:</i> | 1 The field element shall include ramp metering controllers, mainline meters, and lane controls for use on freeways, under center control. |
| <i>Requirement:</i> | 2 The field element shall monitor operation of ramp meter, mainline meters, and lane control indicators and report to the center any instances in which the indicator response does not match that expected from the indicator control information. |
| <i>Requirement:</i> | 3 The field element shall monitor operation of ramp meter, mainline meters, and lane control indicators and report to the center any instances in which the indicator response does not match that expected from known indicator preemptions. |
| <i>Requirement:</i> | 4 The field element shall return ramp metering controller, mainline meters, and lane control operational status to the controlling center. |
| <i>Requirement:</i> | 5 The field element shall return ramp metering controller, mainline meters, and lane control fault data to the maintenance center for repair. |
| <i>Requirement:</i> | 6 The field element shall provide indications to the driver that a freeway ramp or a lane is available for use, with possible usage data for the freeway lanes they are entering. |

Functional Area: Roadway Traffic Information Dissemination

Driver information systems, such as dynamic message signs and Highway Advisory Radio (HAR).

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| <i>Requirement:</i> | 1 The field element shall include dynamic messages signs for dissemination of traffic and other information to drivers, under center control; the DMS may be either those that display variable text messages, or those that have fixed format display(s) (e.g. vehicle restrictions, or lane open/close). |
| <i>Requirement:</i> | 2 The field element shall include driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers, under center control. |
| <i>Requirement:</i> | 3 The field element shall include pedestrian information systems under center control (e.g. warning pedestrians of a potential hazard, or providing mandatory instructions as to the availability of pedestrian access). |
| <i>Requirement:</i> | 4 The field element shall provide operational status for the driver information systems equipment (DMS, HAR, etc.) to the center. |
| <i>Requirement:</i> | 5 The field element shall provide fault data for the driver information systems equipment (DMS, HAR, etc.) to the center for repair. |

Functional Area: Standard Rail Crossing

Field elements at highway-rail intersections (HRIs) where operational requirements do not dictate advanced features (e.g., where rail operational speeds are less than 80 miles per hour). Includes traditional HRI warning systems augmented with other standard traffic management devices.

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| <i>Requirement:</i> | 1 The field element shall collect and process, traffic sensor data in the vicinity of a highway-rail intersection (HRI). |
| <i>Requirement:</i> | 2 The field element shall monitor the status of the highway-rail intersection (HRI) equipment, including both the current state and mode of operation and the current equipment condition, to be forwarded on to the traffic management center. |
| <i>Requirement:</i> | 3 The field element shall monitor the status of the highway-rail intersection (HRI) equipment, including both the current state and mode of operation and the current equipment condition, to be forwarded on to the rail wayside equipment. |

Architecture**Northern New Jersey ITS Architecture****Element: NJDOT Central ITS Field Equipment****Entity: Roadway Subsystem****Functional Area: Standard Rail Crossing**

Field elements at highway-rail intersections (HRIs) where operational requirements do not dictate advanced features (e.g., where rail operational speeds are less than 80 miles per hour). Includes traditional HRI warning systems augmented with other standard traffic management devices.

- Requirement:* 4 The field element shall receive track status from the rail wayside equipment that can be passed on to the traffic management center. This may include the current status of the tracks and whether a train is approaching.
- Requirement:* 5 The field element shall collect pedestrian images and pedestrian sensor data, and respond to pedestrian crossing requests via display, audio signal, or other manner.
- Requirement:* 6 The field element shall control the dynamic message signs (DMS) in the vicinity of a highway-rail intersection (HRI) to advise drivers, cyclists, and pedestrians of approaching trains.
- Requirement:* 7 The field element shall close the highway-rail intersection (HRI) when a train is approaching using gates, lights/signs, barriers, and traffic control signals.
- Requirement:* 8 The field element shall support the integrated control of adjacent traffic signals to clear an area in advance of an approaching train and to manage traffic around the intersection.
- Requirement:* 9 The field element shall forward rail traffic advisories received from the Wayside Equipment to the traffic management center.

Functional Area: Advanced Rail Crossing

Field elements at highway-rail intersections (HRIs) where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). Capabilities from the Standard Rail Crossing plus systems which preclude entrance into the intersection when the barriers are activated, additional arriving train information, and detection of blocked intersections.

- Requirement:* 1 The field element shall collect and process, traffic sensor data in the vicinity of a highway-rail intersection (HRI).
- Requirement:* 2 The field element shall determine whether the highway-rail intersection (HRI) is blocked by traffic in the roadway or some other obstruction.
- Requirement:* 3 The field element shall notify the traffic management center and the rail wayside equipment of any intersection blockages, including trapped vehicles or other obstructions.
- Requirement:* 4 The field element shall monitor the status of the highway-rail intersection (HRI) equipment, including both the current state and mode of operation and the current equipment condition, to be forwarded on to the traffic management center.
- Requirement:* 5 The field element shall monitor the status of the highway-rail intersection (HRI) equipment, including both the current state and mode of operation and the current equipment condition, to be forwarded on to the rail wayside equipment.
- Requirement:* 6 The field element shall receive track status and arriving train information from the rail wayside equipment that can be passed on to the traffic management center. This may include the current status of the tracks and when a train is expected and/or how long the crossing will be closed.
- Requirement:* 7 The field element shall collect pedestrian images and pedestrian sensor data, and respond to pedestrian crossing requests via display, audio signal, or other manner.
- Requirement:* 8 The field element shall control the dynamic message signs (DMS) in the vicinity of a highway-rail intersection (HRI) to advise drivers, cyclists, and pedestrians of approaching trains.
- Requirement:* 9 The field element shall close the highway-rail intersection (HRI) when a train is approaching with enough time for traffic to safely clear the crossing using gates, lights/signs, barriers, and traffic control signals.

Architecture

Northern New Jersey ITS Architecture

Element: **NJDOT Central ITS Field Equipment**

Entity: **Roadway Subsystem**

Functional Area: **Advanced Rail Crossing**

Field elements at highway-rail intersections (HRIs) where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). Capabilities from the Standard Rail Crossing plus systems which preclude entrance into the intersection when the barriers are activated, additional arriving train information, and detection of blocked intersections.

Requirement: 10 The field element shall support the integrated control of adjacent traffic signals to clear an area in advance of an approaching train and to manage traffic around the intersection.

Requirement: 11 The field element shall forward rail traffic advisories received from the Wayside Equipment to the traffic management center.

Functional Area: **Roadway Equipment Coordination**

Field elements that control and send data to other field elements (such as environmental sensors that send data to a DMS or coordination between traffic controllers on adjacent intersections), without center control.

Requirement: 1 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that provide data and status information to other field element devices (such as dynamic message signs, ramp meters, traffic signals, work zone intrusion alert systems), without center control.

Requirement: 2 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that receive control information from other field element devices, without center control.

Requirement: 3 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that provide data and status information to other field element devices (such as dynamic message signs, traffic controllers on adjacent intersections), without center control.

Requirement: 4 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that receive control information from other field element devices, without center control.

Functional Area: **Roadway Environmental Monitoring**

Environmental sensors, surface and sub-surface, that collect weather and road surface information. Weather conditions measured include temperature, wind, humidity, precipitation, and visibility. Sensors measure road surface temperature, moisture, icing, salinity, etc.

Requirement: 1 The field element shall include surface and sub-surface environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures.

Requirement: 2 The field element shall include environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.

Requirement: 3 The field element's environmental sensors shall be remotely controlled by a maintenance center.

Requirement: 4 The field element's environmental sensors shall be remotely controlled by a traffic management center.

Requirement: 5 The field element's environmental sensors shall be remotely controlled by weather service providers such as the National Weather Service or value-added sector specific meteorological services.

Requirement: 6 The field element's environmental sensors shall be remotely controlled by a maintenance and construction vehicle.

Requirement: 7 The field element shall provide environmental sensor equipment operational status to the controlling center or maintenance vehicle.

Requirement: 8 The field element shall provide environmental sensor equipment fault indication to the controlling center or maintenance vehicle.

Architecture

Northern New Jersey ITS Architecture

Element: **NJDOT Central ITS Field Equipment**

Entity: **Roadway Subsystem**

Functional Area: **Roadway Environmental Monitoring**

Environmental sensors, surface and sub-surface, that collect weather and road surface information. Weather conditions measured include temperature, wind, humidity, precipitation, and visibility. Sensors measure road surface temperature, moisture, icing, salinity, etc.

Requirement: 9 The field element shall remotely aggregate environmental sensor data with environmental data collected from maintenance and construction vehicles.

Requirement: 10 The field element shall provide weather and road surface condition data to centers.

Requirement: 11 The field element shall provide weather and road surface condition data to maintenance and construction vehicles.

Functional Area: **Roadway Automated Treatment**

Field elements that activate automated roadway treatment systems (to disperse anti-icing chemicals, etc.) based on environmental or atmospheric conditions, or under center control.

Requirement: 1 The field element shall activate automated roadway treatment systems based on environmental or atmospheric conditions. Treatments can be in the form of fog dispersion, anti-icing chemicals, etc.

Requirement: 2 The field element shall activate automated roadway treatment systems under center control. Treatments can be in the form of fog dispersion, anti-icing chemicals, etc.

Requirement: 3 The field element shall return automated roadway treatment system and associated environmental sensor operational status to the maintenance center.

Requirement: 4 The field element shall return automated roadway treatment system and associated environmental sensor fault data to the maintenance center for repair.

Functional Area: **Multimodal Crossing Control**

Field elements to monitor and control traffic at multimodal crossings, such as draw bridges and other crossings between highway traffic and other modes; does not include highway-rail intersection.

Requirement: 1 The field element shall include sensors to monitor requests from non-highway traffic to cross at multimodal crossings for specified durations (such as draw bridges and miscellaneous other interference crossings between highway traffic and other modes such as river traffic, aircraft, etc.); the sensors are under center control.

Requirement: 2 The field element shall include signals to control traffic at multimodal crossings on surface streets, under center control.

Requirement: 3 The field element shall include driver information systems (such as dynamic messages signs, highway advisory radios (HAR), and equipment that controls warning lights and gates) that advise drivers at multimodal crossings, under center control.

Requirement: 4 The field element shall provide operational status for the sensors, signals, and driver information systems equipment at multimodal crossings to the center.

Requirement: 5 The field element shall provide fault data for the sensors, signals, and driver information systems equipment at multimodal crossings to the center for repair.

Requirement: 6 The field element shall forward all requests for right-of-way at multimodal crossings to the controlling center.

Functional Area: **Roadway Work Zone Safety**

Work zone intrusion detection devices (to detect vehicle intrusion upon a work zone or crew worker movement across a work zone boundary) and intrusion alerting devices that provide alerts to crew and drivers.

Requirement: 1 The field element shall include work zone intrusion detection devices that detect when a vehicle has intruded upon the boundary of a work zone, under center control.

Architecture**Northern New Jersey ITS Architecture****Element: NJDOT Central ITS Field Equipment****Entity: Roadway Subsystem****Functional Area: Roadway Work Zone Safety**

Work zone intrusion detection devices (to detect vehicle intrusion upon a work zone or crew worker movement across a work zone boundary) and intrusion alerting devices that provide alerts to crew and drivers.

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| <i>Requirement:</i> | 2 The field element shall include work zone intrusion detection devices that detect when crew workers have crossed the boundary between the work zone and vehicle traffic, under center control. |
| <i>Requirement:</i> | 3 The field element shall include work zone intrusion alerting devices that alert crew workers of a work zone emergency or safety issue such as the intrusion of a vehicle into the work zone area or movement of field crew into the travel lanes. |
| <i>Requirement:</i> | 4 The field element shall include work zone intrusion alerting devices that notify crew via maintenance vehicles of a work zone emergency or safety issue such as the intrusion of a vehicle into the work zone area or movement of field crew into the travel lanes. |
| <i>Requirement:</i> | 5 The field element shall include work zone intrusion alerting devices that alert drivers that they have intruded upon the perimeter of the work zone, or are about to do so; may provide alerts to drivers directly or via in-vehicle signing. |
| <i>Requirement:</i> | 6 The field element shall provide operational status for the work zone intrusion detection devices to the maintenance center. |
| <i>Requirement:</i> | 7 The field element shall provide fault data for the work zone intrusion detection devices to the maintenance center for repair. |
| <i>Requirement:</i> | 8 The field element shall provide operational status for the work zone intrusion alerting devices to the maintenance center. |
| <i>Requirement:</i> | 9 The field element shall provide fault data for the work zone intrusion alerting devices to the maintenance center for repair. |

Element: NJDOT Central Traveler Information System**Entity: Information Service Provider****Functional Area: Basic Information Broadcast**

Collection, processing, storage, and broadcast dissemination of traffic, transit, maintenance and construction, event, and weather information to traveler interface systems and vehicles.

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| <i>Requirement:</i> | 1 The center shall collect, process, store, and disseminate traffic and highway condition information to travelers, including incident information, detours and road closures, event information, recommended routes, and current speeds on specific routes. |
| <i>Requirement:</i> | 2 The center shall collect, process, store, and disseminate maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities. |
| <i>Requirement:</i> | 3 The center shall collect, process, store, and disseminate transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers. |
| <i>Requirement:</i> | 4 The center shall collect, process, store, and disseminate parking information to travelers, including location, availability, and fees. |
| <i>Requirement:</i> | 5 The center shall collect, process, store, and disseminate toll fee information to travelers. |
| <i>Requirement:</i> | 6 The center shall collect, process, store, and disseminate weather information to travelers. |
| <i>Requirement:</i> | 7 The center shall collect, process, store, and disseminate event information to travelers. |
| <i>Requirement:</i> | 8 The center shall collect, process, store, and disseminate air quality information to travelers. |
| <i>Requirement:</i> | 9 The center shall provide the capability to support requests from the media for traffic and incident data. |
| <i>Requirement:</i> | 10 The center shall provide the capability for a system operator to control the type and update frequency of broadcast traveler information. |

Architecture**Northern New Jersey ITS Architecture****Element: NJDOT Central Traveler Information System****Entity: Information Service Provider****Functional Area: Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

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| <i>Requirement:</i> | 1 | The center shall collect, process, store, and disseminate customized traffic and highway condition information to travelers, including incident information, detours and road closures, recommended routes, and current speeds on specific routes upon request. |
| <i>Requirement:</i> | 2 | The center shall collect, process, store, and disseminate customized maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities upon request. |
| <i>Requirement:</i> | 3 | The center shall collect, process, store, and disseminate customized transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers upon request. |
| <i>Requirement:</i> | 4 | The center shall collect, process, store, and disseminate customized parking information to travelers, including location, availability, and fees upon request. |
| <i>Requirement:</i> | 5 | The center shall collect, process, store, and disseminate customized toll fee information to travelers upon request. |
| <i>Requirement:</i> | 6 | The center shall collect, process, store, and disseminate customized weather information to travelers upon request. |
| <i>Requirement:</i> | 7 | The center shall collect, process, store, and disseminate customized multimodal transportation service information (for example, from ferry and airline operators), including transfer points and other information, to travelers upon request. |
| <i>Requirement:</i> | 8 | The center shall collect, process, store, and disseminate customized event information to travelers upon request. |
| <i>Requirement:</i> | 9 | The center shall collect, process, store, and disseminate customized air quality information to travelers upon request. |
| <i>Requirement:</i> | 10 | The center shall provide all traveler information based on the traveler's current location or a specific location identified by the traveler, and filter or customize the provided information accordingly. |
| <i>Requirement:</i> | 11 | The center shall accept traveler profiles for determining the type of personalized data to send to the traveler. |
| <i>Requirement:</i> | 12 | The center shall manage payment for services, such as tolls, transit fares, parking lot charges, map updates, and advanced payment for tolls, and provide transaction success or failure details. |
| <i>Requirement:</i> | 13 | The center shall support requests for traveler information and advanced payment for traveler services from commercial fleet operators. |
| <i>Requirement:</i> | 14 | The center shall provide the capability to exchange information with another traveler information service provider current or predicted data for road links that are outside the area served by the local supplier. |
| <i>Requirement:</i> | 15 | The center shall manage updates of digitized map data and provide updates to traveler interface systems upon request. |
| <i>Requirement:</i> | 16 | The center shall provide the capability to support requests from the media for traffic and incident data. |
| <i>Requirement:</i> | 17 | The center shall provide the capability for a system operator to control the type and update frequency of traveler information. |

Functional Area: Traveler Telephone Information

Collection and distribution of traveler information and wide-area alerts to traveler telephone information systems such as 511, based on voice-based traveler requests.

Architecture**Northern New Jersey ITS Architecture****Element: NJDOT Central Traveler Information System****Entity: Information Service Provider****Functional Area: Traveler Telephone Information**

Collection and distribution of traveler information and wide-area alerts to traveler telephone information systems such as 511, based on voice-based traveler requests.

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| <i>Requirement:</i> | 1 The center shall provide the capability to process voice-formatted requests for traveler information from a traveler telephone information system, and return the information in the requested format. |
| <i>Requirement:</i> | 2 The center shall provide the capability to process dual-tone multifrequency (DTMF)-based requests (touch-tone) for traveler information from a traveler telephone information system. |
| <i>Requirement:</i> | 3 The center shall provide the capability to process traveler information requests from a traveler telephone information system. |
| <i>Requirement:</i> | 4 The center shall collect and provide information on traffic conditions in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 5 The center shall collect and provide work zone and roadway maintenance information in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 6 The center shall collect and provide roadway environment conditions information in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 7 The center shall collect and provide weather and event information in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 8 The center shall collect and provide transit service information in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 9 The center shall collect and provide yellow pages services information in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 10 The center shall collect and provide current ferry and rail schedule and airport status information in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 11 The center shall provide the capability to support both specific caller requests as well as bulk upload of regional traveler information. |
| <i>Requirement:</i> | 12 The center shall receive and forward region-specific wide-area alert and advisory information to the traveler telephone information system, including major emergencies such as a natural or man-made disaster, civil emergency, child abductions, severe weather watches and warnings, military activities, and law enforcement warnings. |

Functional Area: Infrastructure Provided Route Selection

Generation of pre-trip and enroute trip plans for travelers (and vehicles) based on current traffic conditions, work zones, weather, and travelers constraints and preferences. Includes end-to-end trips using multiple modes, such as bicycle, transit, etc.

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| <i>Requirement:</i> | 1 The center shall provide the capability to provide specific pre-trip and enroute directions to travelers (and drivers), including costs, arrival times, and transfer points. |
| <i>Requirement:</i> | 2 The center shall include bicycle routes, walkways, skyways, and multi-use trails in the pre-trip and enroute directions it provides to travelers. |
| <i>Requirement:</i> | 3 The center shall support on-line route guidance for travelers using personal devices (such as PDAs). |
| <i>Requirement:</i> | 4 The center shall support on-line route guidance for drivers in vehicles. |
| <i>Requirement:</i> | 5 The center shall support on-line route guidance for specialty vehicles, such as commercial vehicles. |
| <i>Requirement:</i> | 6 The center shall generate route plans based on current and/or predicted conditions of the road network, scheduled maintenance and construction work activities, and work zone activities. |

Architecture

Northern New Jersey ITS Architecture

Element: **NJDOT Central Traveler Information System**

Entity: **Information Service Provider**

Functional Area: **Infrastructure Provided Route Selection**

Generation of pre-trip and enroute trip plans for travelers (and vehicles) based on current traffic conditions, work zones, weather, and travelers constraints and preferences. Includes end-to-end trips using multiple modes, such as bicycle, transit, etc.

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| <i>Requirement:</i> | 7 The center shall generate route plans based on transit services, including fares, schedules, and requirements for travelers with special needs. |
| <i>Requirement:</i> | 8 The center shall generate route plans based on current asset restrictions, such as height and weight restrictions on tunnels or bridges. |
| <i>Requirement:</i> | 9 The center shall generate route plans based on current or forecasted weather. |
| <i>Requirement:</i> | 10 The center shall generate route plans based on ferry, rail, air, or other multimodal transportation data. |
| <i>Requirement:</i> | 11 The center shall exchange route segment information with other centers outside the area served by the local center. |
| <i>Requirement:</i> | 12 The center shall generate trips based on the use of more than one mode of transport. |
| <i>Requirement:</i> | 13 The center shall use the preferences and constraints specified by the traveler in the trip request to select the most appropriate mode of transport. |
| <i>Requirement:</i> | 14 The center shall provide the capability for the traveler to confirm the proposed trip plan. |
| <i>Requirement:</i> | 15 The center shall log route plans, particularly for special vehicles such as those containing hazardous materials, over-sized vehicles, or motorcades, with a traffic center. |
| <i>Requirement:</i> | 16 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used to determine vehicle and non-vehicle routes, trip planning, and on-line vehicle guidance. |
| <i>Requirement:</i> | 17 The center shall provide the capability for center personnel to control route calculation parameters. |
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Element: **NJDOT Construction Management System**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Incident Management**

Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.

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| <i>Requirement:</i> | 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System. |
| <i>Requirement:</i> | 2 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, etc. |
| <i>Requirement:</i> | 3 The center shall exchange incident and threat information with emergency management centers as well as traffic management centers; including notification of existence of incident and expected severity, location, time and nature of incident. |
| <i>Requirement:</i> | 4 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations. |
| <i>Requirement:</i> | 5 The center shall respond to requests from emergency management to provide maintenance and construction resources to implement response plans, assist in clean up, verify an incident, etc. This may also involve coordination with traffic management centers and other maintenance centers. |
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Architecture

Northern New Jersey ITS Architecture

Element: **NJDOT Construction Management System**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Incident Management**

Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.

- Requirement:* 6 The center shall exchange road network status assessment information with emergency management and traffic management centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.
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- Requirement:* 7 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.
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- Requirement:* 8 The center shall receive information indicating the damage sustained by transportation assets, derived from aerial surveillance, field reports, inspections, tests, and analyses to support incident management.
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Functional Area: **MCM Maintenance Decision Support**

Maintenance Decision Support Systems recommend courses of action based on current and forecast environmental and road conditions (filtered and fused for specific time horizons) and additional application specific information. Recommendations and dispatch instructions are generated based on this integrated information.

- Requirement:* 1 The center shall provide the center personnel with tailored external information, including weather or road condition observations, forecasted weather information or road conditions, current usage of treatments and materials, available resources, equipment and vehicle availability, road network information, and source reliability information.
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- Requirement:* 2 The center shall tailor the decision support information to include filtering (selection from a large amount of external information), error reduction ('smoothing' the information), fusion (combination of disparate information to match the decision needs), and analysis (creating the decision).
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- Requirement:* 3 The center shall provide an interface to the center personnel to input control parameters for the decision support process and receive decisions or information presentation.
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- Requirement:* 4 The center shall provide dispatch information to maintenance and construction vehicles based on the outputs of the decision support system, including recommended roadway treatment actions.
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Functional Area: **MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

- Requirement:* 1 The center shall maintain an interface with asset management systems to track the inventory, restrictions, repair needs and status updates of transportation assets (pavement, bridges, signs, etc.) including location, installation and materials information, vendor/contractor, current maintenance status, standard height, width, and weight restrictions.
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- Requirement:* 2 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other roadway maintenance.
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- Requirement:* 3 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
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- Requirement:* 4 The center shall provide emergency management and traffic management centers with information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.
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Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT Construction Management System***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

- Requirement:* 5 The center shall collect the status and fault data from roadside equipment, such as traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
- Requirement:* 6 The center shall collect the status and fault data from traffic management centers, including data for traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
- Requirement:* 7 The center shall remotely control and collect data from infrastructure monitoring sensors located along the roadway infrastructure or on maintenance and construction vehicles.
- Requirement:* 8 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of roadway maintenance and construction activities.
- Requirement:* 9 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of roadway maintenance and construction activities.
- Requirement:* 10 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
- Requirement:* 11 The center shall dispatch and route maintenance and construction vehicle drivers and support them with route- specific environmental, incident, advisory, threat, alert, and traffic congestion information.
- Requirement:* 12 The center shall manage an interface with center personnel to accept vehicle systems control information and remotely control maintenance and construction vehicle on-board equipment.
- Requirement:* 13 The center shall track the status of roadway maintenance and construction activities by monitoring collected data from the dispatched vehicles and equipment.

Functional Area: **MCM Work Zone Management**

Remotely monitors and supports work zone activities, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).

- Requirement:* 1 The center shall generate new work zone activity schedules for use by maintenance and construction vehicles, maintenance and construction operators, and for information coordination purposes.
- Requirement:* 2 The center shall control the collection of work zone status information including video images from cameras located in or near the work zone.
- Requirement:* 3 The center shall disseminate work zone information to other agencies and centers including traffic, transit, emergency management centers, other maintenance centers, traveler information providers, and the media.
- Requirement:* 4 The center shall control traffic in work zones by providing remote control of dynamic message signs and highway advisory radio systems located in or near the work zone.

Architecture

Northern New Jersey ITS Architecture

Element: **NJDOT Construction Management System**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Work Zone Management**

Remotely monitors and supports work zone activities, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).

- Requirement:* 5 The center shall exchange information with administrative systems to support the planning and scheduling of work zone activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
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Functional Area: **MCM Work Activity Coordination**

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

- Requirement:* 1 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.
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- Requirement:* 2 The center shall provide status information about scheduled maintenance and construction activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, multimodal transportation providers, rail operations, and the media.
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- Requirement:* 3 The center shall collect and respond to feedback concerning scheduled maintenance and construction activities with other management centers such as traffic, emergency, transit, and rail operations.
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- Requirement:* 4 The center shall collect and disseminate asset restriction information levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.
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- Requirement:* 5 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance and construction activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
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- Requirement:* 6 The center shall exchange rail schedules and work plans with rail operations centers.
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Element: **NJDOT ESP Vehicles**

Entity: **Emergency Vehicle Subsystem**

Functional Area: **On-board EV En Route Support**

On-board systems for gathering of dispatch and routing information for emergency vehicle personnel, vehicle tracking, communications with care facilities, and signal preemption via short range communication directly with traffic control equipment at the roadside.

- Requirement:* 1 The emergency vehicle, including roadway service patrols, shall compute the location of the emergency vehicle based on inputs from a vehicle location determination function.
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- Requirement:* 2 The emergency vehicle, including roadway service patrols, shall send the vehicle's location and operational data to the center for emergency management and dispatch.
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- Requirement:* 3 The emergency vehicle, including roadway service patrols, shall receive incident details and a suggested route when dispatched to a scene.
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Architecture

Northern New Jersey ITS Architecture

*Element:***NJDOT ESP Vehicles**

*Entity:***Emergency Vehicle Subsystem**

Functional Area: **On-board EV En Route Support**

On-board systems for gathering of dispatch and routing information for emergency vehicle personnel, vehicle tracking, communications with care facilities, and signal preemption via short range communication directly with traffic control equipment at the roadside.

Requirement: 4 The emergency vehicle shall send the current en route status (including estimated time of arrival) and requests for emergency dispatch updates.

Requirement: 5 The emergency vehicle shall send requests to traffic signal control equipment at the roadside to preempt the signal.

Requirement: 6 The emergency vehicle shall provide the personnel on-board with dispatch information, including incident type and location, and forward an acknowledgment from personnel to the center that the vehicle is on its way to the incident scene.

Requirement: 7 The emergency vehicle shall send patient status information to the care facility along with a request for further information.

Requirement: 8 The emergency vehicle shall forward care facility status information to emergency vehicle personnel, including the location, specialized services, quality of care, waiting time, number of rooms available, and emergency room status of hospitals or emergency care providers.

Functional Area: **On-board EV Incident Management Communication**

On-board systems providing the direct interface between the emergency vehicle and incident management personnel at the incident site.

Requirement: 1 The emergency vehicle shall receive dispatch instructions sufficient to enable emergency personnel in the field to implement an effective incident response. It includes local traffic, road, and weather conditions, hazardous material information, and the current status of resources that have been allocated to an incident.

Requirement: 2 The emergency vehicle shall provide an interface to the center for emergency personnel to transmit information about the incident site such as the extent of injuries, identification of vehicles and people involved, hazardous material, etc.

Requirement: 3 The emergency vehicle shall provide an interface to the center for emergency personnel to transmit information about the current incident response status such as the identification of the resources on site, site management strategies in effect, and current clearance status.

*Element:***NJDOT Maintenance**

*Entity:***Maintenance and Construction Management**

Functional Area: **MCM Vehicle Tracking**

Remotely tracks the location of maintenance and construction vehicles and other equipment; presented to the center personnel.

Requirement: 1 The center shall monitor the locations of all maintenance and construction vehicles and other equipment under its jurisdiction.

Requirement: 2 The center shall present location data to center personnel for the fleet of maintenance and construction vehicles and other equipment.

Requirement: 3 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for maintenance and construction vehicle tracking.

Functional Area: **MCM Vehicle and Equipment Maintenance Management**

Monitors vehicle and equipment condition, tracks maintenance history, and schedules routine and corrective maintenance.

Architecture**Northern New Jersey ITS Architecture***Element:***NJDOT Maintenance***Entity:***Maintenance and Construction Management***Functional Area:* **MCM Vehicle and Equipment Maintenance Management**

Monitors vehicle and equipment condition, tracks maintenance history, and schedules routine and corrective maintenance.

- Requirement:*
- 1 The center shall collect and analyze vehicle diagnostics information from maintenance and construction vehicles. The information includes engine temperature, mileage, tire wear, brake wear, belt wear, and any warnings or alarms concerning the operational condition of the vehicle and ancillary equipment.
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- Requirement:*
- 2 The center shall exchange information with equipment repair facilities including status and history of repairs concerning maintenance and construction vehicles. This information includes vehicle status and diagnostic information, vehicle utilization, and coordination of when vehicles will be available for preventative and corrective maintenance.
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- Requirement:*
- 3 The center shall schedule preventive and corrective vehicle maintenance with the equipment repair facility based on fleet health reports, maintenance records, vehicle utilization and vehicle availability schedules.

Functional Area: **MCM Environmental Information Collection**

Remotely controls environmental sensors and assimilates collected data with other current and forecast road conditions and surface weather information from weather service providers and transportation operations.

- Requirement:*
- 1 The center shall remotely control environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures.
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- Requirement:*
- 2 The center shall remotely control environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.
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- Requirement:*
- 3 The center shall remotely control environmental sensors on-board maintenance and construction vehicles that measure road and weather conditions including air and surface temperatures, wind speed, humidity, precipitation, visibility and other measures.
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- Requirement:*
- 4 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services), data from traffic, emergency, and transit management, traveler information providers, and environmental data collected from sensors deployed on and about the roadway as well as the fleet of maintenance and construction vehicles.
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- Requirement:*
- 5 The center shall provide weather and road condition information to weather service providers and center personnel.
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- Requirement:*
- 6 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.
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- Requirement:*
- 7 The center shall collect operational status for the roadside and vehicle-based environmental sensor equipment.
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- Requirement:*
- 8 The center shall collect fault data for the roadside and vehicle-based environmental sensor equipment for repair.

Functional Area: **MCM Automated Treatment System Control**

Remotely controls automated roadway treatment systems (to disperse anti-icing chemicals, etc.) directly, or via control of the environmental sensors that activate the treatment systems automatically in the field.

- Requirement:*
- 1 The center shall remotely control automated roadway treatment systems. Treatments can be in the form of fog dispersion, anti-icing chemicals, etc.
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- Requirement:*
- 2 The center shall remotely control the environmental sensors that upon detecting changes in environmental or atmospheric conditions, automatically activate roadway treatment systems.

Architecture**Northern New Jersey ITS Architecture***Element:***NJDOT Maintenance***Entity:***Maintenance and Construction Management***Functional Area:* **MCM Automated Treatment System Control**

Remotely controls automated roadway treatment systems (to disperse anti-icing chemicals, etc.) directly, or via control of the environmental sensors that activate the treatment systems automatically in the field.

Requirement: 3 The center shall collect automated roadway treatment system and associated environmental sensor operational status.

Requirement: 4 The center shall collect automated roadway treatment system and associated environmental sensor fault data and request repair.

Requirement: 5 The center shall accept requests for automated roadway treatment system activation from center personnel.

Functional Area: **MCM Incident Management**

Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.

Requirement: 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.

Requirement: 2 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, etc.

Requirement: 3 The center shall exchange incident and threat information with emergency management centers as well as traffic management centers; including notification of existence of incident and expected severity, location, time and nature of incident.

Requirement: 4 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.

Requirement: 5 The center shall respond to requests from emergency management to provide maintenance and construction resources to implement response plans, assist in clean up, verify an incident, etc. This may also involve coordination with traffic management centers and other maintenance centers.

Requirement: 6 The center shall exchange road network status assessment information with emergency management and traffic management centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.

Requirement: 7 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

Requirement: 8 The center shall receive information indicating the damage sustained by transportation assets, derived from aerial surveillance, field reports, inspections, tests, and analyses to support incident management.

Functional Area: **MCM Maintenance Decision Support**

Maintenance Decision Support Systems recommend courses of action based on current and forecast environmental and road conditions (filtered and fused for specific time horizons) and additional application specific information. Recommendations and dispatch instructions are generated based on this integrated information.

Requirement: 1 The center shall provide the center personnel with tailored external information, including weather or road condition observations, forecasted weather information or road conditions, current usage of treatments and materials, available resources, equipment and vehicle availability, road network information, and source reliability information.

Architecture**Northern New Jersey ITS Architecture***Element:***NJDOT Maintenance***Entity:***Maintenance and Construction Management***Functional Area:* **MCM Maintenance Decision Support**

Maintenance Decision Support Systems recommend courses of action based on current and forecast environmental and road conditions (filtered and fused for specific time horizons) and additional application specific information. Recommendations and dispatch instructions are generated based on this integrated information.

- Requirement:* 2 The center shall tailor the decision support information to include filtering (selection from a large amount of external information), error reduction ('smoothing' the information), fusion (combination of disparate information to match the decision needs), and analysis (creating the decision).
- Requirement:* 3 The center shall provide an interface to the center personnel to input control parameters for the decision support process and receive decisions or information presentation.
- Requirement:* 4 The center shall provide dispatch information to maintenance and construction vehicles based on the outputs of the decision support system, including recommended roadway treatment actions.

Functional Area: **MCM Winter Maintenance Management**

Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.

- Requirement:* 1 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other winter roadway maintenance.
- Requirement:* 2 The center shall exchange information with administrative systems to support the planning and scheduling of winter maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
- Requirement:* 3 The center shall provide status information about scheduled winter maintenance activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, and the media.
- Requirement:* 4 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of winter maintenance activities.
- Requirement:* 5 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of winter maintenance activities.
- Requirement:* 6 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
- Requirement:* 7 The center shall dispatch and route winter maintenance vehicle drivers and support them with route-specific environmental, incident, advisory, threat, alert, and traffic congestion information.
- Requirement:* 8 The center shall determine the need for roadway treatment based on current and forecasted weather information, current usage of treatments and materials, available resources, requests for action from other agencies, and recommendations from the Maintenance Decision Support system, specifically under winter conditions. This supports winter maintenance such as plowing, treating, anti-icing, etc.
- Requirement:* 9 The center shall provide dispatch instructions for vehicle operators based on input parameters from center personnel, specifically for winter conditions. This could include a treatment route, treatment application rates, start and end times, and other treatment instructions.
- Requirement:* 10 The center shall support remote control of on-board maintenance and construction vehicle systems and field equipment that is remotely controlled by the vehicle such as adjusting material application rates and spread patterns.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT Maintenance***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Winter Maintenance Management**

Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.

- Requirement:* 11 The center shall assess the current status of all winter maintenance activities, including actual work activities performed, current locations and operational conditions of vehicles, materials and equipment inventories, field equipment status, environmental information, etc.

Functional Area: **MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

- Requirement:* 1 The center shall maintain an interface with asset management systems to track the inventory, restrictions, repair needs and status updates of transportation assets (pavement, bridges, signs, etc.) including location, installation and materials information, vendor/contractor, current maintenance status, standard height, width, and weight restrictions.

- Requirement:* 2 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other roadway maintenance.

- Requirement:* 3 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.

- Requirement:* 4 The center shall provide emergency management and traffic management centers with information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.

- Requirement:* 5 The center shall collect the status and fault data from roadside equipment, such as traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.

- Requirement:* 6 The center shall collect the status and fault data from traffic management centers, including data for traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.

- Requirement:* 7 The center shall remotely control and collect data from infrastructure monitoring sensors located along the roadway infrastructure or on maintenance and construction vehicles.

- Requirement:* 8 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of roadway maintenance and construction activities.

- Requirement:* 9 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of roadway maintenance and construction activities.

- Requirement:* 10 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).

- Requirement:* 11 The center shall dispatch and route maintenance and construction vehicle drivers and support them with route- specific environmental, incident, advisory, threat, alert, and traffic congestion information.

Architecture

Northern New Jersey ITS Architecture

Element: **NJDOT Maintenance**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

Requirement: 12 The center shall manage an interface with center personnel to accept vehicle systems control information and remotely control maintenance and construction vehicle on-board equipment.

Requirement: 13 The center shall track the status of roadway maintenance and construction activities by monitoring collected data from the dispatched vehicles and equipment.

Functional Area: **MCM Work Zone Management**

Remotely monitors and supports work zone activities, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).

Requirement: 1 The center shall generate new work zone activity schedules for use by maintenance and construction vehicles, maintenance and construction operators, and for information coordination purposes.

Requirement: 2 The center shall control the collection of work zone status information including video images from cameras located in or near the work zone.

Requirement: 3 The center shall disseminate work zone information to other agencies and centers including traffic, transit, emergency management centers, other maintenance centers, traveler information providers, and the media.

Requirement: 4 The center shall control traffic in work zones by providing remote control of dynamic message signs and highway advisory radio systems located in or near the work zone.

Requirement: 5 The center shall exchange information with administrative systems to support the planning and scheduling of work zone activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.

Functional Area: **MCM Work Zone Safety Management**

Remotely monitors work zone safety systems that detect vehicle intrusions in work zones and warns crew workers and drivers of imminent encroachment. Crew movements are also monitored so that the crew can be warned of movement beyond the designated safe zone.

Requirement: 1 The center shall provide remote monitoring and control of work zone safety devices - including intrusion detection devices that have been installed in work zones or maintenance areas.

Requirement: 2 The center shall provide remote monitoring and control of intrusion alert devices that have been installed in work zones or maintenance areas.

Requirement: 3 The center shall collect status information of work zone safety device status from field equipment or the maintenance and construction vehicles.

Requirement: 4 The center shall collect and store work zone data collected from work zone monitoring devices (such as intrusion detection or alert devices and speed monitoring devices) on-board the vehicle and at the roadside.

Functional Area: **MCM Work Activity Coordination**

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

Architecture**Northern New Jersey ITS Architecture***Element:***NJDOT Maintenance***Entity:***Maintenance and Construction Management***Functional Area:* **MCM Work Activity Coordination**

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

- Requirement:*
- 1 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.
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- Requirement:*
- 2 The center shall provide status information about scheduled maintenance and construction activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, multimodal transportation providers, rail operations, and the media.
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- Requirement:*
- 3 The center shall collect and respond to feedback concerning scheduled maintenance and construction activities with other management centers such as traffic, emergency, transit, and rail operations.
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- Requirement:*
- 4 The center shall collect and disseminate asset restriction information levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.
-
- Requirement:*
- 5 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance and construction activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
-
- Requirement:*
- 6 The center shall exchange rail schedules and work plans with rail operations centers.

*Element:***NJDOT Maintenance Vehicles***Entity:***Maintenance and Construction Vehicle***Functional Area:* **MCV Vehicle Location Tracking**

On-board systems to track vehicle location and reports the position and timestamp information to the dispatch center.

- Requirement:*
- 1 The maintenance and construction vehicle shall compute the location of the vehicle based on inputs from a vehicle location determination function.
-
- Requirement:*
- 2 The maintenance and construction vehicle shall send the timestamped vehicle location to the controlling center.

Functional Area: **MCV Vehicle System Monitoring and Diagnostics**

On-board sensors capable of monitoring the condition of each of the vehicle systems and diagnostics that can be used to support vehicle maintenance.

- Requirement:*
- 1 The maintenance and construction vehicle shall collect vehicle diagnostics and operating status data from the maintenance vehicle platform including engine temperature, mileage, tire wear, brake wear, belt wear, and other operational status measures as well as the status of maintenance and construction-specific systems on the vehicle.
-
- Requirement:*
- 2 The maintenance and construction vehicle shall use the diagnostic and status information to support scheduling vehicle maintenance, monitoring safety status, and informing the vehicle operator of the conditions.
-
- Requirement:*
- 3 The maintenance and construction vehicle shall the vehicle diagnostic and safety information to an equipment repair facility.

Architecture

Northern New Jersey ITS Architecture

Element: **NJDOT Maintenance Vehicles**

Entity: **Maintenance and Construction Vehicle**

Functional Area: **MCV Vehicle System Monitoring and Diagnostics**

On-board sensors capable of monitoring the condition of each of the vehicle systems and diagnostics that can be used to support vehicle maintenance.

- Requirement:* 4 The maintenance and construction vehicle shall send the vehicle diagnostic and safety information to the controlling maintenance center.
-

Functional Area: **MCV Winter Maintenance**

On-board systems that support snow plow operations and other roadway treatments (e.g., salt spraying and other material applications). Supports platooning of snow plows.

- Requirement:* 1 The maintenance and construction vehicle shall track the location and status of safety systems on-board the vehicle.
-

- Requirement:* 2 The maintenance and construction vehicle shall respond to control information from the center to allow remote operation of the on-board vehicle systems. These systems include winter maintenance equipment for plowing, treating, and anti-icing.
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- Requirement:* 3 The maintenance and construction vehicle shall monitor materials information including remaining quantity and current application rate of materials on the vehicle.
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- Requirement:* 4 The maintenance and construction vehicle shall respond to dispatch information from the center, presented to the vehicle operator for acknowledgement and returning status.
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- Requirement:* 5 The maintenance and construction vehicle shall send operational data to the center including the operational state of the maintenance equipment (e.g., blade up/down, spreader pattern), types and quantities of materials used for construction and maintenance activities, and a record of the actual work performed.
-

- Requirement:* 6 The maintenance and construction vehicle shall exchange operational and environmental data with other maintenance and construction vehicles. Operational data includes operational state of the maintenance equipment (e.g., blade up/down, spreader pattern, equipment configuration) and a record of the actual work performed while the environmental data includes environmental sensor data collected on-board a maintenance and construction vehicle, either raw or processed data.
-

Functional Area: **MCV Infrastructure Monitoring**

On-board systems to monitor the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts). Includes vehicle-based sensors and communications with roadway-based infrastructure monitoring sensors.

- Requirement:* 1 The maintenance and construction vehicle shall collect infrastructure data from on-board sensors relating to the physical characteristics of the roadway infrastructure, including pavement, bridges, culverts, signs, etc.
-

Functional Area: **MCV Roadway Maintenance and Construction**

On-board systems that support routine non-winter maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of equipment on the roadway.

- Requirement:* 1 The maintenance and construction vehicle shall track the location and status of safety systems on-board the vehicle.
-

Functional Area: **MCV Infrastructure Monitoring**

On-board systems to monitor the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts). Includes vehicle-based sensors and communications with roadway-based infrastructure monitoring sensors.

Architecture**Northern New Jersey ITS Architecture***Element:***NJDOT Maintenance Vehicles***Entity:***Maintenance and Construction Vehicle***Functional Area:* **MCV Infrastructure Monitoring**

On-board systems to monitor the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts). Includes vehicle-based sensors and communications with roadway-based infrastructure monitoring sensors.

- Requirement:* 2 The maintenance and construction vehicle shall collect infrastructure data from sensors located along the roadway relating to the physical characteristics of the roadway infrastructure, including pavement, bridges, culverts, signs, etc.

Functional Area: **MCV Roadway Maintenance and Construction**

On-board systems that support routine non-winter maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of equipment on the roadway.

- Requirement:* 2 The maintenance and construction vehicle shall respond to control information from the center to allow remote operation of the on-board vehicle systems. These systems include routine maintenance equipment for cutting, repairs, hazard removal, etc.

Functional Area: **MCV Infrastructure Monitoring**

On-board systems to monitor the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts). Includes vehicle-based sensors and communications with roadway-based infrastructure monitoring sensors.

- Requirement:* 3 The maintenance and construction vehicle shall provide control signals to infrastructure monitoring sensors located at the roadway.

Functional Area: **MCV Roadway Maintenance and Construction**

On-board systems that support routine non-winter maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of equipment on the roadway.

- Requirement:* 3 The maintenance and construction vehicle shall monitor materials information including remaining quantity and current application rate of materials on the vehicle.

Functional Area: **MCV Infrastructure Monitoring**

On-board systems to monitor the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts). Includes vehicle-based sensors and communications with roadway-based infrastructure monitoring sensors.

- Requirement:* 4 The maintenance and construction vehicle shall send current condition of pavement, bridges, culverts, signs, and other roadway infrastructure as measured by on-board sensors or read from infrastructure-based sensors to the center. The data may include raw data or images (e.g., photo logs) that indicate the current status of the infrastructure.

Functional Area: **MCV Roadway Maintenance and Construction**

On-board systems that support routine non-winter maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of equipment on the roadway.

- Requirement:* 4 The maintenance and construction vehicle shall respond to dispatch information from the center, presented to the vehicle operator for acknowledgement and returning status.

- Requirement:* 5 The maintenance and construction vehicle shall send operational data to the center including the operational state of the maintenance equipment (e.g., blade up/down, spreader pattern), types and quantities of materials used for construction and maintenance activities, and a record of the actual work performed.

Functional Area: **MCV Infrastructure Monitoring**

Architecture

Northern New Jersey ITS Architecture

*Element:***NJDOT Maintenance Vehicles**

*Entity:***Maintenance and Construction Vehicle**

Functional Area: **MCV Infrastructure Monitoring**

On-board systems to monitor the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts). Includes vehicle-based sensors and communications with roadway-based infrastructure monitoring sensors.

- Requirement:* 5 The maintenance and construction vehicle shall provide infrastructure sensor equipment operational status to the center.
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Functional Area: **MCV Vehicle Safety Monitoring**

On-board systems to detect vehicle intrusions and warn crew workers and drivers of imminent encroachment. Crew movements are monitored so that the crew can be warned of movement beyond the designated safe zone. Used for stationary work zones or in mobile applications where a safe zone is maintained around the moving vehicle.

- Requirement:* 1 The maintenance and construction vehicle shall detect that a vehicle has intruded upon the boundary of a work zone. The boundary of the work zone represents an area around the maintenance and construction vehicle, which may be stationary or moving.
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- Requirement:* 2 The maintenance and construction vehicle shall receive work zone warnings from the field equipment at the roadside, other maintenance and construction vehicles.
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- Requirement:* 3 The maintenance and construction vehicle shall present work zone warnings to the field personnel using direct warning signals or in-vehicle signage functions.
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- Requirement:* 4 The maintenance and construction vehicle shall monitor the crew movements to identify when a crew member is crossing the boundary between a work zone and vehicle traffic and issue an alert to the crew member.
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- Requirement:* 5 The maintenance and construction vehicle shall provide status of the work zone warning systems to the center.
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*Element:***NJDOT North ITS Field Equipment**

*Entity:***Roadway Subsystem**

Functional Area: **Roadway Basic Surveillance**

Field elements that monitor traffic conditions using loop detectors and CCTV cameras.

- Requirement:* 1 The field element shall collect, process, digitize, and send traffic sensor data (speed, volume, and occupancy) to the center for further analysis and storage, under center control.
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- Requirement:* 2 The field element shall collect, process, and send traffic images to the center for further analysis and distribution.
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- Requirement:* 3 The field element shall collect, digitize, and send pedestrian sensor data to the center for further analysis and storage.
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- Requirement:* 4 The field element shall collect, process, and send pedestrian images to the center for further analysis and distribution.
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- Requirement:* 5 The field element shall collect, digitize, and send multimodal crossing and high occupancy vehicle (HOV) lane sensor data to the center for further analysis and storage.
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- Requirement:* 6 The field element shall return sensor and CCTV system operational status to the controlling center.
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- Requirement:* 7 The field element shall return sensor and CCTV system fault data to the controlling center for repair.
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Functional Area: **Roadway Probe Beacons**

Field elements to collect traffic and road conditions from passing vehicles; both anonymous toll/parking tag readings for link time calculations and smart probe data supported.

Architecture**Northern New Jersey ITS Architecture****Element: NJDOT North ITS Field Equipment****Entity: Roadway Subsystem****Functional Area: Roadway Probe Beacons**

Field elements to collect traffic and road conditions from passing vehicles; both anonymous toll/parking tag readings for link time calculations and smart probe data supported.

- Requirement:* 1 The field element shall use toll and parking tags on passing vehicles for traffic data link time calculations and send to the controlling center; tag identities will be removed to ensure anonymity.
- Requirement:* 2 The field element shall include equipment that monitors traffic conditions (e.g., average speed) by communicating with passing vehicles equipped with a transponder or other short range communications device; also called smart probes.
- Requirement:* 3 The field element shall include equipment that monitors road conditions by communicating with passing vehicles equipped with a transponder or other short range communications device; also called smart probes.
- Requirement:* 4 The field element shall aggregate, format, and store collected vehicle smart probe data (traffic and road conditions data), calculate link travel times and processed road condition data, and send to future passing vehicles.
- Requirement:* 5 The field element shall provide roadside beacon equipment operational status to the center.
- Requirement:* 6 The field element shall provide roadside beacon equipment fault indication to the center for repair.

Functional Area: Roadway Signal Controls

Field elements including traffic signal controllers for use at major intersections and on main highways for urban areas; also supports pedestrian crossings.

- Requirement:* 1 The field element shall control traffic signals at intersections and on main highways for urban and rural areas, under center control.
- Requirement:* 2 The field element shall collect pedestrian images and pedestrian sensor data, and respond to pedestrian crossing requests via display, audio signal, or other manner.
- Requirement:* 3 The field element shall provide the capability to notify the traffic management center that a pedestrian has requested right-of-way and when the request was or will be granted (request for right-of-way).
- Requirement:* 4 The field element shall monitor operation of traffic signal controllers and report to the center any instances in which the indicator response does not match that expected from the indicator control information.
- Requirement:* 5 The field element shall monitor operation of traffic signal controllers and report to the center any instances in which the indicator response does not match that expected from known indicator preemptions.
- Requirement:* 6 The field element shall return traffic signal controller operational status to the controlling center.
- Requirement:* 7 The field element shall return traffic signal controller fault data to the maintenance center for repair.

Functional Area: Roadway Signal Priority

Field elements that provide the capability to receive vehicle signal priority requests and control traffic signals accordingly.

- Requirement:* 1 The field element shall respond to requests for indicator (e.g., signal) preemption requests from emergency vehicles at intersections, pedestrian crossings, and multimodal crossings.
- Requirement:* 2 The field element shall respond to requests for indicator (e.g., signal) priority requests from transit vehicles at intersections, pedestrian crossings, and multimodal crossings.
- Requirement:* 3 The field element shall notify controlling traffic management center and maintenance center that the signal timing has changed based on a signal preemption/priority request to help those centers determine whether a fault detected at the signal is a true malfunction or due to a signal override.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT North ITS Field Equipment***Entity:* **Roadway Subsystem***Functional Area:* **Roadway Freeway Control**

Freeway control equipment including ramp meters, mainline metering, and lane control equipment which controls traffic on freeways, including indicators to drivers.

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| <i>Requirement:</i> | 1 The field element shall include ramp metering controllers, mainline meters, and lane controls for use on freeways, under center control. |
| <i>Requirement:</i> | 2 The field element shall monitor operation of ramp meter, mainline meters, and lane control indicators and report to the center any instances in which the indicator response does not match that expected from the indicator control information. |
| <i>Requirement:</i> | 3 The field element shall monitor operation of ramp meter, mainline meters, and lane control indicators and report to the center any instances in which the indicator response does not match that expected from known indicator preemptions. |
| <i>Requirement:</i> | 4 The field element shall return ramp metering controller, mainline meters, and lane control operational status to the controlling center. |
| <i>Requirement:</i> | 5 The field element shall return ramp metering controller, mainline meters, and lane control fault data to the maintenance center for repair. |
| <i>Requirement:</i> | 6 The field element shall provide indications to the driver that a freeway ramp or a lane is available for use, with possible usage data for the freeway lanes they are entering. |

Functional Area: **Roadway Traffic Information Dissemination**

Driver information systems, such as dynamic message signs and Highway Advisory Radio (HAR).

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| <i>Requirement:</i> | 1 The field element shall include dynamic messages signs for dissemination of traffic and other information to drivers, under center control; the DMS may be either those that display variable text messages, or those that have fixed format display(s) (e.g. vehicle restrictions, or lane open/close). |
| <i>Requirement:</i> | 2 The field element shall include driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers, under center control. |
| <i>Requirement:</i> | 3 The field element shall include pedestrian information systems under center control (e.g. warning pedestrians of a potential hazard, or providing mandatory instructions as to the availability of pedestrian access). |
| <i>Requirement:</i> | 4 The field element shall provide operational status for the driver information systems equipment (DMS, HAR, etc.) to the center. |
| <i>Requirement:</i> | 5 The field element shall provide fault data for the driver information systems equipment (DMS, HAR, etc.) to the center for repair. |

Functional Area: **Standard Rail Crossing**

Field elements at highway-rail intersections (HRIs) where operational requirements do not dictate advanced features (e.g., where rail operational speeds are less than 80 miles per hour). Includes traditional HRI warning systems augmented with other standard traffic management devices.

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| <i>Requirement:</i> | 1 The field element shall collect and process, traffic sensor data in the vicinity of a highway-rail intersection (HRI). |
| <i>Requirement:</i> | 2 The field element shall monitor the status of the highway-rail intersection (HRI) equipment, including both the current state and mode of operation and the current equipment condition, to be forwarded on to the traffic management center. |
| <i>Requirement:</i> | 3 The field element shall monitor the status of the highway-rail intersection (HRI) equipment, including both the current state and mode of operation and the current equipment condition, to be forwarded on to the rail wayside equipment. |

Architecture**Northern New Jersey ITS Architecture****Element: NJDOT North ITS Field Equipment****Entity: Roadway Subsystem****Functional Area: Standard Rail Crossing**

Field elements at highway-rail intersections (HRIs) where operational requirements do not dictate advanced features (e.g., where rail operational speeds are less than 80 miles per hour). Includes traditional HRI warning systems augmented with other standard traffic management devices.

- Requirement:* 4 The field element shall receive track status from the rail wayside equipment that can be passed on to the traffic management center. This may include the current status of the tracks and whether a train is approaching.
- Requirement:* 5 The field element shall collect pedestrian images and pedestrian sensor data, and respond to pedestrian crossing requests via display, audio signal, or other manner.
- Requirement:* 6 The field element shall control the dynamic message signs (DMS) in the vicinity of a highway-rail intersection (HRI) to advise drivers, cyclists, and pedestrians of approaching trains.
- Requirement:* 7 The field element shall close the highway-rail intersection (HRI) when a train is approaching using gates, lights/signs, barriers, and traffic control signals.
- Requirement:* 8 The field element shall support the integrated control of adjacent traffic signals to clear an area in advance of an approaching train and to manage traffic around the intersection.
- Requirement:* 9 The field element shall forward rail traffic advisories received from the Wayside Equipment to the traffic management center.

Functional Area: Advanced Rail Crossing

Field elements at highway-rail intersections (HRIs) where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). Capabilities from the Standard Rail Crossing plus systems which preclude entrance into the intersection when the barriers are activated, additional arriving train information, and detection of blocked intersections.

- Requirement:* 1 The field element shall collect and process, traffic sensor data in the vicinity of a highway-rail intersection (HRI).
- Requirement:* 2 The field element shall determine whether the highway-rail intersection (HRI) is blocked by traffic in the roadway or some other obstruction.
- Requirement:* 3 The field element shall notify the traffic management center and the rail wayside equipment of any intersection blockages, including trapped vehicles or other obstructions.
- Requirement:* 4 The field element shall monitor the status of the highway-rail intersection (HRI) equipment, including both the current state and mode of operation and the current equipment condition, to be forwarded on to the traffic management center.
- Requirement:* 5 The field element shall monitor the status of the highway-rail intersection (HRI) equipment, including both the current state and mode of operation and the current equipment condition, to be forwarded on to the rail wayside equipment.
- Requirement:* 6 The field element shall receive track status and arriving train information from the rail wayside equipment that can be passed on to the traffic management center. This may include the current status of the tracks and when a train is expected and/or how long the crossing will be closed.
- Requirement:* 7 The field element shall collect pedestrian images and pedestrian sensor data, and respond to pedestrian crossing requests via display, audio signal, or other manner.
- Requirement:* 8 The field element shall control the dynamic message signs (DMS) in the vicinity of a highway-rail intersection (HRI) to advise drivers, cyclists, and pedestrians of approaching trains.
- Requirement:* 9 The field element shall close the highway-rail intersection (HRI) when a train is approaching with enough time for traffic to safely clear the crossing using gates, lights/signs, barriers, and traffic control signals.

Architecture**Northern New Jersey ITS Architecture***Element:***NJDOT North ITS Field Equipment***Entity:***Roadway Subsystem***Functional Area:* **Advanced Rail Crossing**

Field elements at highway-rail intersections (HRIs) where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). Capabilities from the Standard Rail Crossing plus systems which preclude entrance into the intersection when the barriers are activated, additional arriving train information, and detection of blocked intersections.

Requirement: 10 The field element shall support the integrated control of adjacent traffic signals to clear an area in advance of an approaching train and to manage traffic around the intersection.

Requirement: 11 The field element shall forward rail traffic advisories received from the Wayside Equipment to the traffic management center.

Functional Area: **Roadway Equipment Coordination**

Field elements that control and send data to other field elements (such as environmental sensors that send data to a DMS or coordination between traffic controllers on adjacent intersections), without center control.

Requirement: 1 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that provide data and status information to other field element devices (such as dynamic message signs, ramp meters, traffic signals, work zone intrusion alert systems), without center control.

Requirement: 2 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that receive control information from other field element devices, without center control.

Requirement: 3 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that provide data and status information to other field element devices (such as dynamic message signs, traffic controllers on adjacent intersections), without center control.

Requirement: 4 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that receive control information from other field element devices, without center control.

Functional Area: **Roadway Environmental Monitoring**

Environmental sensors, surface and sub-surface, that collect weather and road surface information. Weather conditions measured include temperature, wind, humidity, precipitation, and visibility. Sensors measure road surface temperature, moisture, icing, salinity, etc.

Requirement: 1 The field element shall include surface and sub-surface environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures.

Requirement: 2 The field element shall include environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.

Requirement: 3 The field element's environmental sensors shall be remotely controlled by a maintenance center.

Requirement: 4 The field element's environmental sensors shall be remotely controlled by a traffic management center.

Requirement: 5 The field element's environmental sensors shall be remotely controlled by weather service providers such as the National Weather Service or value-added sector specific meteorological services.

Requirement: 6 The field element's environmental sensors shall be remotely controlled by a maintenance and construction vehicle.

Requirement: 7 The field element shall provide environmental sensor equipment operational status to the controlling center or maintenance vehicle.

Requirement: 8 The field element shall provide environmental sensor equipment fault indication to the controlling center or maintenance vehicle.

Architecture**Northern New Jersey ITS Architecture****Element: NJDOT North ITS Field Equipment****Entity: Roadway Subsystem****Functional Area: Roadway Environmental Monitoring**

Environmental sensors, surface and sub-surface, that collect weather and road surface information. Weather conditions measured include temperature, wind, humidity, precipitation, and visibility. Sensors measure road surface temperature, moisture, icing, salinity, etc.

- Requirement:* 9 The field element shall remotely aggregate environmental sensor data with environmental data collected from maintenance and construction vehicles.
- Requirement:* 10 The field element shall provide weather and road surface condition data to centers.
- Requirement:* 11 The field element shall provide weather and road surface condition data to maintenance and construction vehicles.

Functional Area: Roadway Automated Treatment

Field elements that activate automated roadway treatment systems (to disperse anti-icing chemicals, etc.) based on environmental or atmospheric conditions, or under center control.

- Requirement:* 1 The field element shall activate automated roadway treatment systems based on environmental or atmospheric conditions. Treatments can be in the form of fog dispersion, anti-icing chemicals, etc.
- Requirement:* 2 The field element shall activate automated roadway treatment systems under center control. Treatments can be in the form of fog dispersion, anti-icing chemicals, etc.
- Requirement:* 3 The field element shall return automated roadway treatment system and associated environmental sensor operational status to the maintenance center.
- Requirement:* 4 The field element shall return automated roadway treatment system and associated environmental sensor fault data to the maintenance center for repair.

Functional Area: Roadway Reversible Lanes

Traffic sensors, surveillance, and automated reversible lane equipment and lane control signals to control traffic in reversible lanes.

- Requirement:* 1 The field element shall monitor traffic in reversible lanes, including wrong-way vehicles, using sensors and surveillance equipment under center control.
- Requirement:* 2 The field element shall include automated reversible lane equipment and driver information systems (such as lane control signals) that control traffic in reversible lanes on surface streets, under center control.
- Requirement:* 3 The field element shall include automated reversible lane equipment and driver information systems (such as lane control signals) that control traffic in reversible lanes on freeways, under center control.
- Requirement:* 4 The field element shall provide operational status for the reversible lane field equipment to the center.
- Requirement:* 5 The field element shall provide fault data for the reversible lane field equipment to the center.

Functional Area: Roadway Speed Monitoring

Vehicle speed sensors that detect excessive vehicle speeds, informing drivers, centers and/or enforcement agencies of speed violations.

- Requirement:* 1 The field element shall include sensors to detect vehicle speeds, under traffic or maintenance center control.
- Requirement:* 2 The field element shall include sensors to detect vehicle speeds, under enforcement agency control.
- Requirement:* 3 If the speed detected by vehicle speed sensors is determined to be excessive, the field element shall provide a safe speed advisory to passing drivers via a driver information system (such as portable messages signs, etc.).
- Requirement:* 4 The field element shall base speed advisories to passing drivers on environmental conditions.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT North ITS Field Equipment***Entity:* **Roadway Subsystem***Functional Area:* **Roadway Speed Monitoring**

Vehicle speed sensors that detect excessive vehicle speeds, informing drivers, centers and/or enforcement agencies of speed violations.

- Requirement:* 5 The field element shall monitor notify an enforcement agency when a speed violation is detected.
- Requirement:* 6 The field element shall return operational status for the vehicle speed sensors to the controlling traffic or maintenance center; including measured speeds, warning messages displayed, and violation records.
- Requirement:* 7 The field element shall return operational status for the vehicle speed sensors to the enforcement agency.
- Requirement:* 8 The field element shall return fault data for the vehicle speed sensors to the controlling center for repair.

Functional Area: **Multimodal Crossing Control**

Field elements to monitor and control traffic at multimodal crossings, such as draw bridges and other crossings between highway traffic and other modes; does not include highway-rail intersection.

- Requirement:* 1 The field element shall include sensors to monitor requests from non-highway traffic to cross at multimodal crossings for specified durations (such as draw bridges and miscellaneous other interference crossings between highway traffic and other modes such as river traffic, aircraft, etc.); the sensors are under center control.
- Requirement:* 2 The field element shall include signals to control traffic at multimodal crossings on surface streets, under center control.
- Requirement:* 3 The field element shall include driver information systems (such as dynamic messages signs, highway advisory radios (HAR), and equipment that controls warning lights and gates) that advise drivers at multimodal crossings, under center control.
- Requirement:* 4 The field element shall provide operational status for the sensors, signals, and driver information systems equipment at multimodal crossings to the center.
- Requirement:* 5 The field element shall provide fault data for the sensors, signals, and driver information systems equipment at multimodal crossings to the center for repair.
- Requirement:* 6 The field element shall forward all requests for right-of-way at multimodal crossings to the controlling center.

Functional Area: **Roadway Work Zone Safety**

Work zone intrusion detection devices (to detect vehicle intrusion upon a work zone or crew worker movement across a work zone boundary) and intrusion alerting devices that provide alerts to crew and drivers.

- Requirement:* 1 The field element shall include work zone intrusion detection devices that detect when a vehicle has intruded upon the boundary of a work zone, under center control.
- Requirement:* 2 The field element shall include work zone intrusion detection devices that detect when crew workers have crossed the boundary between the work zone and vehicle traffic, under center control.
- Requirement:* 3 The field element shall include work zone intrusion alerting devices that alert crew workers of a work zone emergency or safety issue such as the intrusion of a vehicle into the work zone area or movement of field crew into the travel lanes.
- Requirement:* 4 The field element shall include work zone intrusion alerting devices that notify crew via maintenance vehicles of a work zone emergency or safety issue such as the intrusion of a vehicle into the work zone area or movement of field crew into the travel lanes.
- Requirement:* 5 The field element shall include work zone intrusion alerting devices that alert drivers that they have intruded upon the perimeter of the work zone, or are about to do so; may provide alerts to drivers directly or via in-vehicle signing.

Architecture**Northern New Jersey ITS Architecture***Element:***NJDOT North ITS Field Equipment***Entity:***Roadway Subsystem***Functional Area:* **Roadway Work Zone Safety**

Work zone intrusion detection devices (to detect vehicle intrusion upon a work zone or crew worker movement across a work zone boundary) and intrusion alerting devices that provide alerts to crew and drivers.

- Requirement:* 6 The field element shall provide operational status for the work zone intrusion detection devices to the maintenance center.
- Requirement:* 7 The field element shall provide fault data for the work zone intrusion detection devices to the maintenance center for repair.
- Requirement:* 8 The field element shall provide operational status for the work zone intrusion alerting devices to the maintenance center.
- Requirement:* 9 The field element shall provide fault data for the work zone intrusion alerting devices to the maintenance center for repair.

*Element:***NJDOT North Traveler Information System***Entity:***Information Service Provider***Functional Area:* **Basic Information Broadcast**

Collection, processing, storage, and broadcast dissemination of traffic, transit, maintenance and construction, event, and weather information to traveler interface systems and vehicles.

- Requirement:* 1 The center shall collect, process, store, and disseminate traffic and highway condition information to travelers, including incident information, detours and road closures, event information, recommended routes, and current speeds on specific routes.
- Requirement:* 2 The center shall collect, process, store, and disseminate maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities.
- Requirement:* 3 The center shall collect, process, store, and disseminate transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers.
- Requirement:* 4 The center shall collect, process, store, and disseminate parking information to travelers, including location, availability, and fees.
- Requirement:* 5 The center shall collect, process, store, and disseminate toll fee information to travelers.
- Requirement:* 6 The center shall collect, process, store, and disseminate weather information to travelers.
- Requirement:* 7 The center shall collect, process, store, and disseminate event information to travelers.
- Requirement:* 8 The center shall collect, process, store, and disseminate air quality information to travelers.
- Requirement:* 9 The center shall provide the capability to support requests from the media for traffic and incident data.
- Requirement:* 10 The center shall provide the capability for a system operator to control the type and update frequency of broadcast traveler information.

Functional Area: **Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

- Requirement:* 1 The center shall collect, process, store, and disseminate customized traffic and highway condition information to travelers, including incident information, detours and road closures, recommended routes, and current speeds on specific routes upon request.
- Requirement:* 2 The center shall collect, process, store, and disseminate customized maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities upon request.
- Requirement:* 3 The center shall collect, process, store, and disseminate customized transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers upon request.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT North Traveler Information System***Entity:* **Information Service Provider***Functional Area:* **Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

Requirement: 4 The center shall collect, process, store, and disseminate customized parking information to travelers, including location, availability, and fees upon request.

Requirement: 5 The center shall collect, process, store, and disseminate customized toll fee information to travelers upon request.

Requirement: 6 The center shall collect, process, store, and disseminate customized weather information to travelers upon request.

Requirement: 7 The center shall collect, process, store, and disseminate customized multimodal transportation service information (for example, from ferry and airline operators), including transfer points and other information, to travelers upon request.

Requirement: 8 The center shall collect, process, store, and disseminate customized event information to travelers upon request.

Requirement: 9 The center shall collect, process, store, and disseminate customized air quality information to travelers upon request.

Requirement: 10 The center shall provide all traveler information based on the traveler's current location or a specific location identified by the traveler, and filter or customize the provided information accordingly.

Requirement: 11 The center shall accept traveler profiles for determining the type of personalized data to send to the traveler.

Requirement: 12 The center shall manage payment for services, such as tolls, transit fares, parking lot charges, map updates, and advanced payment for tolls, and provide transaction success or failure details.

Requirement: 13 The center shall support requests for traveler information and advanced payment for traveler services from commercial fleet operators.

Requirement: 14 The center shall provide the capability to exchange information with another traveler information service provider current or predicted data for road links that are outside the area served by the local supplier.

Requirement: 15 The center shall manage updates of digitized map data and provide updates to traveler interface systems upon request.

Requirement: 16 The center shall provide the capability to support requests from the media for traffic and incident data.

Requirement: 17 The center shall provide the capability for a system operator to control the type and update frequency of traveler information.

Functional Area: **Traveler Telephone Information**

Collection and distribution of traveler information and wide-area alerts to traveler telephone information systems such as 511, based on voice-based traveler requests.

Requirement: 1 The center shall provide the capability to process voice-formatted requests for traveler information from a traveler telephone information system, and return the information in the requested format.

Requirement: 2 The center shall provide the capability to process dual-tone multifrequency (DTMF)-based requests (touch-tone) for traveler information from a traveler telephone information system.

Requirement: 3 The center shall provide the capability to process traveler information requests from a traveler telephone information system.

Requirement: 4 The center shall collect and provide information on traffic conditions in the requested voice format and for the requested location.

Architecture**Northern New Jersey ITS Architecture****Element: NJDOT North Traveler Information System****Entity: Information Service Provider****Functional Area: Traveler Telephone Information**

Collection and distribution of traveler information and wide-area alerts to traveler telephone information systems such as 511, based on voice-based traveler requests.

- Requirement:* 5 The center shall collect and provide work zone and roadway maintenance information in the requested voice format and for the requested location.
- Requirement:* 6 The center shall collect and provide roadway environment conditions information in the requested voice format and for the requested location.
- Requirement:* 7 The center shall collect and provide weather and event information in the requested voice format and for the requested location.
- Requirement:* 8 The center shall collect and provide transit service information in the requested voice format and for the requested location.
- Requirement:* 9 The center shall collect and provide yellow pages services information in the requested voice format and for the requested location.
- Requirement:* 10 The center shall collect and provide current ferry and rail schedule and airport status information in the requested voice format and for the requested location.
- Requirement:* 11 The center shall provide the capability to support both specific caller requests as well as bulk upload of regional traveler information.
- Requirement:* 12 The center shall receive and forward region-specific wide-area alert and advisory information to the traveler telephone information system, including major emergencies such as a natural or man-made disaster, civil emergency, child abductions, severe weather watches and warnings, military activities, and law enforcement warnings.

Functional Area: Infrastructure Provided Route Selection

Generation of pre-trip and enroute trip plans for travelers (and vehicles) based on current traffic conditions, work zones, weather, and travelers constraints and preferences. Includes end-to-end trips using multiple modes, such as bicycle, transit, etc.

- Requirement:* 1 The center shall provide the capability to provide specific pre-trip and enroute directions to travelers (and drivers), including costs, arrival times, and transfer points.
- Requirement:* 2 The center shall include bicycle routes, walkways, skyways, and multi-use trails in the pre-trip and enroute directions it provides to travelers.
- Requirement:* 3 The center shall support on-line route guidance for travelers using personal devices (such as PDAs).
- Requirement:* 4 The center shall support on-line route guidance for drivers in vehicles.
- Requirement:* 5 The center shall support on-line route guidance for specialty vehicles, such as commercial vehicles.
- Requirement:* 6 The center shall generate route plans based on current and/or predicted conditions of the road network, scheduled maintenance and construction work activities, and work zone activities.
- Requirement:* 7 The center shall generate route plans based on transit services, including fares, schedules, and requirements for travelers with special needs.
- Requirement:* 8 The center shall generate route plans based on current asset restrictions, such as height and weight restrictions on tunnels or bridges.
- Requirement:* 9 The center shall generate route plans based on current or forecasted weather.
- Requirement:* 10 The center shall generate route plans based on ferry, rail, air, or other multimodal transportation data.
- Requirement:* 11 The center shall exchange route segment information with other centers outside the area served by the local center.
- Requirement:* 12 The center shall generate trips based on the use of more than one mode of transport.

Architecture

Northern New Jersey ITS Architecture

Element: **NJDOT North Traveler Information System**

Entity: **Information Service Provider**

Functional Area: **Infrastructure Provided Route Selection**

Generation of pre-trip and enroute trip plans for travelers (and vehicles) based on current traffic conditions, work zones, weather, and travelers constraints and preferences. Includes end-to-end trips using multiple modes, such as bicycle, transit, etc.

- Requirement:* 13 The center shall use the preferences and constraints specified by the traveler in the trip request to select the most appropriate mode of transport.
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- Requirement:* 14 The center shall provide the capability for the traveler to confirm the proposed trip plan.
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- Requirement:* 15 The center shall log route plans, particularly for special vehicles such as those containing hazardous materials, over-sized vehicles, or motorcades, with a traffic center.
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- Requirement:* 16 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used to determine vehicle and non-vehicle routes, trip planning, and on-line vehicle guidance.
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- Requirement:* 17 The center shall provide the capability for center personnel to control route calculation parameters.
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Element: **NJDOT REOC Central**

Entity: **Traffic Management**

Functional Area: **TMC Probe Information Collection**

Collects, assimilates, and disseminates vehicle probe data collected from roadside beacons and centers controlling transit vehicles, emergency vehicles, toll collection points, and route-guided vehicles.

- Requirement:* 1 The center shall collect probe data including traffic and road conditions from vehicles via roadside beacon field elements; the data may be aggregated and initial link time calculations performed in the field.
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- Requirement:* 2 The center shall collect road condition data from probe-equipped transit vehicles via transit management centers; the data may be aggregated and preliminarily processed at the sending center.
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- Requirement:* 3 The center shall collect traffic data from probe-equipped emergency vehicles via emergency management centers; the data may be aggregated and initial link time calculations performed at the sending center.
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- Requirement:* 4 The center shall collect traffic data from traveler information centers based on data from their subscriber vehicles; the data may be aggregated and initial link time calculations performed at the sending center.
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- Requirement:* 5 The center shall collect traffic data from toll administrative centers containing journey times between toll collection points for those vehicles equipped for electronic toll collection; the data may be aggregated and processed at the sending center.
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- Requirement:* 6 The center shall assimilate current and forecast traffic and road conditions based on collected probe data and distribute to other centers for dissemination to travelers.
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- Requirement:* 7 The center shall collect operational status for the roadside probe data collection equipment.
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- Requirement:* 8 The center shall collect fault data for the roadside probe data collection equipment for repair.
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Functional Area: **TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT REOC Central***Entity:* **Traffic Management***Functional Area:* **TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

- Requirement:* 1 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction for distribution to the public. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, and information and instructions necessary for the public to respond to the alert. This may also identify specific information that should not be released to the public.
- Requirement:* 2 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.
- Requirement:* 3 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field, provide special routing for emergency vehicles, and to provide responding emergency vehicles with signal preemption.
- Requirement:* 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.
- Requirement:* 5 The center shall respond to requests from emergency management to provide traffic management resources to implement special traffic control measures, assist in clean up, verify an incident, etc. This may also involve coordination with maintenance centers.
- Requirement:* 6 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, media, and rail operations centers.
- Requirement:* 7 The center shall provide road network conditions and traffic images to emergency management centers, maintenance and construction centers, and traveler information service providers.
- Requirement:* 8 The center shall exchange road network status assessment information with emergency management and maintenance centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.
- Requirement:* 9 The center shall coordinate information and controls with other traffic management centers.
- Requirement:* 10 The center shall receive inputs from emergency management and transit management centers to develop an overall status of the transportation system including emergency transit schedules in effect and current status and condition of the transportation infrastructure.
- Requirement:* 11 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic incident management.

Functional Area: **TMC Environmental Monitoring**

Management of environmental sensors and assimilation of collected data with other current and forecast road conditions and surface weather information from weather service providers and roadway maintenance operations.

- Requirement:* 1 The center shall remotely control environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures.
- Requirement:* 2 The center shall remotely control environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.

Architecture

Northern New Jersey ITS Architecture

*Element:***NJDOT REOC Central**

*Entity:***Traffic Management**

Functional Area: **TMC Environmental Monitoring**

Management of environmental sensors and assimilation of collected data with other current and forecast road conditions and surface weather information from weather service providers and roadway maintenance operations.

Requirement: 3 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services), data from roadway maintenance operations, and environmental data collected from sensors deployed on and about the roadway.

Requirement: 4 The center shall provide weather and road condition information to weather service providers and center personnel.

Requirement: 5 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.

Functional Area: **Traffic Data Collection**

Collection and storage of traffic management data. For use by operations personnel or data archives in the region.

Requirement: 1 The center shall collect traffic management data such as operational data, event logs, etc.

Requirement: 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

Requirement: 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the traffic data or for the data itself.

Requirement: 4 The center shall be able to produce sample products of the data available.

*Element:***NJDOT STOC**

*Entity:***Emergency Management**

Functional Area: **Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

Requirement: 1 The center shall support the interface to the Emergency Telecommunications System (e.g. 911 or 7-digit call routing) to receive emergency notification information and provide it to the emergency system operator.

Requirement: 2 The center shall receive emergency call information from 911 services and present the possible incident information to the emergency system operator.

Requirement: 3 The center shall receive emergency call information from motorist call-boxes and present the possible incident information to the emergency system operator.

Requirement: 4 The center shall receive emergency call information from mayday service providers and present the possible incident information to the emergency system operator.

Requirement: 5 The center shall receive emergency notification information from other public safety agencies and present the possible incident information to the emergency system operator.

Requirement: 6 The center shall receive emergency notification information from public transit systems and present the possible incident information to the emergency system operator.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT STOC***Entity:* **Emergency Management***Functional Area:* **Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

- Requirement:* 7 The center shall receive emergency notification information from commercial vehicles, commercial vehicle check stations, or commercial fleet operators and present the possible incident information to the emergency system operator. This may include detection of non-permitted transport of security sensitive hazmat, hazardous cargo spills, etc.
- Requirement:* 8 The center shall receive details of the cargo being carried by commercial vehicles from their commercial fleet manager for incidents involving potential hazardous materials.
- Requirement:* 9 The center shall coordinate, correlate, and verify all emergency inputs, including those identified based on external calls and internal analysis of security sensor and surveillance data, and assign each a level of confidence.
- Requirement:* 10 The center shall send a request for remote control of CCTV systems from a traffic management center in order to verify the reported incident.
- Requirement:* 11 The center shall update the incident information log once the emergency system operator has verified the incident.
- Requirement:* 12 The center shall provide the capability for digitized map data to act as the background to the emergency information presented to the emergency system operator.
- Requirement:* 13 The center shall forward the verified emergency information to the responding agency based on the location and nature of the emergency.

Functional Area: **Emergency Dispatch**

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

- Requirement:* 1 The center shall dispatch emergency vehicles to respond to verified emergencies and provide suggested routing under center personnel control.
- Requirement:* 2 The center shall store the current status of all emergency vehicles available for dispatch and those that have been dispatched.
- Requirement:* 3 The center shall relay location and incident details to the responding vehicles.
- Requirement:* 4 The center shall provide the capability to request traffic control measures from traffic management centers such as signal preemption, traffic barriers and road closures.
- Requirement:* 5 The center shall track the location and status of emergency vehicles responding to an emergency and update the incident status based on information from the emergency vehicle.
- Requirement:* 6 The center shall receive status information from care facilities to determine the appropriate facility and its location.
- Requirement:* 7 The center shall store and maintain the emergency service responses in an action log.
- Requirement:* 8 The center shall receive asset restriction information from maintenance centers to support the dispatching of appropriate emergency resources.
- Requirement:* 9 The center shall receive traffic information, including closures, traffic conditions, etc. from traffic management centers.
- Requirement:* 10 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT STOC***Entity:* **Emergency Management***Functional Area:* **Emergency Dispatch**

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

Requirement: 11 The center shall receive road network conditions and traffic images to support dispatch of emergency vehicles.

Requirement: 12 The center shall coordinate response to incidents with other Emergency Management centers to ensure appropriate resources are dispatched and utilized.

Functional Area: **Emergency Early Warning System**

Monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies in order to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to other ITS centers to notify the traveling public. Includes support for Child Abduction notices.

Requirement: 1 The center shall monitor information from Alerting and Advisory Systems such as the Information Sharing and Analysis Centers (ISACs), the National Infrastructure Protection Center (NIPC), the Homeland Security Advisory System (HSAS), etc. The information may include assessments (general incident and vulnerability awareness information), advisories (identification of threats or recommendations to increase preparedness levels), or alerts (information on imminent or in-progress emergencies).

Requirement: 2 The center shall provide the capability to correlate alerts and advisories, incident information, and security sensor and surveillance data.

Requirement: 3 The center shall broadcast wide-area alerts and advisories to traffic management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.

Requirement: 4 The center shall broadcast wide-area alerts and advisories to transit management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.

Requirement: 5 The center shall broadcast wide-area alerts and advisories to toll administration centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.

Requirement: 6 The center shall broadcast wide-area alerts and advisories to traveler information service providers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.

Requirement: 7 The center shall broadcast wide-area alerts and advisories to maintenance centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.

Requirement: 8 The center shall broadcast wide-area alerts and advisories to other emergency management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.

Requirement: 9 The center shall process status information from each of the centers that have been sent the wide-area alert.

Requirement: 10 The center shall coordinate the broadcast of wide-area alerts and advisories with other emergency management centers.

Requirement: 11 The center shall receive incident information from other transportation management centers to support the early warning system.

Requirement: 12 The center shall present the alert and advisory information and the status of the actions taken in response to the alert by the other centers to the emergency system operator as received from other system inputs.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT STOC***Entity:* **Emergency Management***Functional Area:* **Emergency Early Warning System**

Monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies in order to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to other ITS centers to notify the traveling public. Includes support for Child Abduction notices.

Requirement: 13 The center shall support the entry of alert and advisory information directly from the emergency system operator.

Functional Area: **Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

Requirement: 1 The center shall provide strategic emergency response capabilities such as that of an Emergency Operations Center for large-scale incidents and disasters.

Requirement: 2 The center shall manage coordinated inter-agency responses to and recovery from large-scale emergencies. Such agencies include traffic management, transit, maintenance and construction management, rail operations, and other emergency management agencies.

Requirement: 3 The center shall provide the capability to implement response plans and track progress through the incident by exchanging incident information and distributing response status to allied agencies.

Requirement: 4 The center shall develop, coordinate with other agencies, and store emergency response plans.

Requirement: 5 The center shall track the availability of resources (including vehicles, roadway cleanup?, etc.), request additional resources from traffic, maintenance, or other emergency centers if needed.

Requirement: 6 The center shall allocate the appropriate emergency services, resources, and vehicle (s) to respond to incidents, and shall provide the capability to override the current allocation to suit the special needs of a current incident.

Requirement: 7 The center shall receive event scheduling information from Event Promoters.

Requirement: 8 The center shall receive hazardous materials incident information from commercial fleet operators.

Requirement: 9 The center shall provide the capability to request the safe disabling of a commercial vehicle during a hazardous materials incident.

Requirement: 10 The center shall provide the capability to request transit resource availability from transit centers for use during disaster and evacuation operations.

Requirement: 11 The center shall assimilate the status of the transit, traffic, rail, maintenance, and other emergency center services and systems to create an overall transportation system status, and disseminate to each of these centers and the traveling public via traveler information providers.

Requirement: 12 The center shall provide information to the media concerning the status of an emergency response.

Requirement: 13 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.

Requirement: 14 The center shall provide the capability for center personnel to provide inputs to the management of incidents, disasters and evacuations.

Functional Area: **Incident Command**

Tactical decision support, resource coordination, and communications integration among emergency management agencies for Incident Commands that are established by first responders to support local management of an incident.

Requirement: 1 The center shall provide tactical decision support, resource coordination, and communications integration for Incident Commands that are established by first responders to support local management of an incident.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT STOC***Entity:* **Emergency Management***Functional Area:* **Incident Command**

Tactical decision support, resource coordination, and communications integration among emergency management agencies for Incident Commands that are established by first responders to support local management of an incident.

- Requirement:* 2 The center shall provide incident command communications with public safety, emergency management, transportation, and other allied response agency centers.
- Requirement:* 3 The center shall track and maintain resource information and action plans pertaining to the incident command.
- Requirement:* 4 The center shall share incident command information with other public safety agencies including resource deployment status, hazardous material information, rail incident information, evacuation advice as well as traffic, road, and weather conditions.
- Requirement:* 5 The center shall assess the status of responding emergency vehicles as part of an incident command.

Functional Area: **Emergency Evacuation Support**

Evacuation planning and coordination to manage evacuation and reentry of a population in the vicinity of a disaster or other emergency that poses a risk to public safety.

- Requirement:* 1 The center shall manage inter-agency coordination of evacuation operations, from initial planning through the evacuation process and reentry.
- Requirement:* 2 The center shall develop and exchange evacuation plans with allied agencies prior to the occurrence of a disaster.
- Requirement:* 3 The center shall provide an interface to the emergency system operator to enter evacuation plans and procedures and present the operator with other agencies' plans.
- Requirement:* 4 The center shall coordinate evacuation destinations and shelter needs with shelter providers (e.g., the American Red Cross) in the region.
- Requirement:* 5 The center shall provide evacuation information to traffic, transit, maintenance and construction, rail operations, and other emergency management centers as needed.
- Requirement:* 6 The center shall request resources from transit agencies as needed to support the evacuation.
- Requirement:* 7 The center shall request traffic management agencies to implement special traffic control strategies and to control evacuation traffic, including traffic on local streets and arterials as well as the major evacuation routes.
- Requirement:* 8 The center shall provide traveler information systems with evacuation guidance including basic information to assist potential evacuees in determining whether evacuation is necessary and when it is safe to return.
- Requirement:* 9 The center shall monitor the progress or status of the evacuation once it begins and exchange tactical plans, prepared during the incident, with allied agencies.
- Requirement:* 10 The center shall monitor the progress of the reentry process.
- Requirement:* 11 The center shall submit evacuation information to toll administration centers along with requests for changes in the toll services or fee collection during an evacuation.

Functional Area: **Emergency Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and emergency vehicles equipped with environmental sensors; used by the operator to more effectively manage incidents.

- Requirement:* 1 The center shall collect current and forecast road and weather information from weather service providers (such as the National Weather Service and value-added sector specific meteorological services).

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT STOC***Entity:* **Emergency Management***Functional Area:* **Emergency Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and emergency vehicles equipped with environmental sensors; used by the operator to more effectively manage incidents.

- Requirement:* 2 The center shall receive environmental probe information from its fleet of emergency vehicles.
- Requirement:* 3 The center shall collect current road and weather information from roadway maintenance operations.
- Requirement:* 4 The center shall assimilate current and forecast road conditions and surface weather information to support incident management.
- Requirement:* 5 The center shall present the current and forecast road and weather information to the emergency system operator.
- Requirement:* 6 The center shall provide aggregated or processed environmental probe information from its fleet of emergency vehicles to traffic management and maintenance centers.

Functional Area: **Center Secure Area Surveillance**

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 1 The center shall remotely monitor video images and audio surveillance data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The data may be raw or pre-processed in the field.
- Requirement:* 2 The center shall remotely monitor video images and audio surveillance data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The data may be raw or pre-processed in the field.
- Requirement:* 3 The center shall remotely monitor video images and audio surveillance data collected on-board transit vehicles. The data may be raw or pre-processed in the field.
- Requirement:* 4 The center shall exchange surveillance data with other emergency centers.
- Requirement:* 5 The center shall identify potential security threats based on collected security surveillance data.
- Requirement:* 6 The center shall verify potential security threats by correlating security surveillance data from multiple sources.
- Requirement:* 7 The center shall remotely control security surveillance devices in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways).
- Requirement:* 8 The center shall remotely control security surveillance devices in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers).
- Requirement:* 9 The center shall remotely control security surveillance devices on-board transit vehicles.
- Requirement:* 10 The center shall match traveler video images against a database from the Alerting and Advisory Systems of known images that may represent criminals and terrorists.
- Requirement:* 11 The center shall exchange traveler images with other emergency management centers to support traveler image matching.
- Requirement:* 12 The center shall respond to control data from center personnel regarding security surveillance data collection, processing, threat detection, and image matching.

Functional Area: **Center Secure Area Sensor Management**

Architecture**Northern New Jersey ITS Architecture***Element:***NJDOT STOC***Entity:***Emergency Management***Functional Area:* **Center Secure Area Sensor Management**

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 1 The center shall remotely monitor and control security sensor data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), infrastructure condition and integrity, intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 2 The center shall remotely monitor and control security sensor data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 3 The center shall remotely monitor and control security sensor data collected on-board transit vehicles. The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors) and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 4 The center shall exchange security sensor data with other emergency centers.
- Requirement:* 5 The center shall identify potential security threats based on collected security sensor data.
- Requirement:* 6 The center shall verify potential security threats by correlating security sensor data from multiple sources.
- Requirement:* 7 The center shall perform threat analysis based on correlations of security sensor and surveillance data.
- Requirement:* 8 The center shall exchange threat analysis data with Alerting and Advisory Systems and use that data in local threat analysis processing.
- Requirement:* 9 The center shall disseminate threat information to other agencies, including traffic, transit, maintenance, rail operations, and other emergency management centers.
- Requirement:* 10 The center shall respond to control data from center personnel regarding security sensor data collection, processing, threat detection, and threat analysis.

Functional Area: **Service Patrol Management**

Dispatch and communication with roadway service patrol vehicles that monitor roads to aid motorists, offering rapid response to minor incidents.

- Requirement:* 1 The center shall dispatch roadway service patrol vehicles to identified incident locations.
- Requirement:* 2 The center shall store the current status of all service patrol vehicles available for dispatch and those that have been dispatched.
- Requirement:* 3 The center shall share incident information collected by the service patrol with traffic, maintenance and construction, and traveler information centers for incident management, incident notification to travelers, and incident cleanup.
- Requirement:* 4 The center shall track the location and status of service patrol vehicles.

*Entity:***Information Service Provider***Functional Area:* **Traveler Telephone Information**

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT STOC***Entity:* **Information Service Provider***Functional Area:* **Traveler Telephone Information**

Collection and distribution of traveler information and wide-area alerts to traveler telephone information systems such as 511, based on voice-based traveler requests.

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| <i>Requirement:</i> | 1 The center shall provide the capability to process voice-formatted requests for traveler information from a traveler telephone information system, and return the information in the requested format. |
| <i>Requirement:</i> | 2 The center shall provide the capability to process dual-tone multifrequency (DTMF)-based requests (touch-tone) for traveler information from a traveler telephone information system. |
| <i>Requirement:</i> | 3 The center shall provide the capability to process traveler information requests from a traveler telephone information system. |
| <i>Requirement:</i> | 4 The center shall collect and provide information on traffic conditions in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 5 The center shall collect and provide work zone and roadway maintenance information in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 6 The center shall collect and provide roadway environment conditions information in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 7 The center shall collect and provide weather and event information in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 8 The center shall collect and provide transit service information in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 9 The center shall collect and provide yellow pages services information in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 10 The center shall collect and provide current ferry and rail schedule and airport status information in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 11 The center shall provide the capability to support both specific caller requests as well as bulk upload of regional traveler information. |
| <i>Requirement:</i> | 12 The center shall receive and forward region-specific wide-area alert and advisory information to the traveler telephone information system, including major emergencies such as a natural or man-made disaster, civil emergency, child abductions, severe weather watches and warnings, military activities, and law enforcement warnings. |

Functional Area: **ISP Emergency Traveler Information**

Collection and distribution of emergency information to the traveler public, including evacuation information and wide-area alerts.

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| <i>Requirement:</i> | 1 The center shall collect and provide to the traveler interface systems emergency evacuation information, including evacuation zones, shelter information, available transportation modes, road closures and detours, changes to transit services, and traffic and road conditions at the origin, destination, and along the evacuation routes. |
| <i>Requirement:</i> | 2 The center shall provide evacuation information to shelter providers. |
| <i>Requirement:</i> | 3 The center shall collect and provide wide-area alert information to the traveler interface system with region-specific data, including major emergencies such as a natural or man-made disaster, civil emergency, child abductions, severe weather watches and warnings, military activities, and law enforcement warnings. |
| <i>Requirement:</i> | 4 The center shall provide the capability for a system operator to control the type and update frequency of emergency and wide-area alert information distributed to travelers. |

Entity: **Maintenance and Construction Management**

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT STOC***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Incident Management**

Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.

- Requirement:* 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.
- Requirement:* 2 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, etc.
- Requirement:* 3 The center shall exchange incident and threat information with emergency management centers as well as traffic management centers; including notification of existence of incident and expected severity, location, time and nature of incident.
- Requirement:* 4 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.
- Requirement:* 5 The center shall respond to requests from emergency management to provide maintenance and construction resources to implement response plans, assist in clean up, verify an incident, etc. This may also involve coordination with traffic management centers and other maintenance centers.
- Requirement:* 6 The center shall exchange road network status assessment information with emergency management and traffic management centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.
- Requirement:* 7 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.
- Requirement:* 8 The center shall receive information indicating the damage sustained by transportation assets, derived from aerial surveillance, field reports, inspections, tests, and analyses to support incident management.

Functional Area: **MCM Maintenance Decision Support**

Maintenance Decision Support Systems recommend courses of action based on current and forecast environmental and road conditions (filtered and fused for specific time horizons) and additional application specific information. Recommendations and dispatch instructions are generated based on this integrated information.

- Requirement:* 1 The center shall provide the center personnel with tailored external information, including weather or road condition observations, forecasted weather information or road conditions, current usage of treatments and materials, available resources, equipment and vehicle availability, road network information, and source reliability information.
- Requirement:* 2 The center shall tailor the decision support information to include filtering (selection from a large amount of external information), error reduction ('smoothing' the information), fusion (combination of disparate information to match the decision needs), and analysis (creating the decision).
- Requirement:* 3 The center shall provide an interface to the center personnel to input control parameters for the decision support process and receive decisions or information presentation.
- Requirement:* 4 The center shall provide dispatch information to maintenance and construction vehicles based on the outputs of the decision support system, including recommended roadway treatment actions.

Functional Area: **MCM Roadway Maintenance and Construction**

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT STOC***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

- Requirement:* 1 The center shall maintain an interface with asset management systems to track the inventory, restrictions, repair needs and status updates of transportation assets (pavement, bridges, signs, etc.) including location, installation and materials information, vendor/contractor, current maintenance status, standard height, width, and weight restrictions.
- Requirement:* 2 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other roadway maintenance.
- Requirement:* 3 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
- Requirement:* 4 The center shall provide emergency management and traffic management centers with information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.
- Requirement:* 5 The center shall collect the status and fault data from roadside equipment, such as traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
- Requirement:* 6 The center shall collect the status and fault data from traffic management centers, including data for traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
- Requirement:* 7 The center shall remotely control and collect data from infrastructure monitoring sensors located along the roadway infrastructure or on maintenance and construction vehicles.
- Requirement:* 8 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of roadway maintenance and construction activities.
- Requirement:* 9 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of roadway maintenance and construction activities.
- Requirement:* 10 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
- Requirement:* 11 The center shall dispatch and route maintenance and construction vehicle drivers and support them with route- specific environmental, incident, advisory, threat, alert, and traffic congestion information.
- Requirement:* 12 The center shall manage an interface with center personnel to accept vehicle systems control information and remotely control maintenance and construction vehicle on-board equipment.
- Requirement:* 13 The center shall track the status of roadway maintenance and construction activities by monitoring collected data from the dispatched vehicles and equipment.

Functional Area: **MCM Work Zone Management**

Architecture**Northern New Jersey ITS Architecture***Element:***NJDOT STOC***Entity:***Maintenance and Construction Management***Functional Area:* **MCM Work Zone Management**

Remotely monitors and supports work zone activities, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).

- Requirement:* 1 The center shall generate new work zone activity schedules for use by maintenance and construction vehicles, maintenance and construction operators, and for information coordination purposes.
- Requirement:* 2 The center shall control the collection of work zone status information including video images from cameras located in or near the work zone.
- Requirement:* 3 The center shall disseminate work zone information to other agencies and centers including traffic, transit, emergency management centers, other maintenance centers, traveler information providers, and the media.
- Requirement:* 4 The center shall control traffic in work zones by providing remote control of dynamic message signs and highway advisory radio systems located in or near the work zone.
- Requirement:* 5 The center shall exchange information with administrative systems to support the planning and scheduling of work zone activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.

Functional Area: **MCM Work Activity Coordination**

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

- Requirement:* 1 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.
- Requirement:* 2 The center shall provide status information about scheduled maintenance and construction activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, multimodal transportation providers, rail operations, and the media.
- Requirement:* 3 The center shall collect and respond to feedback concerning scheduled maintenance and construction activities with other management centers such as traffic, emergency, transit, and rail operations.
- Requirement:* 4 The center shall collect and disseminate asset restriction information levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.
- Requirement:* 5 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance and construction activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
- Requirement:* 6 The center shall exchange rail schedules and work plans with rail operations centers.

*Entity:***Traffic Management***Functional Area:* **TMC Signal Control**

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT STOC***Entity:* **Traffic Management***Functional Area:* **TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

- Requirement:* 1 The center shall remotely control traffic signal controllers.
- Requirement:* 2 The center shall accept notifications of right-of-way requests from pedestrians.
- Requirement:* 3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center.
- Requirement:* 4 The center shall collect traffic signal controller fault data from the field.
- Requirement:* 5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.

Functional Area: **TMC Freeway Management**

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

- Requirement:* 1 The center shall remotely control systems to manage use of the freeways, including ramp meters, mainline metering, and lane controls.
- Requirement:* 2 The center shall collect operational status from ramp meters, mainline metering, and lane controls and compare against the control information sent by the center.
- Requirement:* 3 The center shall collect fault data from ramp meters, mainline metering, and lane controls.
- Requirement:* 4 The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, mainline metering, and lane controls), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the ramps themselves.

Functional Area: **TMC Traffic Information Dissemination**

Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.

- Requirement:* 1 The center shall remotely control dynamic messages signs for dissemination of traffic and other information to drivers.
- Requirement:* 2 The center shall remotely control driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers.
- Requirement:* 3 The center shall collect operational status for the driver information systems equipment (DMS, HAR, etc.).
- Requirement:* 4 The center shall collect fault data for the driver information systems equipment (DMS, HAR, etc.) for repair.
- Requirement:* 5 The center shall retrieve locally stored traffic information, including current and forecasted traffic information, road and weather conditions, traffic incident information, information on diversions and alternate routes, closures, and special traffic restrictions (lane/shoulder use, weight restrictions, width restrictions, HOV requirements), etc.
- Requirement:* 6 The center shall distribute traffic data to maintenance and construction centers, transit centers, emergency management centers, and traveler information providers.
- Requirement:* 7 The center shall distribute traffic data to the media upon request; the capability to provide the information in both data stream and graphical display shall be supported.

Architecture

Northern New Jersey ITS Architecture

Element: **NJDOT STOC**

Entity: **Traffic Management**

Functional Area: **TMC Traffic Information Dissemination**

Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.

- Requirement:* 8 The center shall provide the capability for center personnel to control the nature of the data that is available to non-traffic operations centers and the media.
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Functional Area: **TMC Regional Traffic Control**

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

- Requirement:* 1 The center shall exchange traffic information with other traffic management centers, includes incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.
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- Requirement:* 2 The center shall exchange traffic control information with other traffic management centers, includes remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).
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Functional Area: **TMC Incident Detection**

Remotely controls traffic and video sensors to support incident detection and verification; exchange information with other agencies including emergency management, maintenance and construction, alerting and advisory systems, event promoters, intermodal freight depots, and traveler information systems.

- Requirement:* 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.
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- Requirement:* 2 The center shall collect and store traffic flow and image data from the field equipment to detect and verify incidents.
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- Requirement:* 3 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, and intermodal freight depots.
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- Requirement:* 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.
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- Requirement:* 5 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field.
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- Requirement:* 6 The center shall provide road network conditions and traffic images to emergency management centers to support the detection, verification, and classification of incidents.
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- Requirement:* 7 The center shall provide video and traffic sensor control commands to the field equipment to detect and verify incidents.
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Functional Area: **TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT STOC***Entity:* **Traffic Management***Functional Area:* **TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

- Requirement:* 1 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction for distribution to the public. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, and information and instructions necessary for the public to respond to the alert. This may also identify specific information that should not be released to the public.
- Requirement:* 2 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.
- Requirement:* 3 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field, provide special routing for emergency vehicles, and to provide responding emergency vehicles with signal preemption.
- Requirement:* 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.
- Requirement:* 5 The center shall respond to requests from emergency management to provide traffic management resources to implement special traffic control measures, assist in clean up, verify an incident, etc. This may also involve coordination with maintenance centers.
- Requirement:* 6 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, media, and rail operations centers.
- Requirement:* 7 The center shall provide road network conditions and traffic images to emergency management centers, maintenance and construction centers, and traveler information service providers.
- Requirement:* 8 The center shall exchange road network status assessment information with emergency management and maintenance centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.
- Requirement:* 9 The center shall coordinate information and controls with other traffic management centers.
- Requirement:* 10 The center shall receive inputs from emergency management and transit management centers to develop an overall status of the transportation system including emergency transit schedules in effect and current status and condition of the transportation infrastructure.
- Requirement:* 11 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic incident management.

Functional Area: **TMC Evacuation Support**

Development, coordination, and execution of special traffic management strategies during evacuation and subsequent reentry of a population in the vicinity of a disaster or major emergency. Interfaces with emergency management and other traffic management centers.

- Requirement:* 1 The center shall coordinate planning for evacuation with emergency management centers - including pre-planning activities such as establishing routes, areas to be evacuated, timing, etc.
- Requirement:* 2 The center shall support requests from emergency management centers to preempt the current traffic control strategy, activate traffic control and closure systems such as gates and barriers, activate safeguard systems, or use driver information systems to support evacuation traffic control plans.

Architecture

Northern New Jersey ITS Architecture

Element: **NJDOT STOC**

Entity: **Traffic Management**

Functional Area: **TMC Evacuation Support**

Development, coordination, and execution of special traffic management strategies during evacuation and subsequent reentry of a population in the vicinity of a disaster or major emergency. Interfaces with emergency management and other traffic management centers.

Requirement: 3 The center shall coordinate information and controls with other traffic management centers.

Requirement: 4 The center shall coordinate execution of evacuation strategies with emergency management centers - including activities such as setting closures and detours, establishing routes, updating areas to be evacuated, timing the process, etc.

Functional Area: **Barrier System Management**

Remotely controls barrier systems such as gates and other systems that manage entry to roadways, transportation facilities and infrastructure.

Requirement: 1 The center shall remotely control barrier systems for transportation facilities and infrastructure. Barrier systems include automated or remotely controlled gates, barriers and other systems that manage entry to roadways.

Requirement: 2 The center shall collect barrier system operational status.

Requirement: 3 The center shall collect barrier system fault data and send to the maintenance center for repair.

Requirement: 4 The center shall accept requests for barrier system activation from other centers and from center personnel to support emergency response and detours.

Functional Area: **Safeguard System Management**

Remotely controls safeguard systems such as blast shields and tunnel exhaust systems that are used to mitigate the impact of incidents on transportation infrastructure.

Requirement: 1 The center shall remotely control safeguard systems, equipment used to mitigate the impact of incidents on transportation infrastructure (e.g., blast shields, tunnel exhaust systems, etc.)

Requirement: 2 The center shall collect safeguard system operational status.

Requirement: 3 The center shall collect safeguard system fault data and send to the maintenance center for repair.

Requirement: 4 The center shall accept requests for safeguard system activation from other centers and from center personnel to support emergency response.

Functional Area: **Traffic Maintenance**

Monitoring and remote diagnostics of field equipment - detect failures, issue problem reports, and track the repair or replacement of the failed equipment.

Requirement: 1 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) operational status.

Requirement: 2 The center shall collect and store CCTV surveillance system (traffic, pedestrian) operational status.

Requirement: 3 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) fault data and send to the maintenance center for repair.

Requirement: 4 The center shall collect and store CCTV surveillance system (traffic, pedestrian) fault data send to the maintenance center for repair.

Requirement: 5 The center shall collect environmental sensor operational status.

Requirement: 6 The center shall collect environmental sensor equipment fault data and send to the maintenance center for repair.

Requirement: 7 The center shall exchange data with maintenance centers concerning the reporting of faulty equipment and the schedule/status of their repair. Information exchanged includes details of new equipment faults, and clearances when the faults are cleared.

Architecture

Northern New Jersey ITS Architecture

Element: **NJDOT STOC**

Entity: **Traffic Management**

Functional Area: **Traffic Maintenance**

Monitoring and remote diagnostics of field equipment - detect failures, issue problem reports, and track the repair or replacement of the failed equipment.

- Requirement:* 8 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic maintenance data.
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Functional Area: **TMC Work Zone Traffic Management**

Coordination with maintenance systems using work zone images and traveler information systems (such as DMS), and distribution of work plans so that work zones are established that have minimum traffic impact.

- Requirement:* 1 The center shall receive work zone images from a maintenance center.
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- Requirement:* 2 The center shall analyze work zone images for indications of a possible incident.
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- Requirement:* 3 The center shall remotely control driver information systems (such as dynamic messages signs, highway advisory radios) to advise drivers of activity around a work zone.
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- Requirement:* 4 The center shall collect operational status for the driver information systems equipment in work zones.
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- Requirement:* 5 The center shall collect fault data for the driver information systems equipment in work zones for repair.
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- Requirement:* 6 The center shall receive proposed maintenance and construction work plans, analyze the activity as a possible incident, and provide work plan feedback to the sending center.
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Entity: **Transit Management**

Functional Area: **Transit Center Security**

Monitor transit vehicle operator or traveler activated alarms; authenticate transit vehicle operators; remotely disable a transit vehicle; alert operators, travelers, and police to potential incidents identified by these security features.

- Requirement:* 1 The center shall monitor transit vehicle operational data to determine if the transit vehicle is off-route and assess whether a security incident is occurring.
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- Requirement:* 2 The center shall receive reports of emergencies on-board transit vehicles entered directly by the transit vehicle operator or from a traveler through interfaces such as panic buttons or alarm switches.
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- Requirement:* 3 The center shall support the back-office portion of functionality to authenticate transit vehicle operators.
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- Requirement:* 4 The center shall exchange transit incident information along with other service data with other transit agencies.
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- Requirement:* 5 The center shall receive information pertaining to a wide-area alert such as weather alerts, disaster situations, or child abductions. This information may come from Emergency Management or from other Alerting and Advisory Systems.
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- Requirement:* 6 The center shall send wide-area alert information to travelers (on-board transit vehicles or at stations/stops) and transit vehicle operators.
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- Requirement:* 7 The center shall coordinate the response to security incidents involving transit with other agencies including Emergency Management, other transit agencies, media, traffic management, and traveler information service providers.
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- Requirement:* 8 The center shall receive threat information and status on the integrity of the transit infrastructure.
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- Requirement:* 9 The center shall provide support to remotely disable (or reset the disabling of) a transit vehicle in service.
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Functional Area: **Transit Center Information Services**

Architecture**Northern New Jersey ITS Architecture***Element:***NJDOT STOC***Entity:***Transit Management***Functional Area:* **Transit Center Information Services**

Provide interactive traveler information to travelers (on-board transit vehicles, at stops/stations, using personal devices), traveler information service providers, media, and other transit organizations. Includes routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, yellow pages, and special events.

- Requirement:* 1 The center shall provide travelers using public transportation with traffic and advisory information upon request. Such information may include transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events.
- Requirement:* 2 The center shall provide transit information to the media including details of deviations from schedule of regular transit services.
- Requirement:* 3 The center shall exchange transit schedules, real-time arrival information, fare schedules, and general transit service information with other transit organizations to support transit traveler information systems.
- Requirement:* 4 The center shall provide transit service information to traveler information service providers including routes, schedules, schedule adherence, and fare information as well as transit service information during evacuation.
- Requirement:* 5 The center shall enable yellow pages (including non-motorized transportation) information to be output to the traveler.
- Requirement:* 6 The center shall broadcast transit advisory data, including alerts and advisories pertaining to major emergencies, or man made disasters.

Functional Area: **Transit Center Multi-Modal Coordination**

Generate requests for transit priority on routes and at certain intersections. Coordinate schedules with other agencies and modes, including transit transfer cluster and transfer point information.

- Requirement:* 1 The center shall analyze transit vehicle schedule performance to determine the need for priority along certain routes or at certain intersections.
- Requirement:* 2 The center shall send requests for priority along routes or at intersections to traffic management.
- Requirement:* 3 The center shall coordinate schedules and services between transit agencies, traffic management, maintenance and construction operations, parking management, and other surface or air transportation modes.
- Requirement:* 4 The center shall share transfer cluster and transfer point information with multimodal transportation service providers, other transit agencies, and traveler information service providers. A transfer cluster is a collection of stops, stations, or terminals where transfers can be made conveniently.

Functional Area: **Transit Evacuation Support**

Support evacuation and subsequent reentry of a population in the vicinity of a disaster or other emergency. Coordinate regional evacuation plans and resources including transit and school bus fleets.

- Requirement:* 1 The center shall manage the use of transit resources to support evacuation and subsequent reentry of a population in the vicinity of a disaster or other emergency.
- Requirement:* 2 The center shall coordinate regional evacuation plans with Emergency Management - identifying the transit role in an evacuation and the transit resources that would be used.
- Requirement:* 3 The center shall coordinate the use of transit and school bus fleets during an evacuation, supporting evacuation of those with special needs and the general population.
- Requirement:* 4 The center shall adjust and update transit service and fare schedules and provide that information to other agencies as they coordinate evacuations.

*Element:***NJDOT TEOC**

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TEOC***Entity:* **Emergency Management***Functional Area:* **Emergency Early Warning System**

Monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies in order to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to other ITS centers to notify the traveling public. Includes support for Child Abduction notices.

- Requirement:* 1 The center shall monitor information from Alerting and Advisory Systems such as the Information Sharing and Analysis Centers (ISACs), the National Infrastructure Protection Center (NIPC), the Homeland Security Advisory System (HSAS), etc. The information may include assessments (general incident and vulnerability awareness information), advisories (identification of threats or recommendations to increase preparedness levels), or alerts (information on imminent or in-progress emergencies).
- Requirement:* 2 The center shall provide the capability to correlate alerts and advisories, incident information, and security sensor and surveillance data.
- Requirement:* 3 The center shall broadcast wide-area alerts and advisories to traffic management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 4 The center shall broadcast wide-area alerts and advisories to transit management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 5 The center shall broadcast wide-area alerts and advisories to toll administration centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 6 The center shall broadcast wide-area alerts and advisories to traveler information service providers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 7 The center shall broadcast wide-area alerts and advisories to maintenance centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 8 The center shall broadcast wide-area alerts and advisories to other emergency management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 9 The center shall process status information from each of the centers that have been sent the wide-area alert.
- Requirement:* 10 The center shall coordinate the broadcast of wide-area alerts and advisories with other emergency management centers.
- Requirement:* 11 The center shall receive incident information from other transportation management centers to support the early warning system.
- Requirement:* 12 The center shall present the alert and advisory information and the status of the actions taken in response to the alert by the other centers to the emergency system operator as received from other system inputs.
- Requirement:* 13 The center shall support the entry of alert and advisory information directly from the emergency system operator.

Functional Area: **Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

- Requirement:* 1 The center shall provide strategic emergency response capabilities such as that of an Emergency Operations Center for large-scale incidents and disasters.

Architecture**Northern New Jersey ITS Architecture***Element:* NJDOT TEOC*Entity:* Emergency Management*Functional Area:* **Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

- Requirement:* 2 The center shall manage coordinated inter-agency responses to and recovery from large-scale emergencies. Such agencies include traffic management, transit, maintenance and construction management, rail operations, and other emergency management agencies.
- Requirement:* 3 The center shall provide the capability to implement response plans and track progress through the incident by exchanging incident information and distributing response status to allied agencies.
- Requirement:* 4 The center shall develop, coordinate with other agencies, and store emergency response plans.
- Requirement:* 5 The center shall track the availability of resources (including vehicles, roadway cleanup?, etc.), request additional resources from traffic, maintenance, or other emergency centers if needed.
- Requirement:* 6 The center shall allocate the appropriate emergency services, resources, and vehicle (s) to respond to incidents, and shall provide the capability to override the current allocation to suit the special needs of a current incident.
- Requirement:* 7 The center shall receive event scheduling information from Event Promoters.
- Requirement:* 8 The center shall receive hazardous materials incident information from commercial fleet operators.
- Requirement:* 9 The center shall provide the capability to request the safe disabling of a commercial vehicle during a hazardous materials incident.
- Requirement:* 10 The center shall provide the capability to request transit resource availability from transit centers for use during disaster and evacuation operations.
- Requirement:* 11 The center shall assimilate the status of the transit, traffic, rail, maintenance, and other emergency center services and systems to create an overall transportation system status, and disseminate to each of these centers and the traveling public via traveler information providers.
- Requirement:* 12 The center shall provide information to the media concerning the status of an emergency response.
- Requirement:* 13 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.
- Requirement:* 14 The center shall provide the capability for center personnel to provide inputs to the management of incidents, disasters and evacuations.

Functional Area: **Incident Command**

Tactical decision support, resource coordination, and communications integration among emergency management agencies for Incident Commands that are established by first responders to support local management of an incident.

- Requirement:* 1 The center shall provide tactical decision support, resource coordination, and communications integration for Incident Commands that are established by first responders to support local management of an incident.
- Requirement:* 2 The center shall provide incident command communications with public safety, emergency management, transportation, and other allied response agency centers.
- Requirement:* 3 The center shall track and maintain resource information and action plans pertaining to the incident command.
- Requirement:* 4 The center shall share incident command information with other public safety agencies including resource deployment status, hazardous material information, rail incident information, evacuation advice as well as traffic, road, and weather conditions.
- Requirement:* 5 The center shall assess the status of responding emergency vehicles as part of an incident command.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TEOC***Entity:* **Emergency Management***Functional Area:* **Emergency Evacuation Support**

Evacuation planning and coordination to manage evacuation and reentry of a population in the vicinity of a disaster or other emergency that poses a risk to public safety.

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| <i>Requirement:</i> | 1 The center shall manage inter-agency coordination of evacuation operations, from initial planning through the evacuation process and reentry. |
| <i>Requirement:</i> | 2 The center shall develop and exchange evacuation plans with allied agencies prior to the occurrence of a disaster. |
| <i>Requirement:</i> | 3 The center shall provide an interface to the emergency system operator to enter evacuation plans and procedures and present the operator with other agencies' plans. |
| <i>Requirement:</i> | 4 The center shall coordinate evacuation destinations and shelter needs with shelter providers (e.g., the American Red Cross) in the region. |
| <i>Requirement:</i> | 5 The center shall provide evacuation information to traffic, transit, maintenance and construction, rail operations, and other emergency management centers as needed. |
| <i>Requirement:</i> | 6 The center shall request resources from transit agencies as needed to support the evacuation. |
| <i>Requirement:</i> | 7 The center shall request traffic management agencies to implement special traffic control strategies and to control evacuation traffic, including traffic on local streets and arterials as well as the major evacuation routes. |
| <i>Requirement:</i> | 8 The center shall provide traveler information systems with evacuation guidance including basic information to assist potential evacuees in determining whether evacuation is necessary and when it is safe to return. |
| <i>Requirement:</i> | 9 The center shall monitor the progress or status of the evacuation once it begins and exchange tactical plans, prepared during the incident, with allied agencies. |
| <i>Requirement:</i> | 10 The center shall monitor the progress of the reentry process. |
| <i>Requirement:</i> | 11 The center shall submit evacuation information to toll administration centers along with requests for changes in the toll services or fee collection during an evacuation. |

Functional Area: **Emergency Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and emergency vehicles equipped with environmental sensors; used by the operator to more effectively manage incidents.

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| <i>Requirement:</i> | 1 The center shall collect current and forecast road and weather information from weather service providers (such as the National Weather Service and value-added sector specific meteorological services). |
| <i>Requirement:</i> | 2 The center shall receive environmental probe information from its fleet of emergency vehicles. |
| <i>Requirement:</i> | 3 The center shall collect current road and weather information from roadway maintenance operations. |
| <i>Requirement:</i> | 4 The center shall assimilate current and forecast road conditions and surface weather information to support incident management. |
| <i>Requirement:</i> | 5 The center shall present the current and forecast road and weather information to the emergency system operator. |
| <i>Requirement:</i> | 6 The center shall provide aggregated or processed environmental probe information from its fleet of emergency vehicles to traffic management and maintenance centers. |

Functional Area: **Center Secure Area Surveillance**

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

Architecture**Northern New Jersey ITS Architecture***Element:* NJDOT TEOC*Entity:* Emergency Management*Functional Area:* **Center Secure Area Surveillance**

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 1 The center shall remotely monitor video images and audio surveillance data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The data may be raw or pre-processed in the field.
- Requirement:* 2 The center shall remotely monitor video images and audio surveillance data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The data may be raw or pre-processed in the field.
- Requirement:* 3 The center shall remotely monitor video images and audio surveillance data collected on-board transit vehicles. The data may be raw or pre-processed in the field.
- Requirement:* 4 The center shall exchange surveillance data with other emergency centers.
- Requirement:* 5 The center shall identify potential security threats based on collected security surveillance data.
- Requirement:* 6 The center shall verify potential security threats by correlating security surveillance data from multiple sources.
- Requirement:* 7 The center shall remotely control security surveillance devices in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways).
- Requirement:* 8 The center shall remotely control security surveillance devices in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers).
- Requirement:* 9 The center shall remotely control security surveillance devices on-board transit vehicles.
- Requirement:* 10 The center shall match traveler video images against a database from the Alerting and Advisory Systems of known images that may represent criminals and terrorists.
- Requirement:* 11 The center shall exchange traveler images with other emergency management centers to support traveler image matching.
- Requirement:* 12 The center shall respond to control data from center personnel regarding security surveillance data collection, processing, threat detection, and image matching.

Functional Area: **Center Secure Area Sensor Management**

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 1 The center shall remotely monitor and control security sensor data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), infrastructure condition and integrity, intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.

Architecture**Northern New Jersey ITS Architecture***Element:***NJDOT TEOC***Entity:***Emergency Management***Functional Area:* **Center Secure Area Sensor Management**

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 2 The center shall remotely monitor and control security sensor data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 3 The center shall remotely monitor and control security sensor data collected on-board transit vehicles. The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors) and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 4 The center shall exchange security sensor data with other emergency centers.
- Requirement:* 5 The center shall identify potential security threats based on collected security sensor data.
- Requirement:* 6 The center shall verify potential security threats by correlating security sensor data from multiple sources.
- Requirement:* 7 The center shall perform threat analysis based on correlations of security sensor and surveillance data.
- Requirement:* 8 The center shall exchange threat analysis data with Alerting and Advisory Systems and use that data in local threat analysis processing.
- Requirement:* 9 The center shall disseminate threat information to other agencies, including traffic, transit, maintenance, rail operations, and other emergency management centers.
- Requirement:* 10 The center shall respond to control data from center personnel regarding security sensor data collection, processing, threat detection, and threat analysis.

Functional Area: **Emergency Data Collection**

Collection and storage of information related to Emergency Management. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect emergency service data, emergency vehicle management data, emergency vehicle data, sensor and surveillance data, threat data, and incident data.
- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.
- Requirement:* 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the emergency management data or for the data itself.
- Requirement:* 4 The center shall be able to produce sample products of the data available.

*Entity:***Maintenance and Construction Management***Functional Area:* **MCM Environmental Information Collection**

Remotely controls environmental sensors and assimilates collected data with other current and forecast road conditions and surface weather information from weather service providers and transportation operations.

- Requirement:* 1 The center shall remotely control environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures.

Architecture**Northern New Jersey ITS Architecture***Element:* NJDOT TEOC*Entity:* Maintenance and Construction Management*Functional Area:* **MCM Environmental Information Collection**

Remotely controls environmental sensors and assimilates collected data with other current and forecast road conditions and surface weather information from weather service providers and transportation operations.

- Requirement:* 2 The center shall remotely control environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.
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- Requirement:* 3 The center shall remotely control environmental sensors on-board maintenance and construction vehicles that measure road and weather conditions including air and surface temperatures, wind speed, humidity, precipitation, visibility and other measures.
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- Requirement:* 4 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services), data from traffic, emergency, and transit management, traveler information providers, and environmental data collected from sensors deployed on and about the roadway as well as the fleet of maintenance and construction vehicles.
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- Requirement:* 5 The center shall provide weather and road condition information to weather service providers and center personnel.
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- Requirement:* 6 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.
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- Requirement:* 7 The center shall collect operational status for the roadside and vehicle-based environmental sensor equipment.
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- Requirement:* 8 The center shall collect fault data for the roadside and vehicle-based environmental sensor equipment for repair.

Functional Area: **MCM Environmental Information Processing**

Processes current and forecast weather data, road condition information, local environmental data, and uses internal models to develop specialized detailed forecasts of local weather and surface conditions. Disseminates road weather information to other agencies and centers.

- Requirement:* 1 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.
-
- Requirement:* 2 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services) and local environmental sensor data.
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- Requirement:* 3 The center shall use the various data inputs of environmental sensors and road weather data to develop a view of current and predicted road weather and road conditions.
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- Requirement:* 4 The center shall disseminate current and forecasted road weather and road condition information to weather service providers (such as the National Weather Service and value-added sector specific meteorological services) as well as other agencies including traffic, emergency, and transit management, traveler information providers, rail operations centers, media, and other maintenance management centers.
-
- Requirement:* 5 The center shall provide value-added sector specific meteorological services with information on basic road facility and treatment information that supports forecasts for road conditions.

Functional Area: **MCM Automated Treatment System Control**

Remotely controls automated roadway treatment systems (to disperse anti-icing chemicals, etc.) directly, or via control of the environmental sensors that activate the treatment systems automatically in the field.

- Requirement:* 1 The center shall remotely control automated roadway treatment systems. Treatments can be in the form of fog dispersion, anti-icing chemicals, etc.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TEOC***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Automated Treatment System Control**

Remotely controls automated roadway treatment systems (to disperse anti-icing chemicals, etc.) directly, or via control of the environmental sensors that activate the treatment systems automatically in the field.

- Requirement:* 2 The center shall remotely control the environmental sensors that upon detecting changes in environmental or atmospheric conditions, automatically activate roadway treatment systems.
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- Requirement:* 3 The center shall collect automated roadway treatment system and associated environmental sensor operational status.
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- Requirement:* 4 The center shall collect automated roadway treatment system and associated environmental sensor fault data and request repair.
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- Requirement:* 5 The center shall accept requests for automated roadway treatment system activation from center personnel.

Functional Area: **MCM Incident Management**

Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.

- Requirement:* 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.
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- Requirement:* 2 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, etc.
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- Requirement:* 3 The center shall exchange incident and threat information with emergency management centers as well as traffic management centers; including notification of existence of incident and expected severity, location, time and nature of incident.
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- Requirement:* 4 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.
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- Requirement:* 5 The center shall respond to requests from emergency management to provide maintenance and construction resources to implement response plans, assist in clean up, verify an incident, etc. This may also involve coordination with traffic management centers and other maintenance centers.
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- Requirement:* 6 The center shall exchange road network status assessment information with emergency management and traffic management centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.
-
- Requirement:* 7 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.
-
- Requirement:* 8 The center shall receive information indicating the damage sustained by transportation assets, derived from aerial surveillance, field reports, inspections, tests, and analyses to support incident management.

Functional Area: **MCM Maintenance Decision Support**

Maintenance Decision Support Systems recommend courses of action based on current and forecast environmental and road conditions (filtered and fused for specific time horizons) and additional application specific information. Recommendations and dispatch instructions are generated based on this integrated information.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TEOC***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Maintenance Decision Support**

Maintenance Decision Support Systems recommend courses of action based on current and forecast environmental and road conditions (filtered and fused for specific time horizons) and additional application specific information. Recommendations and dispatch instructions are generated based on this integrated information.

- Requirement:*
- 1 The center shall provide the center personnel with tailored external information, including weather or road condition observations, forecasted weather information or road conditions, current usage of treatments and materials, available resources, equipment and vehicle availability, road network information, and source reliability information.
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- Requirement:*
- 2 The center shall tailor the decision support information to include filtering (selection from a large amount of external information), error reduction ('smoothing' the information), fusion (combination of disparate information to match the decision needs), and analysis (creating the decision).
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- Requirement:*
- 3 The center shall provide an interface to the center personnel to input control parameters for the decision support process and receive decisions or information presentation.
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- Requirement:*
- 4 The center shall provide dispatch information to maintenance and construction vehicles based on the outputs of the decision support system, including recommended roadway treatment actions.

Functional Area: **MCM Winter Maintenance Management**

Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.

- Requirement:*
- 1 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other winter roadway maintenance.
-
- Requirement:*
- 2 The center shall exchange information with administrative systems to support the planning and scheduling of winter maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
-
- Requirement:*
- 3 The center shall provide status information about scheduled winter maintenance activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, and the media.
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- Requirement:*
- 4 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of winter maintenance activities.
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- Requirement:*
- 5 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of winter maintenance activities.
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- Requirement:*
- 6 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
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- Requirement:*
- 7 The center shall dispatch and route winter maintenance vehicle drivers and support them with route-specific environmental, incident, advisory, threat, alert, and traffic congestion information.
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- Requirement:*
- 8 The center shall determine the need for roadway treatment based on current and forecasted weather information, current usage of treatments and materials, available resources, requests for action from other agencies, and recommendations from the Maintenance Decision Support system, specifically under winter conditions. This supports winter maintenance such as plowing, treating, anti-icing, etc.

Architecture**Northern New Jersey ITS Architecture***Element:* NJDOT TEOC*Entity:* Maintenance and Construction Management*Functional Area:* **MCM Winter Maintenance Management**

Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.

- Requirement:* 9 The center shall provide dispatch instructions for vehicle operators based on input parameters from center personnel, specifically for winter conditions. This could include a treatment route, treatment application rates, start and end times, and other treatment instructions.
-
- Requirement:* 10 The center shall support remote control of on-board maintenance and construction vehicle systems and field equipment that is remotely controlled by the vehicle such as adjusting material application rates and spread patterns.
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- Requirement:* 11 The center shall assess the current status of all winter maintenance activities, including actual work activities performed, current locations and operational conditions of vehicles, materials and equipment inventories, field equipment status, environmental information, etc.

Functional Area: **MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

- Requirement:* 1 The center shall maintain an interface with asset management systems to track the inventory, restrictions, repair needs and status updates of transportation assets (pavement, bridges, signs, etc.) including location, installation and materials information, vendor/contractor, current maintenance status, standard height, width, and weight restrictions.
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- Requirement:* 2 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other roadway maintenance.
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- Requirement:* 3 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
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- Requirement:* 4 The center shall provide emergency management and traffic management centers with information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.
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- Requirement:* 5 The center shall collect the status and fault data from roadside equipment, such as traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
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- Requirement:* 6 The center shall collect the status and fault data from traffic management centers, including data for traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
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- Requirement:* 7 The center shall remotely control and collect data from infrastructure monitoring sensors located along the roadway infrastructure or on maintenance and construction vehicles.
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- Requirement:* 8 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of roadway maintenance and construction activities.
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- Requirement:* 9 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of roadway maintenance and construction activities.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TEOC***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

- Requirement:* 10 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
- Requirement:* 11 The center shall dispatch and route maintenance and construction vehicle drivers and support them with route- specific environmental, incident, advisory, threat, alert, and traffic congestion information.
- Requirement:* 12 The center shall manage an interface with center personnel to accept vehicle systems control information and remotely control maintenance and construction vehicle on-board equipment.
- Requirement:* 13 The center shall track the status of roadway maintenance and construction activities by monitoring collected data from the dispatched vehicles and equipment.

Functional Area: **MCM Work Zone Management**

Remotely monitors and supports work zone activities, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).

- Requirement:* 1 The center shall generate new work zone activity schedules for use by maintenance and construction vehicles, maintenance and construction operators, and for information coordination purposes.
- Requirement:* 2 The center shall control the collection of work zone status information including video images from cameras located in or near the work zone.
- Requirement:* 3 The center shall disseminate work zone information to other agencies and centers including traffic, transit, emergency management centers, other maintenance centers, traveler information providers, and the media.
- Requirement:* 4 The center shall control traffic in work zones by providing remote control of dynamic message signs and highway advisory radio systems located in or near the work zone.
- Requirement:* 5 The center shall exchange information with administrative systems to support the planning and scheduling of work zone activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.

Functional Area: **MCM Work Activity Coordination**

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

- Requirement:* 1 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.
- Requirement:* 2 The center shall provide status information about scheduled maintenance and construction activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, multimodal transportation providers, rail operations, and the media.
- Requirement:* 3 The center shall collect and respond to feedback concerning scheduled maintenance and construction activities with other management centers such as traffic, emergency, transit, and rail operations.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TEOC***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Work Activity Coordination**

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

Requirement: 4 The center shall collect and disseminate asset restriction information levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.

Requirement: 5 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance and construction activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.

Requirement: 6 The center shall exchange rail schedules and work plans with rail operations centers.

Functional Area: **MCM Data Collection**

Collection and storage of maintenance and construction information. For use by operations personnel or data archives in the region.

Requirement: 1 The center shall collect maintenance and construction data (such as field equipment status, infrastructure status, maintenance and construction activity data) gathered from roadway, traffic, and other maintenance and construction sources.

Requirement: 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

Requirement: 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the maintenance and construction data or for the data itself.

Requirement: 4 The center shall be able to produce sample products of the data available.

Requirement: 5 The center shall provide data to Asset Management to be used in updating the status of assets in the inventory.

Entity: **Traffic Management***Functional Area:* **TMC Probe Information Collection**

Collects, assimilates, and disseminates vehicle probe data collected from roadside beacons and centers controlling transit vehicles, emergency vehicles, toll collection points, and route-guided vehicles.

Requirement: 1 The center shall collect probe data including traffic and road conditions from vehicles via roadside beacon field elements; the data may be aggregated and initial link time calculations performed in the field.

Requirement: 2 The center shall collect road condition data from probe-equipped transit vehicles via transit management centers; the data may be aggregated and preliminarily processed at the sending center.

Requirement: 3 The center shall collect traffic data from probe-equipped emergency vehicles via emergency management centers; the data may be aggregated and initial link time calculations performed at the sending center.

Requirement: 4 The center shall collect traffic data from traveler information centers based on data from their subscriber vehicles; the data may be aggregated and initial link time calculations performed at the sending center.

Requirement: 5 The center shall collect traffic data from toll administrative centers containing journey times between toll collection points for those vehicles equipped for electronic toll collection; the data may be aggregated and processed at the sending center.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TEOC***Entity:* **Traffic Management***Functional Area:* **TMC Probe Information Collection**

Collects, assimilates, and disseminates vehicle probe data collected from roadside beacons and centers controlling transit vehicles, emergency vehicles, toll collection points, and route-guided vehicles.

Requirement: 6 The center shall assimilate current and forecast traffic and road conditions based on collected probe data and distribute to other centers for dissemination to travelers.

Requirement: 7 The center shall collect operational status for the roadside probe data collection equipment.

Requirement: 8 The center shall collect fault data for the roadside probe data collection equipment for repair.

Functional Area: **TMC Incident Detection**

Remotely controls traffic and video sensors to support incident detection and verification; exchange information with other agencies including emergency management, maintenance and construction, alerting and advisory systems, event promoters, intermodal freight depots, and traveler information systems.

Requirement: 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.

Requirement: 2 The center shall collect and store traffic flow and image data from the field equipment to detect and verify incidents.

Requirement: 3 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, and intermodal freight depots.

Requirement: 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.

Requirement: 5 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field.

Requirement: 6 The center shall provide road network conditions and traffic images to emergency management centers to support the detection, verification, and classification of incidents.

Requirement: 7 The center shall provide video and traffic sensor control commands to the field equipment to detect and verify incidents.

Functional Area: **TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

Requirement: 1 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction for distribution to the public. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, and information and instructions necessary for the public to respond to the alert. This may also identify specific information that should not be released to the public.

Requirement: 2 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.

Requirement: 3 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field, provide special routing for emergency vehicles, and to provide responding emergency vehicles with signal preemption.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TEOC***Entity:* **Traffic Management***Functional Area:* **TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

- Requirement:* 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.
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- Requirement:* 5 The center shall respond to requests from emergency management to provide traffic management resources to implement special traffic control measures, assist in clean up, verify an incident, etc. This may also involve coordination with maintenance centers.
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- Requirement:* 6 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, media, and rail operations centers.
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- Requirement:* 7 The center shall provide road network conditions and traffic images to emergency management centers, maintenance and construction centers, and traveler information service providers.
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- Requirement:* 8 The center shall exchange road network status assessment information with emergency management and maintenance centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.
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- Requirement:* 9 The center shall coordinate information and controls with other traffic management centers.
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- Requirement:* 10 The center shall receive inputs from emergency management and transit management centers to develop an overall status of the transportation system including emergency transit schedules in effect and current status and condition of the transportation infrastructure.
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- Requirement:* 11 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic incident management.

Functional Area: **TMC Evacuation Support**

Development, coordination, and execution of special traffic management strategies during evacuation and subsequent reentry of a population in the vicinity of a disaster or major emergency. Interfaces with emergency management and other traffic management centers.

- Requirement:* 1 The center shall coordinate planning for evacuation with emergency management centers - including pre-planning activities such as establishing routes, areas to be evacuated, timing, etc.
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- Requirement:* 2 The center shall support requests from emergency management centers to preempt the current traffic control strategy, activate traffic control and closure systems such as gates and barriers, activate safeguard systems, or use driver information systems to support evacuation traffic control plans.
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- Requirement:* 3 The center shall coordinate information and controls with other traffic management centers.
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- Requirement:* 4 The center shall coordinate execution of evacuation strategies with emergency management centers - including activities such as setting closures and detours, establishing routes, updating areas to be evacuated, timing the process, etc.

Functional Area: **TMC Environmental Monitoring**

Management of environmental sensors and assimilation of collected data with other current and forecast road conditions and surface weather information from weather service providers and roadway maintenance operations.

- Requirement:* 1 The center shall remotely control environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures.

Architecture

Northern New Jersey ITS Architecture

Element: **NJDOT TEOC**

Entity: **Traffic Management**

Functional Area: **TMC Environmental Monitoring**

Management of environmental sensors and assimilation of collected data with other current and forecast road conditions and surface weather information from weather service providers and roadway maintenance operations.

- Requirement:* 2 The center shall remotely control environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.
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- Requirement:* 3 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services), data from roadway maintenance operations, and environmental data collected from sensors deployed on and about the roadway.
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- Requirement:* 4 The center shall provide weather and road condition information to weather service providers and center personnel.
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- Requirement:* 5 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.
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Functional Area: **Rail Operations Coordination**

Coordination between rail operations and traffic management centers - exchanging train schedules, maintenance schedules, as well as incidents and priority messages which result in highway-rail intersection (HRI). Supports advanced traffic control strategies and enhanced traveler information.

- Requirement:* 1 The center shall exchange highway-rail intersection (HRI) information with rail operations centers. This information may include event schedules, requests for information from the Rail Operators, incident notification based on rail operations messages, and priority messages like notifications of a HAZMAT spill, equipment failure, or an intersection blockage.
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- Requirement:* 2 The center shall receive highway-rail intersection (HRI) maintenance schedules, train schedules, and incident notifications from rail operations centers.
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- Requirement:* 3 The center shall use the rail operations information to develop forecast HRI closure times and durations which may be applied in advanced traffic control strategies or delivered as enhanced traveler information.
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Functional Area: **Barrier System Management**

Remotely controls barrier systems such as gates and other systems that manage entry to roadways, transportation facilities and infrastructure.

- Requirement:* 1 The center shall remotely control barrier systems for transportation facilities and infrastructure. Barrier systems include automated or remotely controlled gates, barriers and other systems that manage entry to roadways.
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- Requirement:* 2 The center shall collect barrier system operational status.
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- Requirement:* 3 The center shall collect barrier system fault data and send to the maintenance center for repair.
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- Requirement:* 4 The center shall accept requests for barrier system activation from other centers and from center personnel to support emergency response and detours.
-

Functional Area: **Safeguard System Management**

Remotely controls safeguard systems such as blast shields and tunnel exhaust systems that are used to mitigate the impact of incidents on transportation infrastructure.

- Requirement:* 1 The center shall remotely control safeguard systems, equipment used to mitigate the impact of incidents on transportation infrastructure (e.g., blast shields, tunnel exhaust systems, etc.)
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- Requirement:* 2 The center shall collect safeguard system operational status.
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- Requirement:* 3 The center shall collect safeguard system fault data and send to the maintenance center for repair.
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Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TEOC***Entity:* **Traffic Management***Functional Area:* **Safeguard System Management**

Remotely controls safeguard systems such as blast shields and tunnel exhaust systems that are used to mitigate the impact of incidents on transportation infrastructure.

- Requirement:* 4 The center shall accept requests for safeguard system activation from other centers and from center personnel to support emergency response.

Functional Area: **Traffic Maintenance**

Monitoring and remote diagnostics of field equipment - detect failures, issue problem reports, and track the repair or replacement of the failed equipment.

- Requirement:* 1 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) operational status.
- Requirement:* 2 The center shall collect and store CCTV surveillance system (traffic, pedestrian) operational status.
- Requirement:* 3 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) fault data and send to the maintenance center for repair.
- Requirement:* 4 The center shall collect and store CCTV surveillance system (traffic, pedestrian) fault data send to the maintenance center for repair.
- Requirement:* 5 The center shall collect environmental sensor operational status.
- Requirement:* 6 The center shall collect environmental sensor equipment fault data and send to the maintenance center for repair.
- Requirement:* 7 The center shall exchange data with maintenance centers concerning the reporting of faulty equipment and the schedule/status of their repair. Information exchanged includes details of new equipment faults, and clearances when the faults are cleared.
- Requirement:* 8 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic maintenance data.

Functional Area: **TMC Work Zone Traffic Management**

Coordination with maintenance systems using work zone images and traveler information systems (such as DMS), and distribution of work plans so that work zones are established that have minimum traffic impact.

- Requirement:* 1 The center shall receive work zone images from a maintenance center.
- Requirement:* 2 The center shall analyze work zone images for indications of a possible incident.
- Requirement:* 3 The center shall remotely control driver information systems (such as dynamic messages signs, highway advisory radios) to advise drivers of activity around a work zone.
- Requirement:* 4 The center shall collect operational status for the driver information systems equipment in work zones.
- Requirement:* 5 The center shall collect fault data for the driver information systems equipment in work zones for repair.
- Requirement:* 6 The center shall receive proposed maintenance and construction work plans, analyze the activity as a possible incident, and provide work plan feedback to the sending center.

Functional Area: **Traffic Data Collection**

Collection and storage of traffic management data. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect traffic management data such as operational data, event logs, etc.
- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

Architecture**Northern New Jersey ITS Architecture***Element:***NJDOT TEOC***Entity:***Traffic Management***Functional Area:* **Traffic Data Collection**

Collection and storage of traffic management data. For use by operations personnel or data archives in the region.

Requirement: 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the traffic data or for the data itself.

Requirement: 4 The center shall be able to produce sample products of the data available.

*Element:***NJDOT TOC Central***Entity:***Emergency Management***Functional Area:* **Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

Requirement: 1 The center shall support the interface to the Emergency Telecommunications System (e.g. 911 or 7-digit call routing) to receive emergency notification information and provide it to the emergency system operator.

Requirement: 2 The center shall receive emergency call information from 911 services and present the possible incident information to the emergency system operator.

Requirement: 3 The center shall receive emergency call information from motorist call-boxes and present the possible incident information to the emergency system operator.

Requirement: 4 The center shall receive emergency call information from mayday service providers and present the possible incident information to the emergency system operator.

Requirement: 5 The center shall receive emergency notification information from other public safety agencies and present the possible incident information to the emergency system operator.

Requirement: 6 The center shall receive emergency notification information from public transit systems and present the possible incident information to the emergency system operator.

Requirement: 7 The center shall receive emergency notification information from commercial vehicles, commercial vehicle check stations, or commercial fleet operators and present the possible incident information to the emergency system operator. This may include detection of non-permitted transport of security sensitive hazmat, hazardous cargo spills, etc.

Requirement: 8 The center shall receive details of the cargo being carried by commercial vehicles from their commercial fleet manager for incidents involving potential hazardous materials.

Requirement: 9 The center shall coordinate, correlate, and verify all emergency inputs, including those identified based on external calls and internal analysis of security sensor and surveillance data, and assign each a level of confidence.

Requirement: 10 The center shall send a request for remote control of CCTV systems from a traffic management center in order to verify the reported incident.

Requirement: 11 The center shall update the incident information log once the emergency system operator has verified the incident.

Requirement: 12 The center shall provide the capability for digitized map data to act as the background to the emergency information presented to the emergency system operator.

Requirement: 13 The center shall forward the verified emergency information to the responding agency based on the location and nature of the emergency.

Functional Area: **Emergency Dispatch**

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TOC Central***Entity:* **Emergency Management***Functional Area:* **Emergency Dispatch**

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

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| <i>Requirement:</i> | 1 The center shall dispatch emergency vehicles to respond to verified emergencies and provide suggested routing under center personnel control. |
| <i>Requirement:</i> | 2 The center shall store the current status of all emergency vehicles available for dispatch and those that have been dispatched. |
| <i>Requirement:</i> | 3 The center shall relay location and incident details to the responding vehicles. |
| <i>Requirement:</i> | 4 The center shall provide the capability to request traffic control measures from traffic management centers such as signal preemption, traffic barriers and road closures. |
| <i>Requirement:</i> | 5 The center shall track the location and status of emergency vehicles responding to an emergency and update the incident status based on information from the emergency vehicle. |
| <i>Requirement:</i> | 6 The center shall receive status information from care facilities to determine the appropriate facility and its location. |
| <i>Requirement:</i> | 7 The center shall store and maintain the emergency service responses in an action log. |
| <i>Requirement:</i> | 8 The center shall receive asset restriction information from maintenance centers to support the dispatching of appropriate emergency resources. |
| <i>Requirement:</i> | 9 The center shall receive traffic information, including closures, traffic conditions, etc. from traffic management centers. |
| <i>Requirement:</i> | 10 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator. |
| <i>Requirement:</i> | 11 The center shall receive road network conditions and traffic images to support dispatch of emergency vehicles. |
| <i>Requirement:</i> | 12 The center shall coordinate response to incidents with other Emergency Management centers to ensure appropriate resources are dispatched and utilized. |

Functional Area: **Emergency Routing**

Routing of emergency vehicles to facilitate the quickest/safest arrival. Routes may be determined based on real-time traffic information and road conditions or routes may be provided by Traffic Management on request.

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| <i>Requirement:</i> | 1 The center shall collect current traffic and road condition information from traffic management centers for emergency vehicle route calculation. |
| <i>Requirement:</i> | 2 The center shall receive inputs from traffic management and maintenance centers on the location and status of traffic control equipment and work zones along potential emergency routes. |
| <i>Requirement:</i> | 3 The center shall calculate emergency vehicle routes based on information from traffic management and maintenance centers. |
| <i>Requirement:</i> | 4 In special circumstances such as during disasters and evacuations when normal routes are not available, the center shall request a route from the traffic management center. |
| <i>Requirement:</i> | 5 The center shall provide the capability to request special traffic control measures from the traffic management center to facilitate emergency vehicle progress along the suggested route. |
| <i>Requirement:</i> | 6 Once the route is calculated the route shall be provided to the dispatch function. |

Functional Area: **Emergency Early Warning System**

Monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies in order to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to other ITS centers to notify the traveling public. Includes support for Child Abduction notices.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TOC Central***Entity:* **Emergency Management***Functional Area:* **Emergency Early Warning System**

Monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies in order to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to other ITS centers to notify the traveling public. Includes support for Child Abduction notices.

- Requirement:* 1 The center shall monitor information from Alerting and Advisory Systems such as the Information Sharing and Analysis Centers (ISACs), the National Infrastructure Protection Center (NIPC), the Homeland Security Advisory System (HSAS), etc. The information may include assessments (general incident and vulnerability awareness information), advisories (identification of threats or recommendations to increase preparedness levels), or alerts (information on imminent or in-progress emergencies).
- Requirement:* 2 The center shall provide the capability to correlate alerts and advisories, incident information, and security sensor and surveillance data.
- Requirement:* 3 The center shall broadcast wide-area alerts and advisories to traffic management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 4 The center shall broadcast wide-area alerts and advisories to transit management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 5 The center shall broadcast wide-area alerts and advisories to toll administration centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 6 The center shall broadcast wide-area alerts and advisories to traveler information service providers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 7 The center shall broadcast wide-area alerts and advisories to maintenance centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 8 The center shall broadcast wide-area alerts and advisories to other emergency management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 9 The center shall process status information from each of the centers that have been sent the wide-area alert.
- Requirement:* 10 The center shall coordinate the broadcast of wide-area alerts and advisories with other emergency management centers.
- Requirement:* 11 The center shall receive incident information from other transportation management centers to support the early warning system.
- Requirement:* 12 The center shall present the alert and advisory information and the status of the actions taken in response to the alert by the other centers to the emergency system operator as received from other system inputs.
- Requirement:* 13 The center shall support the entry of alert and advisory information directly from the emergency system operator.

Functional Area: **Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

- Requirement:* 1 The center shall provide strategic emergency response capabilities such as that of an Emergency Operations Center for large-scale incidents and disasters.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TOC Central***Entity:* **Emergency Management***Functional Area:* **Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

- Requirement:* 2 The center shall manage coordinated inter-agency responses to and recovery from large-scale emergencies. Such agencies include traffic management, transit, maintenance and construction management, rail operations, and other emergency management agencies.
- Requirement:* 3 The center shall provide the capability to implement response plans and track progress through the incident by exchanging incident information and distributing response status to allied agencies.
- Requirement:* 4 The center shall develop, coordinate with other agencies, and store emergency response plans.
- Requirement:* 5 The center shall track the availability of resources (including vehicles, roadway cleanup?, etc.), request additional resources from traffic, maintenance, or other emergency centers if needed.
- Requirement:* 6 The center shall allocate the appropriate emergency services, resources, and vehicle (s) to respond to incidents, and shall provide the capability to override the current allocation to suit the special needs of a current incident.
- Requirement:* 7 The center shall receive event scheduling information from Event Promoters.
- Requirement:* 8 The center shall receive hazardous materials incident information from commercial fleet operators.
- Requirement:* 9 The center shall provide the capability to request the safe disabling of a commercial vehicle during a hazardous materials incident.
- Requirement:* 10 The center shall provide the capability to request transit resource availability from transit centers for use during disaster and evacuation operations.
- Requirement:* 11 The center shall assimilate the status of the transit, traffic, rail, maintenance, and other emergency center services and systems to create an overall transportation system status, and disseminate to each of these centers and the traveling public via traveler information providers.
- Requirement:* 12 The center shall provide information to the media concerning the status of an emergency response.
- Requirement:* 13 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.
- Requirement:* 14 The center shall provide the capability for center personnel to provide inputs to the management of incidents, disasters and evacuations.

Functional Area: **Incident Command**

Tactical decision support, resource coordination, and communications integration among emergency management agencies for Incident Commands that are established by first responders to support local management of an incident.

- Requirement:* 1 The center shall provide tactical decision support, resource coordination, and communications integration for Incident Commands that are established by first responders to support local management of an incident.
- Requirement:* 2 The center shall provide incident command communications with public safety, emergency management, transportation, and other allied response agency centers.
- Requirement:* 3 The center shall track and maintain resource information and action plans pertaining to the incident command.
- Requirement:* 4 The center shall share incident command information with other public safety agencies including resource deployment status, hazardous material information, rail incident information, evacuation advice as well as traffic, road, and weather conditions.
- Requirement:* 5 The center shall assess the status of responding emergency vehicles as part of an incident command.

Architecture**Northern New Jersey ITS Architecture***Element:***NJDOT TOC Central***Entity:***Emergency Management***Functional Area:* **Emergency Evacuation Support**

Evacuation planning and coordination to manage evacuation and reentry of a population in the vicinity of a disaster or other emergency that poses a risk to public safety.

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| <i>Requirement:</i> | 1 The center shall manage inter-agency coordination of evacuation operations, from initial planning through the evacuation process and reentry. |
| <i>Requirement:</i> | 2 The center shall develop and exchange evacuation plans with allied agencies prior to the occurrence of a disaster. |
| <i>Requirement:</i> | 3 The center shall provide an interface to the emergency system operator to enter evacuation plans and procedures and present the operator with other agencies' plans. |
| <i>Requirement:</i> | 4 The center shall coordinate evacuation destinations and shelter needs with shelter providers (e.g., the American Red Cross) in the region. |
| <i>Requirement:</i> | 5 The center shall provide evacuation information to traffic, transit, maintenance and construction, rail operations, and other emergency management centers as needed. |
| <i>Requirement:</i> | 6 The center shall request resources from transit agencies as needed to support the evacuation. |
| <i>Requirement:</i> | 7 The center shall request traffic management agencies to implement special traffic control strategies and to control evacuation traffic, including traffic on local streets and arterials as well as the major evacuation routes. |
| <i>Requirement:</i> | 8 The center shall provide traveler information systems with evacuation guidance including basic information to assist potential evacuees in determining whether evacuation is necessary and when it is safe to return. |
| <i>Requirement:</i> | 9 The center shall monitor the progress or status of the evacuation once it begins and exchange tactical plans, prepared during the incident, with allied agencies. |
| <i>Requirement:</i> | 10 The center shall monitor the progress of the reentry process. |
| <i>Requirement:</i> | 11 The center shall submit evacuation information to toll administration centers along with requests for changes in the toll services or fee collection during an evacuation. |

Functional Area: **Emergency Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and emergency vehicles equipped with environmental sensors; used by the operator to more effectively manage incidents.

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| <i>Requirement:</i> | 1 The center shall collect current and forecast road and weather information from weather service providers (such as the National Weather Service and value-added sector specific meteorological services). |
| <i>Requirement:</i> | 2 The center shall receive environmental probe information from its fleet of emergency vehicles. |
| <i>Requirement:</i> | 3 The center shall collect current road and weather information from roadway maintenance operations. |
| <i>Requirement:</i> | 4 The center shall assimilate current and forecast road conditions and surface weather information to support incident management. |
| <i>Requirement:</i> | 5 The center shall present the current and forecast road and weather information to the emergency system operator. |
| <i>Requirement:</i> | 6 The center shall provide aggregated or processed environmental probe information from its fleet of emergency vehicles to traffic management and maintenance centers. |

Functional Area: **Center Secure Area Surveillance**

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

Architecture**Northern New Jersey ITS Architecture***Element:***NJDOT TOC Central***Entity:***Emergency Management***Functional Area:* **Center Secure Area Surveillance**

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 1 The center shall remotely monitor video images and audio surveillance data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The data may be raw or pre-processed in the field.
- Requirement:* 2 The center shall remotely monitor video images and audio surveillance data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The data may be raw or pre-processed in the field.
- Requirement:* 3 The center shall remotely monitor video images and audio surveillance data collected on-board transit vehicles. The data may be raw or pre-processed in the field.
- Requirement:* 4 The center shall exchange surveillance data with other emergency centers.
- Requirement:* 5 The center shall identify potential security threats based on collected security surveillance data.
- Requirement:* 6 The center shall verify potential security threats by correlating security surveillance data from multiple sources.
- Requirement:* 7 The center shall remotely control security surveillance devices in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways).
- Requirement:* 8 The center shall remotely control security surveillance devices in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers).
- Requirement:* 9 The center shall remotely control security surveillance devices on-board transit vehicles.
- Requirement:* 10 The center shall match traveler video images against a database from the Alerting and Advisory Systems of known images that may represent criminals and terrorists.
- Requirement:* 11 The center shall exchange traveler images with other emergency management centers to support traveler image matching.
- Requirement:* 12 The center shall respond to control data from center personnel regarding security surveillance data collection, processing, threat detection, and image matching.

Functional Area: **Center Secure Area Sensor Management**

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 1 The center shall remotely monitor and control security sensor data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), infrastructure condition and integrity, intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TOC Central***Entity:* **Emergency Management***Functional Area:* **Center Secure Area Sensor Management**

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 2 The center shall remotely monitor and control security sensor data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 3 The center shall remotely monitor and control security sensor data collected on-board transit vehicles. The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors) and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 4 The center shall exchange security sensor data with other emergency centers.
- Requirement:* 5 The center shall identify potential security threats based on collected security sensor data.
- Requirement:* 6 The center shall verify potential security threats by correlating security sensor data from multiple sources.
- Requirement:* 7 The center shall perform threat analysis based on correlations of security sensor and surveillance data.
- Requirement:* 8 The center shall exchange threat analysis data with Alerting and Advisory Systems and use that data in local threat analysis processing.
- Requirement:* 9 The center shall disseminate threat information to other agencies, including traffic, transit, maintenance, rail operations, and other emergency management centers.
- Requirement:* 10 The center shall respond to control data from center personnel regarding security sensor data collection, processing, threat detection, and threat analysis.

Functional Area: **Service Patrol Management**

Dispatch and communication with roadway service patrol vehicles that monitor roads to aid motorists, offering rapid response to minor incidents.

- Requirement:* 1 The center shall dispatch roadway service patrol vehicles to identified incident locations.
- Requirement:* 2 The center shall store the current status of all service patrol vehicles available for dispatch and those that have been dispatched.
- Requirement:* 3 The center shall share incident information collected by the service patrol with traffic, maintenance and construction, and traveler information centers for incident management, incident notification to travelers, and incident cleanup.
- Requirement:* 4 The center shall track the location and status of service patrol vehicles.

Functional Area: **Emergency Data Collection**

Collection and storage of information related to Emergency Management. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect emergency service data, emergency vehicle management data, emergency vehicle data, sensor and surveillance data, threat data, and incident data.
- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

Architecture**Northern New Jersey ITS Architecture***Element:***NJDOT TOC Central***Entity:***Emergency Management***Functional Area:* **Emergency Data Collection**

Collection and storage of information related to Emergency Management. For use by operations personnel or data archives in the region.

Requirement: 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the emergency management data or for the data itself.

Requirement: 4 The center shall be able to produce sample products of the data available.

*Entity:***Maintenance and Construction Management***Functional Area:* **MCM Environmental Information Collection**

Remotely controls environmental sensors and assimilates collected data with other current and forecast road conditions and surface weather information from weather service providers and transportation operations.

Requirement: 1 The center shall remotely control environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures.

Requirement: 2 The center shall remotely control environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.

Requirement: 3 The center shall remotely control environmental sensors on-board maintenance and construction vehicles that measure road and weather conditions including air and surface temperatures, wind speed, humidity, precipitation, visibility and other measures.

Requirement: 4 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services), data from traffic, emergency, and transit management, traveler information providers, and environmental data collected from sensors deployed on and about the roadway as well as the fleet of maintenance and construction vehicles.

Requirement: 5 The center shall provide weather and road condition information to weather service providers and center personnel.

Requirement: 6 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.

Requirement: 7 The center shall collect operational status for the roadside and vehicle-based environmental sensor equipment.

Requirement: 8 The center shall collect fault data for the roadside and vehicle-based environmental sensor equipment for repair.

Functional Area: **MCM Environmental Information Processing**

Processes current and forecast weather data, road condition information, local environmental data, and uses internal models to develop specialized detailed forecasts of local weather and surface conditions. Disseminates road weather information to other agencies and centers.

Requirement: 1 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.

Requirement: 2 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services) and local environmental sensor data.

Requirement: 3 The center shall use the various data inputs of environmental sensors and road weather data to develop a view of current and predicted road weather and road conditions.

Architecture

Northern New Jersey ITS Architecture

Element: **NJDOT TOC Central**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Environmental Information Processing**

Processes current and forecast weather data, road condition information, local environmental data, and uses internal models to develop specialized detailed forecasts of local weather and surface conditions. Disseminates road weather information to other agencies and centers.

Requirement: 4 The center shall disseminate current and forecasted road weather and road condition information to weather service providers (such as the National Weather Service and value-added sector specific meteorological services) as well as other agencies including traffic, emergency, and transit management, traveler information providers, rail operations centers, media, and other maintenance management centers.

Requirement: 5 The center shall provide value-added sector specific meteorological services with information on basic road facility and treatment information that supports forecasts for road conditions.

Functional Area: **MCM Incident Management**

Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.

Requirement: 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.

Requirement: 2 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, etc.

Requirement: 3 The center shall exchange incident and threat information with emergency management centers as well as traffic management centers; including notification of existence of incident and expected severity, location, time and nature of incident.

Requirement: 4 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.

Requirement: 5 The center shall respond to requests from emergency management to provide maintenance and construction resources to implement response plans, assist in clean up, verify an incident, etc. This may also involve coordination with traffic management centers and other maintenance centers.

Requirement: 6 The center shall exchange road network status assessment information with emergency management and traffic management centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.

Requirement: 7 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

Requirement: 8 The center shall receive information indicating the damage sustained by transportation assets, derived from aerial surveillance, field reports, inspections, tests, and analyses to support incident management.

Functional Area: **MCM Maintenance Decision Support**

Maintenance Decision Support Systems recommend courses of action based on current and forecast environmental and road conditions (filtered and fused for specific time horizons) and additional application specific information. Recommendations and dispatch instructions are generated based on this integrated information.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TOC Central***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Maintenance Decision Support**

Maintenance Decision Support Systems recommend courses of action based on current and forecast environmental and road conditions (filtered and fused for specific time horizons) and additional application specific information. Recommendations and dispatch instructions are generated based on this integrated information.

- Requirement:*
- 1 The center shall provide the center personnel with tailored external information, including weather or road condition observations, forecasted weather information or road conditions, current usage of treatments and materials, available resources, equipment and vehicle availability, road network information, and source reliability information.
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- Requirement:*
- 2 The center shall tailor the decision support information to include filtering (selection from a large amount of external information), error reduction ('smoothing' the information), fusion (combination of disparate information to match the decision needs), and analysis (creating the decision).
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- Requirement:*
- 3 The center shall provide an interface to the center personnel to input control parameters for the decision support process and receive decisions or information presentation.
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- Requirement:*
- 4 The center shall provide dispatch information to maintenance and construction vehicles based on the outputs of the decision support system, including recommended roadway treatment actions.

Functional Area: **MCM Winter Maintenance Management**

Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.

- Requirement:*
- 1 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other winter roadway maintenance.
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- Requirement:*
- 2 The center shall exchange information with administrative systems to support the planning and scheduling of winter maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
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- Requirement:*
- 3 The center shall provide status information about scheduled winter maintenance activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, and the media.
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- Requirement:*
- 4 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of winter maintenance activities.
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- Requirement:*
- 5 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of winter maintenance activities.
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- Requirement:*
- 6 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
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- Requirement:*
- 7 The center shall dispatch and route winter maintenance vehicle drivers and support them with route-specific environmental, incident, advisory, threat, alert, and traffic congestion information.
-
- Requirement:*
- 8 The center shall determine the need for roadway treatment based on current and forecasted weather information, current usage of treatments and materials, available resources, requests for action from other agencies, and recommendations from the Maintenance Decision Support system, specifically under winter conditions. This supports winter maintenance such as plowing, treating, anti-icing, etc.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TOC Central***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Winter Maintenance Management**

Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.

- Requirement:* 9 The center shall provide dispatch instructions for vehicle operators based on input parameters from center personnel, specifically for winter conditions. This could include a treatment route, treatment application rates, start and end times, and other treatment instructions.
-
- Requirement:* 10 The center shall support remote control of on-board maintenance and construction vehicle systems and field equipment that is remotely controlled by the vehicle such as adjusting material application rates and spread patterns.
-
- Requirement:* 11 The center shall assess the current status of all winter maintenance activities, including actual work activities performed, current locations and operational conditions of vehicles, materials and equipment inventories, field equipment status, environmental information, etc.

Functional Area: **MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

- Requirement:* 1 The center shall maintain an interface with asset management systems to track the inventory, restrictions, repair needs and status updates of transportation assets (pavement, bridges, signs, etc.) including location, installation and materials information, vendor/contractor, current maintenance status, standard height, width, and weight restrictions.
-
- Requirement:* 2 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other roadway maintenance.
-
- Requirement:* 3 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
-
- Requirement:* 4 The center shall provide emergency management and traffic management centers with information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.
-
- Requirement:* 5 The center shall collect the status and fault data from roadside equipment, such as traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
-
- Requirement:* 6 The center shall collect the status and fault data from traffic management centers, including data for traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
-
- Requirement:* 7 The center shall remotely control and collect data from infrastructure monitoring sensors located along the roadway infrastructure or on maintenance and construction vehicles.
-
- Requirement:* 8 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of roadway maintenance and construction activities.
-
- Requirement:* 9 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of roadway maintenance and construction activities.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TOC Central***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

- Requirement:* 10 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
- Requirement:* 11 The center shall dispatch and route maintenance and construction vehicle drivers and support them with route- specific environmental, incident, advisory, threat, alert, and traffic congestion information.
- Requirement:* 12 The center shall manage an interface with center personnel to accept vehicle systems control information and remotely control maintenance and construction vehicle on-board equipment.
- Requirement:* 13 The center shall track the status of roadway maintenance and construction activities by monitoring collected data from the dispatched vehicles and equipment.

Functional Area: **MCM Work Zone Management**

Remotely monitors and supports work zone activities, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).

- Requirement:* 1 The center shall generate new work zone activity schedules for use by maintenance and construction vehicles, maintenance and construction operators, and for information coordination purposes.
- Requirement:* 2 The center shall control the collection of work zone status information including video images from cameras located in or near the work zone.
- Requirement:* 3 The center shall disseminate work zone information to other agencies and centers including traffic, transit, emergency management centers, other maintenance centers, traveler information providers, and the media.
- Requirement:* 4 The center shall control traffic in work zones by providing remote control of dynamic message signs and highway advisory radio systems located in or near the work zone.
- Requirement:* 5 The center shall exchange information with administrative systems to support the planning and scheduling of work zone activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.

Functional Area: **MCM Work Zone Safety Management**

Remotely monitors work zone safety systems that detect vehicle intrusions in work zones and warns crew workers and drivers of imminent encroachment. Crew movements are also monitored so that the crew can be warned of movement beyond the designated safe zone.

- Requirement:* 1 The center shall provide remote monitoring and control of work zone safety devices - including intrusion detection devices that have been installed in work zones or maintenance areas.
- Requirement:* 2 The center shall provide remote monitoring and control of intrusion alert devices that have been installed in work zones or maintenance areas.
- Requirement:* 3 The center shall collect status information of work zone safety device status from field equipment or the maintenance and construction vehicles.
- Requirement:* 4 The center shall collect and store work zone data collected from work zone monitoring devices (such as intrusion detection or alert devices and speed monitoring devices) on-board the vehicle and at the roadside.

Architecture

Northern New Jersey ITS Architecture

Element: **NJDOT TOC Central**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Work Activity Coordination**

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

Requirement: 1 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

Requirement: 2 The center shall provide status information about scheduled maintenance and construction activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, multimodal transportation providers, rail operations, and the media.

Requirement: 3 The center shall collect and respond to feedback concerning scheduled maintenance and construction activities with other management centers such as traffic, emergency, transit, and rail operations.

Requirement: 4 The center shall collect and disseminate asset restriction information levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.

Requirement: 5 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance and construction activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.

Requirement: 6 The center shall exchange rail schedules and work plans with rail operations centers.

Functional Area: **MCM Data Collection**

Collection and storage of maintenance and construction information. For use by operations personnel or data archives in the region.

Requirement: 1 The center shall collect maintenance and construction data (such as field equipment status, infrastructure status, maintenance and construction activity data) gathered from roadway, traffic, and other maintenance and construction sources.

Requirement: 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

Requirement: 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the maintenance and construction data or for the data itself.

Requirement: 4 The center shall be able to produce sample products of the data available.

Requirement: 5 The center shall provide data to Asset Management to be used in updating the status of assets in the inventory.

Entity: **Traffic Management**

Functional Area: **Collect Traffic Surveillance**

Management of traffic sensors and surveillance (CCTV) equipment, and distribution of the collected information to other centers and operators.

Requirement: 1 The center shall monitor, analyze, and store traffic sensor data (speed, volume, occupancy) collected from field elements under remote control of the center.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TOC Central***Entity:* **Traffic Management***Functional Area:* **Collect Traffic Surveillance**

Management of traffic sensors and surveillance (CCTV) equipment, and distribution of the collected information to other centers and operators.

- Requirement:* 2 The center shall monitor, analyze, and distribute traffic images from CCTV systems under remote control of the center.
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- Requirement:* 3 The center shall monitor, analyze, and store pedestrian sensor data collected from field elements under remote control of the center.
-
- Requirement:* 4 The center shall monitor, analyze, and distribute pedestrian images from CCTV systems under remote control of the center.
-
- Requirement:* 5 The center shall monitor, analyze, and store multimodal crossing and high occupancy vehicle (HOV) lane sensor data under remote control of the center.
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- Requirement:* 6 The center shall maintain a database of surveillance and sensors and the freeways, surface street and rural roadways, e.g. where they are located, to which part(s) of the network their data applies, the type of data, and the ownership of each link (that is, the agency or entity responsible for collecting and storing surveillance of the link) in the network.
-
- Requirement:* 7 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic data.
-
- Requirement:* 8 The center shall distribute road network conditions data (raw or processed) based on collected and analyzed traffic sensor and surveillance data to other centers.
-
- Requirement:* 9 The center shall respond to control data from center personnel regarding sensor and surveillance data collection, analysis, storage, and distribution.

Functional Area: **TMC Probe Information Collection**

Collects, assimilates, and disseminates vehicle probe data collected from roadside beacons and centers controlling transit vehicles, emergency vehicles, toll collection points, and route-guided vehicles.

- Requirement:* 1 The center shall collect probe data including traffic and road conditions from vehicles via roadside beacon field elements; the data may be aggregated and initial link time calculations performed in the field.
-
- Requirement:* 2 The center shall collect road condition data from probe-equipped transit vehicles via transit management centers; the data may be aggregated and preliminarily processed at the sending center.
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- Requirement:* 3 The center shall collect traffic data from probe-equipped emergency vehicles via emergency management centers; the data may be aggregated and initial link time calculations performed at the sending center.
-
- Requirement:* 4 The center shall collect traffic data from traveler information centers based on data from their subscriber vehicles; the data may be aggregated and initial link time calculations performed at the sending center.
-
- Requirement:* 5 The center shall collect traffic data from toll administrative centers containing journey times between toll collection points for those vehicles equipped for electronic toll collection; the data may be aggregated and processed at the sending center.
-
- Requirement:* 6 The center shall assimilate current and forecast traffic and road conditions based on collected probe data and distribute to other centers for dissemination to travelers.
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- Requirement:* 7 The center shall collect operational status for the roadside probe data collection equipment.
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- Requirement:* 8 The center shall collect fault data for the roadside probe data collection equipment for repair.

Functional Area: **TMC Signal Control**

Architecture

Northern New Jersey ITS Architecture

Element: **NJDOT TOC Central**

Entity: **Traffic Management**

Functional Area: **TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

- Requirement:* 1 The center shall remotely control traffic signal controllers.
-
- Requirement:* 2 The center shall accept notifications of right-of-way requests from pedestrians.
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- Requirement:* 3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center.
-
- Requirement:* 4 The center shall collect traffic signal controller fault data from the field.
-
- Requirement:* 5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.
-

Functional Area: **TMC Freeway Management**

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

- Requirement:* 1 The center shall remotely control systems to manage use of the freeways, including ramp meters, mainline metering, and lane controls.
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- Requirement:* 2 The center shall collect operational status from ramp meters, mainline metering, and lane controls and compare against the control information sent by the center.
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- Requirement:* 3 The center shall collect fault data from ramp meters, mainline metering, and lane controls.
-
- Requirement:* 4 The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, mainline metering, and lane controls), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the ramps themselves.
-

Functional Area: **TMC Traffic Information Dissemination**

Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.

- Requirement:* 1 The center shall remotely control dynamic messages signs for dissemination of traffic and other information to drivers.
-
- Requirement:* 2 The center shall remotely control driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers.
-
- Requirement:* 3 The center shall collect operational status for the driver information systems equipment (DMS, HAR, etc.).
-
- Requirement:* 4 The center shall collect fault data for the driver information systems equipment (DMS, HAR, etc.) for repair.
-
- Requirement:* 5 The center shall retrieve locally stored traffic information, including current and forecasted traffic information, road and weather conditions, traffic incident information, information on diversions and alternate routes, closures, and special traffic restrictions (lane/shoulder use, weight restrictions, width restrictions, HOV requirements), etc.
-
- Requirement:* 6 The center shall distribute traffic data to maintenance and construction centers, transit centers, emergency management centers, and traveler information providers.
-
- Requirement:* 7 The center shall distribute traffic data to the media upon request; the capability to provide the information in both data stream and graphical display shall be supported.
-

Architecture

Northern New Jersey ITS Architecture

Element: **NJDOT TOC Central**

Entity: **Traffic Management**

Functional Area: **TMC Traffic Information Dissemination**

Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.

- Requirement:* 8 The center shall provide the capability for center personnel to control the nature of the data that is available to non-traffic operations centers and the media.
-

Functional Area: **TMC Regional Traffic Control**

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

- Requirement:* 1 The center shall exchange traffic information with other traffic management centers, includes incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.
-

- Requirement:* 2 The center shall exchange traffic control information with other traffic management centers, includes remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).
-

Functional Area: **TMC Incident Detection**

Remotely controls traffic and video sensors to support incident detection and verification; exchange information with other agencies including emergency management, maintenance and construction, alerting and advisory systems, event promoters, intermodal freight depots, and traveler information systems.

- Requirement:* 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.
-

- Requirement:* 2 The center shall collect and store traffic flow and image data from the field equipment to detect and verify incidents.
-

- Requirement:* 3 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, and intermodal freight depots.
-

- Requirement:* 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.
-

- Requirement:* 5 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field.
-

- Requirement:* 6 The center shall provide road network conditions and traffic images to emergency management centers to support the detection, verification, and classification of incidents.
-

- Requirement:* 7 The center shall provide video and traffic sensor control commands to the field equipment to detect and verify incidents.
-

Functional Area: **TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TOC Central***Entity:* **Traffic Management***Functional Area:* **TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

- Requirement:* 1 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction for distribution to the public. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, and information and instructions necessary for the public to respond to the alert. This may also identify specific information that should not be released to the public.
-
- Requirement:* 2 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.
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- Requirement:* 3 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field, provide special routing for emergency vehicles, and to provide responding emergency vehicles with signal preemption.
-
- Requirement:* 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.
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- Requirement:* 5 The center shall respond to requests from emergency management to provide traffic management resources to implement special traffic control measures, assist in clean up, verify an incident, etc. This may also involve coordination with maintenance centers.
-
- Requirement:* 6 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, media, and rail operations centers.
-
- Requirement:* 7 The center shall provide road network conditions and traffic images to emergency management centers, maintenance and construction centers, and traveler information service providers.
-
- Requirement:* 8 The center shall exchange road network status assessment information with emergency management and maintenance centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.
-
- Requirement:* 9 The center shall coordinate information and controls with other traffic management centers.
-
- Requirement:* 10 The center shall receive inputs from emergency management and transit management centers to develop an overall status of the transportation system including emergency transit schedules in effect and current status and condition of the transportation infrastructure.
-
- Requirement:* 11 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic incident management.

Functional Area: **TMC Evacuation Support**

Development, coordination, and execution of special traffic management strategies during evacuation and subsequent reentry of a population in the vicinity of a disaster or major emergency. Interfaces with emergency management and other traffic management centers.

- Requirement:* 1 The center shall coordinate planning for evacuation with emergency management centers - including pre-planning activities such as establishing routes, areas to be evacuated, timing, etc.
-
- Requirement:* 2 The center shall support requests from emergency management centers to preempt the current traffic control strategy, activate traffic control and closure systems such as gates and barriers, activate safeguard systems, or use driver information systems to support evacuation traffic control plans.

Architecture

Northern New Jersey ITS Architecture

Element: **NJDOT TOC Central**

Entity: **Traffic Management**

Functional Area: **TMC Evacuation Support**

Development, coordination, and execution of special traffic management strategies during evacuation and subsequent reentry of a population in the vicinity of a disaster or major emergency. Interfaces with emergency management and other traffic management centers.

Requirement: 3 The center shall coordinate information and controls with other traffic management centers.

Requirement: 4 The center shall coordinate execution of evacuation strategies with emergency management centers - including activities such as setting closures and detours, establishing routes, updating areas to be evacuated, timing the process, etc.

Functional Area: **TMC Environmental Monitoring**

Management of environmental sensors and assimilation of collected data with other current and forecast road conditions and surface weather information from weather service providers and roadway maintenance operations.

Requirement: 1 The center shall remotely control environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures.

Requirement: 2 The center shall remotely control environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.

Requirement: 3 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services), data from roadway maintenance operations, and environmental data collected from sensors deployed on and about the roadway.

Requirement: 4 The center shall provide weather and road condition information to weather service providers and center personnel.

Requirement: 5 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.

Functional Area: **HRI Traffic Management**

Remotely monitor and control highway-rail intersection (HRI) equipment, includes standard speed active warning systems and high speed systems which provide additional information on approaching trains and detect and report on obstructions in the HRI.

Requirement: 1 The center shall remotely control highway-rail intersection (HRI) equipment located in the field.

Requirement: 2 The center shall accept collect highway-rail intersection (HRI) advisory or alert data from rail operations centers.

Requirement: 3 The center shall collect highway-rail intersection (HRI) equipment operational status and compare against the control information sent by the center.

Requirement: 4 The center shall provide the highway-rail intersection (HRI) equipment operational status to rail operations centers.

Requirement: 5 The center shall collect incident information related to a highway-rail intersection (HRI), such as intersection blockages or crashes or equipment malfunctions.

Requirement: 6 The center shall implement control plans to coordinate signalized intersections around highway-rail intersections (HRI), under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, equipment faults, pedestrian crossings, etc.

Functional Area: **TMC Multimodal Crossing Management**

Remotely monitors and manages multimodal crossings, such as draw bridges and other crossings between highway traffic and other modes; does not include highway-rail intersection.

Architecture

Northern New Jersey ITS Architecture

Element: **NJDOT TOC Central**

Entity: **Traffic Management**

Functional Area: **TMC Multimodal Crossing Management**

Remotely monitors and manages multimodal crossings, such as draw bridges and other crossings between highway traffic and other modes; does not include highway-rail intersection.

Requirement: 1 The center shall receive requests from non-highway traffic to cross at multimodal crossings for specified durations (such as draw bridges and miscellaneous other interference crossings between highway traffic and other modes such as river traffic, aircraft, etc.)

Requirement: 2 The center shall remotely control traffic signal controllers for use at major multimodal crossings.

Requirement: 3 The center shall remotely control driver information systems (such as dynamic messages signs, highway advisory radios (HAR), and equipment that controls warning lights and gates) to notify drivers of closure durations and times at multimodal crossings.

Requirement: 4 The center shall collect operational status for the equipment at multimodal crossings.

Requirement: 5 The center shall collect fault data for the equipment at multimodal crossings for repair.

Requirement: 6 The center shall receive and respond to requests for right-of-way at multimodal crossings.

Requirement: 7 The center shall collect and analyze the planned multimodal crossing closures as a possible incident.

Requirement: 8 The center shall distribute multimodal crossing information to other centers for dissemination to travelers.

Functional Area: **Barrier System Management**

Remotely controls barrier systems such as gates and other systems that manage entry to roadways, transportation facilities and infrastructure.

Requirement: 1 The center shall remotely control barrier systems for transportation facilities and infrastructure. Barrier systems include automated or remotely controlled gates, barriers and other systems that manage entry to roadways.

Requirement: 2 The center shall collect barrier system operational status.

Requirement: 3 The center shall collect barrier system fault data and send to the maintenance center for repair.

Requirement: 4 The center shall accept requests for barrier system activation from other centers and from center personnel to support emergency response and detours.

Functional Area: **Safeguard System Management**

Remotely controls safeguard systems such as blast shields and tunnel exhaust systems that are used to mitigate the impact of incidents on transportation infrastructure.

Requirement: 1 The center shall remotely control safeguard systems, equipment used to mitigate the impact of incidents on transportation infrastructure (e.g., blast shields, tunnel exhaust systems, etc.)

Requirement: 2 The center shall collect safeguard system operational status.

Requirement: 3 The center shall collect safeguard system fault data and send to the maintenance center for repair.

Requirement: 4 The center shall accept requests for safeguard system activation from other centers and from center personnel to support emergency response.

Functional Area: **Traffic Maintenance**

Monitoring and remote diagnostics of field equipment - detect failures, issue problem reports, and track the repair or replacement of the failed equipment.

Requirement: 1 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) operational status.

Requirement: 2 The center shall collect and store CCTV surveillance system (traffic, pedestrian) operational status.

Requirement: 3 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) fault data and send to the maintenance center for repair.

Architecture

Northern New Jersey ITS Architecture

Element: **NJDOT TOC Central**

Entity: **Traffic Management**

Functional Area: **Traffic Maintenance**

Monitoring and remote diagnostics of field equipment - detect failures, issue problem reports, and track the repair or replacement of the failed equipment.

- Requirement:* 4 The center shall collect and store CCTV surveillance system (traffic, pedestrian) fault data send to the maintenance center for repair.
-
- Requirement:* 5 The center shall collect environmental sensor operational status.
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- Requirement:* 6 The center shall collect environmental sensor equipment fault data and send to the maintenance center for repair.
-
- Requirement:* 7 The center shall exchange data with maintenance centers concerning the reporting of faulty equipment and the schedule/status of their repair. Information exchanged includes details of new equipment faults, and clearances when the faults are cleared.
-
- Requirement:* 8 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic maintenance data.
-

Functional Area: **TMC Work Zone Traffic Management**

Coordination with maintenance systems using work zone images and traveler information systems (such as DMS), and distribution of work plans so that work zones are established that have minimum traffic impact.

- Requirement:* 1 The center shall receive work zone images from a maintenance center.
-
- Requirement:* 2 The center shall analyze work zone images for indications of a possible incident.
-
- Requirement:* 3 The center shall remotely control driver information systems (such as dynamic messages signs, highway advisory radios) to advise drivers of activity around a work zone.
-
- Requirement:* 4 The center shall collect operational status for the driver information systems equipment in work zones.
-
- Requirement:* 5 The center shall collect fault data for the driver information systems equipment in work zones for repair.
-
- Requirement:* 6 The center shall receive proposed maintenance and construction work plans, analyze the activity as a possible incident, and provide work plan feedback to the sending center.
-

Functional Area: **TMC Multimodal Coordination**

Provides traffic signal priority for transit vehicles based on center-to-center communications with the transit management center; also exchange traffic and transit information.

- Requirement:* 1 The center shall respond to requests from transit management centers for signal priority at one or more intersections along a particular transit route.
-
- Requirement:* 2 The center shall exchange information with transit management centers including details current transit routes, the level of service on each route, and the progress of individual vehicles along their routes.
-

Functional Area: **TMC Input to In-Vehicle Signing**

Formats and outputs information to field equipment that supports in-vehicle signage equipment communications.

- Requirement:* 1 The center shall format and output road condition and environmental information to field equipment that supports in-vehicle signage communications.
-
- Requirement:* 2 The center shall format and output advisory information, such as evacuation information, wide-area alerts, incident information, work zone intrusion information, and other special information to field equipment that supports in-vehicle signage communications.
-

Architecture**Northern New Jersey ITS Architecture***Element:***NJDOT TOC Central***Entity:***Traffic Management***Functional Area:* **TMC Input to In-Vehicle Signing**

Formats and outputs information to field equipment that supports in-vehicle signage equipment communications.

- Requirement:* 3 The center shall format and output indicator and fixed sign information, such as actual intersection traffic signal states, stop, or yield signs to field equipment that supports in-vehicle signage communications.
- Requirement:* 4 The center shall receive system operational status from field equipment that supports in-vehicle signage communications.
- Requirement:* 5 The center shall receive system fault data from field equipment that supports in-vehicle signage communications.

Functional Area: **Traffic Data Collection**

Collection and storage of traffic management data. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect traffic management data such as operational data, event logs, etc.
- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.
- Requirement:* 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the traffic data or for the data itself.
- Requirement:* 4 The center shall be able to produce sample products of the data available.

*Element:***NJDOT TOC North***Entity:***Emergency Management***Functional Area:* **Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

- Requirement:* 1 The center shall support the interface to the Emergency Telecommunications System (e.g. 911 or 7-digit call routing) to receive emergency notification information and provide it to the emergency system operator.
- Requirement:* 2 The center shall receive emergency call information from 911 services and present the possible incident information to the emergency system operator.
- Requirement:* 3 The center shall receive emergency call information from motorist call-boxes and present the possible incident information to the emergency system operator.
- Requirement:* 4 The center shall receive emergency call information from mayday service providers and present the possible incident information to the emergency system operator.
- Requirement:* 5 The center shall receive emergency notification information from other public safety agencies and present the possible incident information to the emergency system operator.
- Requirement:* 6 The center shall receive emergency notification information from public transit systems and present the possible incident information to the emergency system operator.
- Requirement:* 7 The center shall receive emergency notification information from commercial vehicles, commercial vehicle check stations, or commercial fleet operators and present the possible incident information to the emergency system operator. This may include detection of non-permitted transport of security sensitive hazmat, hazardous cargo spills, etc.

Architecture

Northern New Jersey ITS Architecture

Element: **NJDOT TOC North**

Entity: **Emergency Management**

Functional Area: **Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

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| <i>Requirement:</i> | 8 The center shall receive details of the cargo being carried by commercial vehicles from their commercial fleet manager for incidents involving potential hazardous materials. |
| <i>Requirement:</i> | 9 The center shall coordinate, correlate, and verify all emergency inputs, including those identified based on external calls and internal analysis of security sensor and surveillance data, and assign each a level of confidence. |
| <i>Requirement:</i> | 10 The center shall send a request for remote control of CCTV systems from a traffic management center in order to verify the reported incident. |
| <i>Requirement:</i> | 11 The center shall update the incident information log once the emergency system operator has verified the incident. |
| <i>Requirement:</i> | 12 The center shall provide the capability for digitized map data to act as the background to the emergency information presented to the emergency system operator. |
| <i>Requirement:</i> | 13 The center shall forward the verified emergency information to the responding agency based on the location and nature of the emergency. |
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Functional Area: **Emergency Dispatch**

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

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| <i>Requirement:</i> | 1 The center shall dispatch emergency vehicles to respond to verified emergencies and provide suggested routing under center personnel control. |
| <i>Requirement:</i> | 2 The center shall store the current status of all emergency vehicles available for dispatch and those that have been dispatched. |
| <i>Requirement:</i> | 3 The center shall relay location and incident details to the responding vehicles. |
| <i>Requirement:</i> | 4 The center shall provide the capability to request traffic control measures from traffic management centers such as signal preemption, traffic barriers and road closures. |
| <i>Requirement:</i> | 5 The center shall track the location and status of emergency vehicles responding to an emergency and update the incident status based on information from the emergency vehicle. |
| <i>Requirement:</i> | 6 The center shall receive status information from care facilities to determine the appropriate facility and its location. |
| <i>Requirement:</i> | 7 The center shall store and maintain the emergency service responses in an action log. |
| <i>Requirement:</i> | 8 The center shall receive asset restriction information from maintenance centers to support the dispatching of appropriate emergency resources. |
| <i>Requirement:</i> | 9 The center shall receive traffic information, including closures, traffic conditions, etc. from traffic management centers. |
| <i>Requirement:</i> | 10 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator. |
| <i>Requirement:</i> | 11 The center shall receive road network conditions and traffic images to support dispatch of emergency vehicles. |
| <i>Requirement:</i> | 12 The center shall coordinate response to incidents with other Emergency Management centers to ensure appropriate resources are dispatched and utilized. |
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Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TOC North***Entity:* **Emergency Management***Functional Area:* **Emergency Routing**

Routing of emergency vehicles to facilitate the quickest/safest arrival. Routes may be determined based on real-time traffic information and road conditions or routes may be provided by Traffic Management on request.

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| <i>Requirement:</i> | 1 The center shall collect current traffic and road condition information from traffic management centers for emergency vehicle route calculation. |
| <i>Requirement:</i> | 2 The center shall receive inputs from traffic management and maintenance centers on the location and status of traffic control equipment and work zones along potential emergency routes. |
| <i>Requirement:</i> | 3 The center shall calculate emergency vehicle routes based on information from traffic management and maintenance centers. |
| <i>Requirement:</i> | 4 In special circumstances such as during disasters and evacuations when normal routes are not available, the center shall request a route from the traffic management center. |
| <i>Requirement:</i> | 5 The center shall provide the capability to request special traffic control measures from the traffic management center to facilitate emergency vehicle progress along the suggested route. |
| <i>Requirement:</i> | 6 Once the route is calculated the route shall be provided to the dispatch function. |

Functional Area: **Emergency Early Warning System**

Monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies in order to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to other ITS centers to notify the traveling public. Includes support for Child Abduction notices.

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| <i>Requirement:</i> | 1 The center shall monitor information from Alerting and Advisory Systems such as the Information Sharing and Analysis Centers (ISACs), the National Infrastructure Protection Center (NIPC), the Homeland Security Advisory System (HSAS), etc. The information may include assessments (general incident and vulnerability awareness information), advisories (identification of threats or recommendations to increase preparedness levels), or alerts (information on imminent or in-progress emergencies). |
| <i>Requirement:</i> | 2 The center shall provide the capability to correlate alerts and advisories, incident information, and security sensor and surveillance data. |
| <i>Requirement:</i> | 3 The center shall broadcast wide-area alerts and advisories to traffic management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property. |
| <i>Requirement:</i> | 4 The center shall broadcast wide-area alerts and advisories to transit management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property. |
| <i>Requirement:</i> | 5 The center shall broadcast wide-area alerts and advisories to toll administration centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property. |
| <i>Requirement:</i> | 6 The center shall broadcast wide-area alerts and advisories to traveler information service providers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property. |
| <i>Requirement:</i> | 7 The center shall broadcast wide-area alerts and advisories to maintenance centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property. |
| <i>Requirement:</i> | 8 The center shall broadcast wide-area alerts and advisories to other emergency management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property. |

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TOC North***Entity:* **Emergency Management***Functional Area:* **Emergency Early Warning System**

Monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies in order to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to other ITS centers to notify the traveling public. Includes support for Child Abduction notices.

Requirement: 9 The center shall process status information from each of the centers that have been sent the wide-area alert.

Requirement: 10 The center shall coordinate the broadcast of wide-area alerts and advisories with other emergency management centers.

Requirement: 11 The center shall receive incident information from other transportation management centers to support the early warning system.

Requirement: 12 The center shall present the alert and advisory information and the status of the actions taken in response to the alert by the other centers to the emergency system operator as received from other system inputs.

Requirement: 13 The center shall support the entry of alert and advisory information directly from the emergency system operator.

Functional Area: **Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

Requirement: 1 The center shall provide strategic emergency response capabilities such as that of an Emergency Operations Center for large-scale incidents and disasters.

Requirement: 2 The center shall manage coordinated inter-agency responses to and recovery from large-scale emergencies. Such agencies include traffic management, transit, maintenance and construction management, rail operations, and other emergency management agencies.

Requirement: 3 The center shall provide the capability to implement response plans and track progress through the incident by exchanging incident information and distributing response status to allied agencies.

Requirement: 4 The center shall develop, coordinate with other agencies, and store emergency response plans.

Requirement: 5 The center shall track the availability of resources (including vehicles, roadway cleanup?, etc.), request additional resources from traffic, maintenance, or other emergency centers if needed.

Requirement: 6 The center shall allocate the appropriate emergency services, resources, and vehicle (s) to respond to incidents, and shall provide the capability to override the current allocation to suit the special needs of a current incident.

Requirement: 7 The center shall receive event scheduling information from Event Promoters.

Requirement: 8 The center shall receive hazardous materials incident information from commercial fleet operators.

Requirement: 9 The center shall provide the capability to request the safe disabling of a commercial vehicle during a hazardous materials incident.

Requirement: 10 The center shall provide the capability to request transit resource availability from transit centers for use during disaster and evacuation operations.

Requirement: 11 The center shall assimilate the status of the transit, traffic, rail, maintenance, and other emergency center services and systems to create an overall transportation system status, and disseminate to each of these centers and the traveling public via traveler information providers.

Requirement: 12 The center shall provide information to the media concerning the status of an emergency response.

Requirement: 13 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TOC North***Entity:* **Emergency Management***Functional Area:* **Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

- Requirement:* 14 The center shall provide the capability for center personnel to provide inputs to the management of incidents, disasters and evacuations.

Functional Area: **Incident Command**

Tactical decision support, resource coordination, and communications integration among emergency management agencies for Incident Commands that are established by first responders to support local management of an incident.

- Requirement:* 1 The center shall provide tactical decision support, resource coordination, and communications integration for Incident Commands that are established by first responders to support local management of an incident.

- Requirement:* 2 The center shall provide incident command communications with public safety, emergency management, transportation, and other allied response agency centers.

- Requirement:* 3 The center shall track and maintain resource information and action plans pertaining to the incident command.

- Requirement:* 4 The center shall share incident command information with other public safety agencies including resource deployment status, hazardous material information, rail incident information, evacuation advice as well as traffic, road, and weather conditions.

- Requirement:* 5 The center shall assess the status of responding emergency vehicles as part of an incident command.

Functional Area: **Emergency Evacuation Support**

Evacuation planning and coordination to manage evacuation and reentry of a population in the vicinity of a disaster or other emergency that poses a risk to public safety.

- Requirement:* 1 The center shall manage inter-agency coordination of evacuation operations, from initial planning through the evacuation process and reentry.

- Requirement:* 2 The center shall develop and exchange evacuation plans with allied agencies prior to the occurrence of a disaster.

- Requirement:* 3 The center shall provide an interface to the emergency system operator to enter evacuation plans and procedures and present the operator with other agencies' plans.

- Requirement:* 4 The center shall coordinate evacuation destinations and shelter needs with shelter providers (e.g., the American Red Cross) in the region.

- Requirement:* 5 The center shall provide evacuation information to traffic, transit, maintenance and construction, rail operations, and other emergency management centers as needed.

- Requirement:* 6 The center shall request resources from transit agencies as needed to support the evacuation.

- Requirement:* 7 The center shall request traffic management agencies to implement special traffic control strategies and to control evacuation traffic, including traffic on local streets and arterials as well as the major evacuation routes.

- Requirement:* 8 The center shall provide traveler information systems with evacuation guidance including basic information to assist potential evacuees in determining whether evacuation is necessary and when it is safe to return.

- Requirement:* 9 The center shall monitor the progress or status of the evacuation once it begins and exchange tactical plans, prepared during the incident, with allied agencies.

- Requirement:* 10 The center shall monitor the progress of the reentry process.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TOC North***Entity:* **Emergency Management***Functional Area:* **Emergency Evacuation Support**

Evacuation planning and coordination to manage evacuation and reentry of a population in the vicinity of a disaster or other emergency that poses a risk to public safety.

- Requirement:* 11 The center shall submit evacuation information to toll administration centers along with requests for changes in the toll services or fee collection during an evacuation.

Functional Area: **Emergency Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and emergency vehicles equipped with environmental sensors; used by the operator to more effectively manage incidents.

- Requirement:* 1 The center shall collect current and forecast road and weather information from weather service providers (such as the National Weather Service and value-added sector specific meteorological services).

- Requirement:* 2 The center shall receive environmental probe information from its fleet of emergency vehicles.

- Requirement:* 3 The center shall collect current road and weather information from roadway maintenance operations.

- Requirement:* 4 The center shall assimilate current and forecast road conditions and surface weather information to support incident management.

- Requirement:* 5 The center shall present the current and forecast road and weather information to the emergency system operator.

- Requirement:* 6 The center shall provide aggregated or processed environmental probe information from its fleet of emergency vehicles to traffic management and maintenance centers.

Functional Area: **Center Secure Area Surveillance**

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 1 The center shall remotely monitor video images and audio surveillance data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The data may be raw or pre-processed in the field.

- Requirement:* 2 The center shall remotely monitor video images and audio surveillance data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The data may be raw or pre-processed in the field.

- Requirement:* 3 The center shall remotely monitor video images and audio surveillance data collected on-board transit vehicles. The data may be raw or pre-processed in the field.

- Requirement:* 4 The center shall exchange surveillance data with other emergency centers.

- Requirement:* 5 The center shall identify potential security threats based on collected security surveillance data.

- Requirement:* 6 The center shall verify potential security threats by correlating security surveillance data from multiple sources.

- Requirement:* 7 The center shall remotely control security surveillance devices in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways).

- Requirement:* 8 The center shall remotely control security surveillance devices in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers).

- Requirement:* 9 The center shall remotely control security surveillance devices on-board transit vehicles.

Architecture**Northern New Jersey ITS Architecture***Element:***NJDOT TOC North***Entity:***Emergency Management***Functional Area:* **Center Secure Area Surveillance**

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

Requirement: 10 The center shall match traveler video images against a database from the Alerting and Advisory Systems of known images that may represent criminals and terrorists.

Requirement: 11 The center shall exchange traveler images with other emergency management centers to support traveler image matching.

Requirement: 12 The center shall respond to control data from center personnel regarding security surveillance data collection, processing, threat detection, and image matching.

Functional Area: **Center Secure Area Sensor Management**

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

Requirement: 1 The center shall remotely monitor and control security sensor data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), infrastructure condition and integrity, intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.

Requirement: 2 The center shall remotely monitor and control security sensor data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.

Requirement: 3 The center shall remotely monitor and control security sensor data collected on-board transit vehicles. The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors) and object detection sensors. The data may be raw or pre-processed in the field.

Requirement: 4 The center shall exchange security sensor data with other emergency centers.

Requirement: 5 The center shall identify potential security threats based on collected security sensor data.

Requirement: 6 The center shall verify potential security threats by correlating security sensor data from multiple sources.

Requirement: 7 The center shall perform threat analysis based on correlations of security sensor and surveillance data.

Requirement: 8 The center shall exchange threat analysis data with Alerting and Advisory Systems and use that data in local threat analysis processing.

Requirement: 9 The center shall disseminate threat information to other agencies, including traffic, transit, maintenance, rail operations, and other emergency management centers.

Requirement: 10 The center shall respond to control data from center personnel regarding security sensor data collection, processing, threat detection, and threat analysis.

Functional Area: **Service Patrol Management**

Dispatch and communication with roadway service patrol vehicles that monitor roads to aid motorists, offering rapid response to minor incidents.

Architecture**Northern New Jersey ITS Architecture***Element:***NJDOT TOC North***Entity:***Emergency Management***Functional Area:* **Service Patrol Management**

Dispatch and communication with roadway service patrol vehicles that monitor roads to aid motorists, offering rapid response to minor incidents.

- Requirement:* 1 The center shall dispatch roadway service patrol vehicles to identified incident locations.
- Requirement:* 2 The center shall store the current status of all service patrol vehicles available for dispatch and those that have been dispatched.
- Requirement:* 3 The center shall share incident information collected by the service patrol with traffic, maintenance and construction, and traveler information centers for incident management, incident notification to travelers, and incident cleanup.
- Requirement:* 4 The center shall track the location and status of service patrol vehicles.

Functional Area: **Emergency Data Collection**

Collection and storage of information related to Emergency Management. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect emergency service data, emergency vehicle management data, emergency vehicle data, sensor and surveillance data, threat data, and incident data.
- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.
- Requirement:* 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the emergency management data or for the data itself.
- Requirement:* 4 The center shall be able to produce sample products of the data available.

*Entity:***Maintenance and Construction Management***Functional Area:* **MCM Environmental Information Collection**

Remotely controls environmental sensors and assimilates collected data with other current and forecast road conditions and surface weather information from weather service providers and transportation operations.

- Requirement:* 1 The center shall remotely control environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures.
- Requirement:* 2 The center shall remotely control environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.
- Requirement:* 3 The center shall remotely control environmental sensors on-board maintenance and construction vehicles that measure road and weather conditions including air and surface temperatures, wind speed, humidity, precipitation, visibility and other measures.
- Requirement:* 4 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services), data from traffic, emergency, and transit management, traveler information providers, and environmental data collected from sensors deployed on and about the roadway as well as the fleet of maintenance and construction vehicles.
- Requirement:* 5 The center shall provide weather and road condition information to weather service providers and center personnel.
- Requirement:* 6 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.
- Requirement:* 7 The center shall collect operational status for the roadside and vehicle-based environmental sensor equipment.

Architecture

Northern New Jersey ITS Architecture

Element: **NJDOT TOC North**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Environmental Information Collection**

Remotely controls environmental sensors and assimilates collected data with other current and forecast road conditions and surface weather information from weather service providers and transportation operations.

- Requirement:* 8 The center shall collect fault data for the roadside and vehicle-based environmental sensor equipment for repair.
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Functional Area: **MCM Environmental Information Processing**

Processes current and forecast weather data, road condition information, local environmental data, and uses internal models to develop specialized detailed forecasts of local weather and surface conditions. Disseminates road weather information to other agencies and centers.

- Requirement:* 1 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.
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- Requirement:* 2 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services) and local environmental sensor data.
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- Requirement:* 3 The center shall use the various data inputs of environmental sensors and road weather data to develop a view of current and predicted road weather and road conditions.
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- Requirement:* 4 The center shall disseminate current and forecasted road weather and road condition information to weather service providers (such as the National Weather Service and value-added sector specific meteorological services) as well as other agencies including traffic, emergency, and transit management, traveler information providers, rail operations centers, media, and other maintenance management centers.
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- Requirement:* 5 The center shall provide value-added sector specific meteorological services with information on basic road facility and treatment information that supports forecasts for road conditions.
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Functional Area: **MCM Incident Management**

Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.

- Requirement:* 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.
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- Requirement:* 2 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, etc.
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- Requirement:* 3 The center shall exchange incident and threat information with emergency management centers as well as traffic management centers; including notification of existence of incident and expected severity, location, time and nature of incident.
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- Requirement:* 4 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.
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- Requirement:* 5 The center shall respond to requests from emergency management to provide maintenance and construction resources to implement response plans, assist in clean up, verify an incident, etc. This may also involve coordination with traffic management centers and other maintenance centers.
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- Requirement:* 6 The center shall exchange road network status assessment information with emergency management and traffic management centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.
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Architecture

Northern New Jersey ITS Architecture

Element: **NJDOT TOC North**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Incident Management**

Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.

Requirement: 7 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

Requirement: 8 The center shall receive information indicating the damage sustained by transportation assets, derived from aerial surveillance, field reports, inspections, tests, and analyses to support incident management.

Functional Area: **MCM Maintenance Decision Support**

Maintenance Decision Support Systems recommend courses of action based on current and forecast environmental and road conditions (filtered and fused for specific time horizons) and additional application specific information. Recommendations and dispatch instructions are generated based on this integrated information.

Requirement: 1 The center shall provide the center personnel with tailored external information, including weather or road condition observations, forecasted weather information or road conditions, current usage of treatments and materials, available resources, equipment and vehicle availability, road network information, and source reliability information.

Requirement: 2 The center shall tailor the decision support information to include filtering (selection from a large amount of external information), error reduction ('smoothing' the information), fusion (combination of disparate information to match the decision needs), and analysis (creating the decision).

Requirement: 3 The center shall provide an interface to the center personnel to input control parameters for the decision support process and receive decisions or information presentation.

Requirement: 4 The center shall provide dispatch information to maintenance and construction vehicles based on the outputs of the decision support system, including recommended roadway treatment actions.

Functional Area: **MCM Winter Maintenance Management**

Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.

Requirement: 1 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other winter roadway maintenance.

Requirement: 2 The center shall exchange information with administrative systems to support the planning and scheduling of winter maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.

Requirement: 3 The center shall provide status information about scheduled winter maintenance activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, and the media.

Requirement: 4 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of winter maintenance activities.

Requirement: 5 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of winter maintenance activities.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TOC North***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Winter Maintenance Management**

Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.

- Requirement:* 6 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
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- Requirement:* 7 The center shall dispatch and route winter maintenance vehicle drivers and support them with route-specific environmental, incident, advisory, threat, alert, and traffic congestion information.
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- Requirement:* 8 The center shall determine the need for roadway treatment based on current and forecasted weather information, current usage of treatments and materials, available resources, requests for action from other agencies, and recommendations from the Maintenance Decision Support system, specifically under winter conditions. This supports winter maintenance such as plowing, treating, anti-icing, etc.
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- Requirement:* 9 The center shall provide dispatch instructions for vehicle operators based on input parameters from center personnel, specifically for winter conditions. This could include a treatment route, treatment application rates, start and end times, and other treatment instructions.
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- Requirement:* 10 The center shall support remote control of on-board maintenance and construction vehicle systems and field equipment that is remotely controlled by the vehicle such as adjusting material application rates and spread patterns.
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- Requirement:* 11 The center shall assess the current status of all winter maintenance activities, including actual work activities performed, current locations and operational conditions of vehicles, materials and equipment inventories, field equipment status, environmental information, etc.

Functional Area: **MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

- Requirement:* 1 The center shall maintain an interface with asset management systems to track the inventory, restrictions, repair needs and status updates of transportation assets (pavement, bridges, signs, etc.) including location, installation and materials information, vendor/contractor, current maintenance status, standard height, width, and weight restrictions.
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- Requirement:* 2 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other roadway maintenance.
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- Requirement:* 3 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
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- Requirement:* 4 The center shall provide emergency management and traffic management centers with information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.
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- Requirement:* 5 The center shall collect the status and fault data from roadside equipment, such as traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.

Architecture

Northern New Jersey ITS Architecture

Element: **NJDOT TOC North**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

- Requirement:* 6 The center shall collect the status and fault data from traffic management centers, including data for traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
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- Requirement:* 7 The center shall remotely control and collect data from infrastructure monitoring sensors located along the roadway infrastructure or on maintenance and construction vehicles.
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- Requirement:* 8 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of roadway maintenance and construction activities.
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- Requirement:* 9 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of roadway maintenance and construction activities.
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- Requirement:* 10 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
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- Requirement:* 11 The center shall dispatch and route maintenance and construction vehicle drivers and support them with route- specific environmental, incident, advisory, threat, alert, and traffic congestion information.
-
- Requirement:* 12 The center shall manage an interface with center personnel to accept vehicle systems control information and remotely control maintenance and construction vehicle on-board equipment.
-
- Requirement:* 13 The center shall track the status of roadway maintenance and construction activities by monitoring collected data from the dispatched vehicles and equipment.
-

Functional Area: **MCM Work Zone Management**

Remotely monitors and supports work zone activities, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).

- Requirement:* 1 The center shall generate new work zone activity schedules for use by maintenance and construction vehicles, maintenance and construction operators, and for information coordination purposes.
-
- Requirement:* 2 The center shall control the collection of work zone status information including video images from cameras located in or near the work zone.
-
- Requirement:* 3 The center shall disseminate work zone information to other agencies and centers including traffic, transit, emergency management centers, other maintenance centers, traveler information providers, and the media.
-
- Requirement:* 4 The center shall control traffic in work zones by providing remote control of dynamic message signs and highway advisory radio systems located in or near the work zone.
-
- Requirement:* 5 The center shall exchange information with administrative systems to support the planning and scheduling of work zone activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
-

Functional Area: **MCM Speed Monitoring**

Remotely monitors vehicle speeds, and informs an enforcement agency if excessive speeds are detected; primarily used in work zones.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TOC North***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Speed Monitoring**

Remotely monitors vehicle speeds, and informs an enforcement agency if excessive speeds are detected; primarily used in work zones.

- Requirement:*
- 1 The center shall remotely control vehicle speed sensors typically placed in work zones; control parameters may include environmental and traffic conditions.
 - 2 The center shall collect operational status for the vehicle speed sensors; the status shall include logged information including measured speeds, warning messages displayed, and violation records.
 - 3 The center shall provide the capability to notify an enforcement agency when vehicle speeds in the work zone are in excess of the posted speed limit or are creating an unsafe condition based upon the current environmental or traffic conditions.
 - 4 The center shall collect fault data for the vehicle speed sensors for repair.

Functional Area: **MCM Work Zone Safety Management**

Remotely monitors work zone safety systems that detect vehicle intrusions in work zones and warns crew workers and drivers of imminent encroachment. Crew movements are also monitored so that the crew can be warned of movement beyond the designated safe zone.

- Requirement:*
- 1 The center shall provide remote monitoring and control of work zone safety devices - including intrusion detection devices that have been installed in work zones or maintenance areas.
 - 2 The center shall provide remote monitoring and control of intrusion alert devices that have been installed in work zones or maintenance areas.
 - 3 The center shall collect status information of work zone safety device status from field equipment or the maintenance and construction vehicles.
 - 4 The center shall collect and store work zone data collected from work zone monitoring devices (such as intrusion detection or alert devices and speed monitoring devices) on-board the vehicle and at the roadside.

Functional Area: **MCM Work Activity Coordination**

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

- Requirement:*
- 1 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.
 - 2 The center shall provide status information about scheduled maintenance and construction activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, multimodal transportation providers, rail operations, and the media.
 - 3 The center shall collect and respond to feedback concerning scheduled maintenance and construction activities with other management centers such as traffic, emergency, transit, and rail operations.
 - 4 The center shall collect and disseminate asset restriction information levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TOC North***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Work Activity Coordination**

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

- Requirement:* 5 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance and construction activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.

- Requirement:* 6 The center shall exchange rail schedules and work plans with rail operations centers.

Functional Area: **MCM Data Collection**

Collection and storage of maintenance and construction information. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect maintenance and construction data (such as field equipment status, infrastructure status, maintenance and construction activity data) gathered from roadway, traffic, and other maintenance and construction sources.

- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

- Requirement:* 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the maintenance and construction data or for the data itself.

- Requirement:* 4 The center shall be able to produce sample products of the data available.

- Requirement:* 5 The center shall provide data to Asset Management to be used in updating the status of assets in the inventory.

Entity: **Traffic Management***Functional Area:* **Collect Traffic Surveillance**

Management of traffic sensors and surveillance (CCTV) equipment, and distribution of the collected information to other centers and operators.

- Requirement:* 1 The center shall monitor, analyze, and store traffic sensor data (speed, volume, occupancy) collected from field elements under remote control of the center.

- Requirement:* 2 The center shall monitor, analyze, and distribute traffic images from CCTV systems under remote control of the center.

- Requirement:* 3 The center shall monitor, analyze, and store pedestrian sensor data collected from field elements under remote control of the center.

- Requirement:* 4 The center shall monitor, analyze, and distribute pedestrian images from CCTV systems under remote control of the center.

- Requirement:* 5 The center shall monitor, analyze, and store multimodal crossing and high occupancy vehicle (HOV) lane sensor data under remote control of the center.

- Requirement:* 6 The center shall maintain a database of surveillance and sensors and the freeways, surface street and rural roadways, e.g. where they are located, to which part(s) of the network their data applies, the type of data, and the ownership of each link (that is, the agency or entity responsible for collecting and storing surveillance of the link) in the network.

- Requirement:* 7 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic data.

Architecture

Northern New Jersey ITS Architecture

Element: **NJDOT TOC North**

Entity: **Traffic Management**

Functional Area: **Collect Traffic Surveillance**

Management of traffic sensors and surveillance (CCTV) equipment, and distribution of the collected information to other centers and operators.

Requirement: 8 The center shall distribute road network conditions data (raw or processed) based on collected and analyzed traffic sensor and surveillance data to other centers.

Requirement: 9 The center shall respond to control data from center personnel regarding sensor and surveillance data collection, analysis, storage, and distribution.

Functional Area: **TMC Probe Information Collection**

Collects, assimilates, and disseminates vehicle probe data collected from roadside beacons and centers controlling transit vehicles, emergency vehicles, toll collection points, and route-guided vehicles.

Requirement: 1 The center shall collect probe data including traffic and road conditions from vehicles via roadside beacon field elements; the data may be aggregated and initial link time calculations performed in the field.

Requirement: 2 The center shall collect road condition data from probe-equipped transit vehicles via transit management centers; the data may be aggregated and preliminarily processed at the sending center.

Requirement: 3 The center shall collect traffic data from probe-equipped emergency vehicles via emergency management centers; the data may be aggregated and initial link time calculations performed at the sending center.

Requirement: 4 The center shall collect traffic data from traveler information centers based on data from their subscriber vehicles; the data may be aggregated and initial link time calculations performed at the sending center.

Requirement: 5 The center shall collect traffic data from toll administrative centers containing journey times between toll collection points for those vehicles equipped for electronic toll collection; the data may be aggregated and processed at the sending center.

Requirement: 6 The center shall assimilate current and forecast traffic and road conditions based on collected probe data and distribute to other centers for dissemination to travelers.

Requirement: 7 The center shall collect operational status for the roadside probe data collection equipment.

Requirement: 8 The center shall collect fault data for the roadside probe data collection equipment for repair.

Functional Area: **TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

Requirement: 1 The center shall remotely control traffic signal controllers.

Requirement: 2 The center shall accept notifications of right-of-way requests from pedestrians.

Requirement: 3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center.

Requirement: 4 The center shall collect traffic signal controller fault data from the field.

Requirement: 5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.

Functional Area: **TMC Freeway Management**

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TOC North***Entity:* **Traffic Management***Functional Area:* **TMC Freeway Management**

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

- Requirement:* 1 The center shall remotely control systems to manage use of the freeways, including ramp meters, mainline metering, and lane controls.
- Requirement:* 2 The center shall collect operational status from ramp meters, mainline metering, and lane controls and compare against the control information sent by the center.
- Requirement:* 3 The center shall collect fault data from ramp meters, mainline metering, and lane controls.
- Requirement:* 4 The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, mainline metering, and lane controls), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the ramps themselves.

Functional Area: **TMC Traffic Information Dissemination**

Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.

- Requirement:* 1 The center shall remotely control dynamic messages signs for dissemination of traffic and other information to drivers.
- Requirement:* 2 The center shall remotely control driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers.
- Requirement:* 3 The center shall collect operational status for the driver information systems equipment (DMS, HAR, etc.).
- Requirement:* 4 The center shall collect fault data for the driver information systems equipment (DMS, HAR, etc.) for repair.
- Requirement:* 5 The center shall retrieve locally stored traffic information, including current and forecasted traffic information, road and weather conditions, traffic incident information, information on diversions and alternate routes, closures, and special traffic restrictions (lane/shoulder use, weight restrictions, width restrictions, HOV requirements), etc.
- Requirement:* 6 The center shall distribute traffic data to maintenance and construction centers, transit centers, emergency management centers, and traveler information providers.
- Requirement:* 7 The center shall distribute traffic data to the media upon request; the capability to provide the information in both data stream and graphical display shall be supported.
- Requirement:* 8 The center shall provide the capability for center personnel to control the nature of the data that is available to non-traffic operations centers and the media.

Functional Area: **TMC Regional Traffic Control**

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

- Requirement:* 1 The center shall exchange traffic information with other traffic management centers, includes incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.
- Requirement:* 2 The center shall exchange traffic control information with other traffic management centers, includes remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).

Functional Area: **TMC Incident Detection**

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TOC North***Entity:* **Traffic Management***Functional Area:* **TMC Incident Detection**

Remotely controls traffic and video sensors to support incident detection and verification; exchange information with other agencies including emergency management, maintenance and construction, alerting and advisory systems, event promoters, intermodal freight depots, and traveler information systems.

- Requirement:* 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.
- Requirement:* 2 The center shall collect and store traffic flow and image data from the field equipment to detect and verify incidents.
- Requirement:* 3 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, and intermodal freight depots.
- Requirement:* 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.
- Requirement:* 5 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field.
- Requirement:* 6 The center shall provide road network conditions and traffic images to emergency management centers to support the detection, verification, and classification of incidents.
- Requirement:* 7 The center shall provide video and traffic sensor control commands to the field equipment to detect and verify incidents.

Functional Area: **TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

- Requirement:* 1 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction for distribution to the public. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, and information and instructions necessary for the public to respond to the alert. This may also identify specific information that should not be released to the public.
- Requirement:* 2 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.
- Requirement:* 3 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field, provide special routing for emergency vehicles, and to provide responding emergency vehicles with signal preemption.
- Requirement:* 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.
- Requirement:* 5 The center shall respond to requests from emergency management to provide traffic management resources to implement special traffic control measures, assist in clean up, verify an incident, etc. This may also involve coordination with maintenance centers.
- Requirement:* 6 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, media, and rail operations centers.
- Requirement:* 7 The center shall provide road network conditions and traffic images to emergency management centers, maintenance and construction centers, and traveler information service providers.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TOC North***Entity:* **Traffic Management***Functional Area:* **TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

- Requirement:* 8 The center shall exchange road network status assessment information with emergency management and maintenance centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.
- Requirement:* 9 The center shall coordinate information and controls with other traffic management centers.
- Requirement:* 10 The center shall receive inputs from emergency management and transit management centers to develop an overall status of the transportation system including emergency transit schedules in effect and current status and condition of the transportation infrastructure.
- Requirement:* 11 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic incident management.

Functional Area: **TMC Evacuation Support**

Development, coordination, and execution of special traffic management strategies during evacuation and subsequent reentry of a population in the vicinity of a disaster or major emergency. Interfaces with emergency management and other traffic management centers.

- Requirement:* 1 The center shall coordinate planning for evacuation with emergency management centers - including pre-planning activities such as establishing routes, areas to be evacuated, timing, etc.
- Requirement:* 2 The center shall support requests from emergency management centers to preempt the current traffic control strategy, activate traffic control and closure systems such as gates and barriers, activate safeguard systems, or use driver information systems to support evacuation traffic control plans.
- Requirement:* 3 The center shall coordinate information and controls with other traffic management centers.
- Requirement:* 4 The center shall coordinate execution of evacuation strategies with emergency management centers - including activities such as setting closures and detours, establishing routes, updating areas to be evacuated, timing the process, etc.

Functional Area: **TMC Environmental Monitoring**

Management of environmental sensors and assimilation of collected data with other current and forecast road conditions and surface weather information from weather service providers and roadway maintenance operations.

- Requirement:* 1 The center shall remotely control environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures.
- Requirement:* 2 The center shall remotely control environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.
- Requirement:* 3 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services), data from roadway maintenance operations, and environmental data collected from sensors deployed on and about the roadway.
- Requirement:* 4 The center shall provide weather and road condition information to weather service providers and center personnel.
- Requirement:* 5 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TOC North***Entity:* **Traffic Management***Functional Area:* **HRI Traffic Management**

Remotely monitor and control highway-rail intersection (HRI) equipment, includes standard speed active warning systems and high speed systems which provide additional information on approaching trains and detect and report on obstructions in the HRI.

Requirement: 1 The center shall remotely control highway-rail intersection (HRI) equipment located in the field.

Requirement: 2 The center shall accept collect highway-rail intersection (HRI) advisory or alert data from rail operations centers.

Requirement: 3 The center shall collect highway-rail intersection (HRI) equipment operational status and compare against the control information sent by the center.

Requirement: 4 The center shall provide the highway-rail intersection (HRI) equipment operational status to rail operations centers.

Requirement: 5 The center shall collect incident information related to a highway-rail intersection (HRI), such as intersection blockages or crashes or equipment malfunctions.

Requirement: 6 The center shall implement control plans to coordinate signalized intersections around highway-rail intersections (HRI), under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, equipment faults, pedestrian crossings, etc.

Functional Area: **TMC Reversible Lane Management**

Remotely controls traffic sensors, surveillance, and automated reversible lane equipment and lane control signals to control traffic in reversible lanes.

Requirement: 1 The center shall remotely control devices to detect traffic in reversible lanes, including wrong-way vehicles.

Requirement: 2 The center shall monitor the use of reversible lanes and detect wrong-way vehicles in reversible lanes using sensor and surveillance information, and the current lane control status (which direction the lane is currently operating). This may include identification of wrong-way violators.

Requirement: 3 The center shall remotely control automated reversible lane equipment and driver information systems (such as lane control signals) that control traffic in reversible lanes on surface streets.

Requirement: 4 The center shall remotely control automated reversible lane equipment and driver information systems (such as lane control signals) that control traffic in reversible lanes on freeways.

Requirement: 5 The center shall collect operational status for the reversible lane field equipment.

Requirement: 6 The center shall collect fault data for the reversible lane field equipment and send to the maintenance center for repair.

Requirement: 7 The center shall provide the capability for center personnel to control access and management of reversible lane facilities, including the direction of traffic flow changes during the day, especially between the peak hours and dedication of more lanes to the congestion direction during special events.

Functional Area: **TMC Speed Monitoring**

Remotely monitors vehicle speeds, and informs an enforcement agency if excessive speeds are detected; primarily used in work zones.

Requirement: 1 The center shall remotely control vehicle speed sensors typically placed in work zones; control parameters may include environmental and traffic conditions.

Requirement: 2 The center shall collect operational status for the vehicle speed sensors; the status shall include logged information including measured speeds, warning messages displayed, and violation records.

Requirement: 3 The center shall provide the capability to notify an enforcement agency when vehicle speeds in the work zone are in excess of the posted speed limit or are creating an unsafe condition based upon the current environmental or traffic conditions.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT TOC North***Entity:* **Traffic Management***Functional Area:* **TMC Speed Monitoring**

Remotely monitors vehicle speeds, and informs an enforcement agency if excessive speeds are detected; primarily used in work zones.

Requirement: 4 The center shall collect fault data for the vehicle speed sensors for repair.

Functional Area: **TMC Multimodal Crossing Management**

Remotely monitors and manages multimodal crossings, such as draw bridges and other crossings between highway traffic and other modes; does not include highway-rail intersection.

Requirement: 1 The center shall receive requests from non-highway traffic to cross at multimodal crossings for specified durations (such as draw bridges and miscellaneous other interference crossings between highway traffic and other modes such as river traffic, aircraft, etc.)

Requirement: 2 The center shall remotely control traffic signal controllers for use at major multimodal crossings.

Requirement: 3 The center shall remotely control driver information systems (such as dynamic messages signs, highway advisory radios (HAR), and equipment that controls warning lights and gates) to notify drivers of closure durations and times at multimodal crossings.

Requirement: 4 The center shall collect operational status for the equipment at multimodal crossings.

Requirement: 5 The center shall collect fault data for the equipment at multimodal crossings for repair.

Requirement: 6 The center shall receive and respond to requests for right-of-way at multimodal crossings.

Requirement: 7 The center shall collect and analyze the planned multimodal crossing closures as a possible incident.

Requirement: 8 The center shall distribute multimodal crossing information to other centers for dissemination to travelers.

Functional Area: **Barrier System Management**

Remotely controls barrier systems such as gates and other systems that manage entry to roadways, transportation facilities and infrastructure.

Requirement: 1 The center shall remotely control barrier systems for transportation facilities and infrastructure. Barrier systems include automated or remotely controlled gates, barriers and other systems that manage entry to roadways.

Requirement: 2 The center shall collect barrier system operational status.

Requirement: 3 The center shall collect barrier system fault data and send to the maintenance center for repair.

Requirement: 4 The center shall accept requests for barrier system activation from other centers and from center personnel to support emergency response and detours.

Functional Area: **Safeguard System Management**

Remotely controls safeguard systems such as blast shields and tunnel exhaust systems that are used to mitigate the impact of incidents on transportation infrastructure.

Requirement: 1 The center shall remotely control safeguard systems, equipment used to mitigate the impact of incidents on transportation infrastructure (e.g., blast shields, tunnel exhaust systems, etc.)

Requirement: 2 The center shall collect safeguard system operational status.

Requirement: 3 The center shall collect safeguard system fault data and send to the maintenance center for repair.

Requirement: 4 The center shall accept requests for safeguard system activation from other centers and from center personnel to support emergency response.

Functional Area: **Traffic Maintenance**

Monitoring and remote diagnostics of field equipment - detect failures, issue problem reports, and track the repair or replacement of the failed equipment.

Architecture

Northern New Jersey ITS Architecture

Element: **NJDOT TOC North**

Entity: **Traffic Management**

Functional Area: **Traffic Maintenance**

Monitoring and remote diagnostics of field equipment - detect failures, issue problem reports, and track the repair or replacement of the failed equipment.

Requirement: 1 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) operational status.

Requirement: 2 The center shall collect and store CCTV surveillance system (traffic, pedestrian) operational status.

Requirement: 3 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) fault data and send to the maintenance center for repair.

Requirement: 4 The center shall collect and store CCTV surveillance system (traffic, pedestrian) fault data send to the maintenance center for repair.

Requirement: 5 The center shall collect environmental sensor operational status.

Requirement: 6 The center shall collect environmental sensor equipment fault data and send to the maintenance center for repair.

Requirement: 7 The center shall exchange data with maintenance centers concerning the reporting of faulty equipment and the schedule/status of their repair. Information exchanged includes details of new equipment faults, and clearances when the faults are cleared.

Requirement: 8 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic maintenance data.

Functional Area: **TMC Work Zone Traffic Management**

Coordination with maintenance systems using work zone images and traveler information systems (such as DMS), and distribution of work plans so that work zones are established that have minimum traffic impact.

Requirement: 1 The center shall receive work zone images from a maintenance center.

Requirement: 2 The center shall analyze work zone images for indications of a possible incident.

Requirement: 3 The center shall remotely control driver information systems (such as dynamic messages signs, highway advisory radios) to advise drivers of activity around a work zone.

Requirement: 4 The center shall collect operational status for the driver information systems equipment in work zones.

Requirement: 5 The center shall collect fault data for the driver information systems equipment in work zones for repair.

Requirement: 6 The center shall receive proposed maintenance and construction work plans, analyze the activity as a possible incident, and provide work plan feedback to the sending center.

Functional Area: **TMC Multimodal Coordination**

Provides traffic signal priority for transit vehicles based on center-to-center communications with the transit management center; also exchange traffic and transit information.

Requirement: 1 The center shall respond to requests from transit management centers for signal priority at one or more intersections along a particular transit route.

Requirement: 2 The center shall exchange information with transit management centers including details current transit routes, the level of service on each route, and the progress of individual vehicles along their routes.

Functional Area: **TMC Input to In-Vehicle Signing**

Formats and outputs information to field equipment that supports in-vehicle signage equipment communications.

Architecture**Northern New Jersey ITS Architecture***Element:***NJDOT TOC North***Entity:***Traffic Management***Functional Area:* **TMC Input to In-Vehicle Signing**

Formats and outputs information to field equipment that supports in-vehicle signage equipment communications.

- Requirement:* 1 The center shall format and output road condition and environmental information to field equipment that supports in-vehicle signage communications.
- Requirement:* 2 The center shall format and output advisory information, such as evacuation information, wide-area alerts, incident information, work zone intrusion information, and other special information to field equipment that supports in-vehicle signage communications.
- Requirement:* 3 The center shall format and output indicator and fixed sign information, such as actual intersection traffic signal states, stop, or yield signs to field equipment that supports in-vehicle signage communications.
- Requirement:* 4 The center shall receive system operational status from field equipment that supports in-vehicle signage communications.
- Requirement:* 5 The center shall receive system fault data from field equipment that supports in-vehicle signage communications.

Functional Area: **Traffic Data Collection**

Collection and storage of traffic management data. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect traffic management data such as operational data, event logs, etc.
- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.
- Requirement:* 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the traffic data or for the data itself.
- Requirement:* 4 The center shall be able to produce sample products of the data available.

*Element:***NJDOT Website***Entity:***Information Service Provider***Functional Area:* **Basic Information Broadcast**

Collection, processing, storage, and broadcast dissemination of traffic, transit, maintenance and construction, event, and weather information to traveler interface systems and vehicles.

- Requirement:* 1 The center shall collect, process, store, and disseminate traffic and highway condition information to travelers, including incident information, detours and road closures, event information, recommended routes, and current speeds on specific routes.
- Requirement:* 2 The center shall collect, process, store, and disseminate maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities.
- Requirement:* 3 The center shall collect, process, store, and disseminate transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers.
- Requirement:* 4 The center shall collect, process, store, and disseminate parking information to travelers, including location, availability, and fees.
- Requirement:* 5 The center shall collect, process, store, and disseminate toll fee information to travelers.
- Requirement:* 6 The center shall collect, process, store, and disseminate weather information to travelers.
- Requirement:* 7 The center shall collect, process, store, and disseminate event information to travelers.
- Requirement:* 8 The center shall collect, process, store, and disseminate air quality information to travelers.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT Website***Entity:* **Information Service Provider***Functional Area:* **Basic Information Broadcast**

Collection, processing, storage, and broadcast dissemination of traffic, transit, maintenance and construction, event, and weather information to traveler interface systems and vehicles.

Requirement: 9 The center shall provide the capability to support requests from the media for traffic and incident data.

Requirement: 10 The center shall provide the capability for a system operator to control the type and update frequency of broadcast traveler information.

Functional Area: **Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

Requirement: 1 The center shall collect, process, store, and disseminate customized traffic and highway condition information to travelers, including incident information, detours and road closures, recommended routes, and current speeds on specific routes upon request.

Requirement: 2 The center shall collect, process, store, and disseminate customized maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities upon request.

Requirement: 3 The center shall collect, process, store, and disseminate customized transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers upon request.

Requirement: 4 The center shall collect, process, store, and disseminate customized parking information to travelers, including location, availability, and fees upon request.

Requirement: 5 The center shall collect, process, store, and disseminate customized toll fee information to travelers upon request.

Requirement: 6 The center shall collect, process, store, and disseminate customized weather information to travelers upon request.

Requirement: 7 The center shall collect, process, store, and disseminate customized multimodal transportation service information (for example, from ferry and airline operators), including transfer points and other information, to travelers upon request.

Requirement: 8 The center shall collect, process, store, and disseminate customized event information to travelers upon request.

Requirement: 9 The center shall collect, process, store, and disseminate customized air quality information to travelers upon request.

Requirement: 10 The center shall provide all traveler information based on the traveler's current location or a specific location identified by the traveler, and filter or customize the provided information accordingly.

Requirement: 11 The center shall accept traveler profiles for determining the type of personalized data to send to the traveler.

Requirement: 12 The center shall manage payment for services, such as tolls, transit fares, parking lot charges, map updates, and advanced payment for tolls, and provide transaction success or failure details.

Requirement: 13 The center shall support requests for traveler information and advanced payment for traveler services from commercial fleet operators.

Requirement: 14 The center shall provide the capability to exchange information with another traveler information service provider current or predicted data for road links that are outside the area served by the local supplier.

Requirement: 15 The center shall manage updates of digitized map data and provide updates to traveler interface systems upon request.

Requirement: 16 The center shall provide the capability to support requests from the media for traffic and incident data.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJDOT Website***Entity:* **Information Service Provider***Functional Area:* **Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

- Requirement:* 17 The center shall provide the capability for a system operator to control the type and update frequency of traveler information.

Functional Area: **Traveler Telephone Information**

Collection and distribution of traveler information and wide-area alerts to traveler telephone information systems such as 511, based on voice-based traveler requests.

- Requirement:* 1 The center shall provide the capability to process voice-formatted requests for traveler information from a traveler telephone information system, and return the information in the requested format.
- Requirement:* 2 The center shall provide the capability to process dual-tone multifrequency (DTMF)-based requests (touch-tone) for traveler information from a traveler telephone information system.
- Requirement:* 3 The center shall provide the capability to process traveler information requests from a traveler telephone information system.
- Requirement:* 4 The center shall collect and provide information on traffic conditions in the requested voice format and for the requested location.
- Requirement:* 5 The center shall collect and provide work zone and roadway maintenance information in the requested voice format and for the requested location.
- Requirement:* 6 The center shall collect and provide roadway environment conditions information in the requested voice format and for the requested location.
- Requirement:* 7 The center shall collect and provide weather and event information in the requested voice format and for the requested location.
- Requirement:* 8 The center shall collect and provide transit service information in the requested voice format and for the requested location.
- Requirement:* 9 The center shall collect and provide yellow pages services information in the requested voice format and for the requested location.
- Requirement:* 10 The center shall collect and provide current ferry and rail schedule and airport status information in the requested voice format and for the requested location.
- Requirement:* 11 The center shall provide the capability to support both specific caller requests as well as bulk upload of regional traveler information.
- Requirement:* 12 The center shall receive and forward region-specific wide-area alert and advisory information to the traveler telephone information system, including major emergencies such as a natural or man-made disaster, civil emergency, child abductions, severe weather watches and warnings, military activities, and law enforcement warnings.

Functional Area: **Infrastructure Provided Route Selection**

Generation of pre-trip and enroute trip plans for travelers (and vehicles) based on current traffic conditions, work zones, weather, and travelers constraints and preferences. Includes end-to-end trips using multiple modes, such as bicycle, transit, etc.

- Requirement:* 1 The center shall provide the capability to provide specific pre-trip and enroute directions to travelers (and drivers), including costs, arrival times, and transfer points.
- Requirement:* 2 The center shall include bicycle routes, walkways, skyways, and multi-use trails in the pre-trip and enroute directions it provides to travelers.
- Requirement:* 3 The center shall support on-line route guidance for travelers using personal devices (such as PDAs).

Architecture**Northern New Jersey ITS Architecture***Element:***NJDOT Website***Entity:***Information Service Provider***Functional Area:* **Infrastructure Provided Route Selection**

Generation of pre-trip and enroute trip plans for travelers (and vehicles) based on current traffic conditions, work zones, weather, and travelers constraints and preferences. Includes end-to-end trips using multiple modes, such as bicycle, transit, etc.

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| <i>Requirement:</i> | 4 | The center shall support on-line route guidance for drivers in vehicles. |
| <i>Requirement:</i> | 5 | The center shall support on-line route guidance for specialty vehicles, such as commercial vehicles. |
| <i>Requirement:</i> | 6 | The center shall generate route plans based on current and/or predicted conditions of the road network, scheduled maintenance and construction work activities, and work zone activities. |
| <i>Requirement:</i> | 7 | The center shall generate route plans based on transit services, including fares, schedules, and requirements for travelers with special needs. |
| <i>Requirement:</i> | 8 | The center shall generate route plans based on current asset restrictions, such as height and weight restrictions on tunnels or bridges. |
| <i>Requirement:</i> | 9 | The center shall generate route plans based on current or forecasted weather. |
| <i>Requirement:</i> | 10 | The center shall generate route plans based on ferry, rail, air, or other multimodal transportation data. |
| <i>Requirement:</i> | 11 | The center shall exchange route segment information with other centers outside the area served by the local center. |
| <i>Requirement:</i> | 12 | The center shall generate trips based on the use of more than one mode of transport. |
| <i>Requirement:</i> | 13 | The center shall use the preferences and constraints specified by the traveler in the trip request to select the most appropriate mode of transport. |
| <i>Requirement:</i> | 14 | The center shall provide the capability for the traveler to confirm the proposed trip plan. |
| <i>Requirement:</i> | 15 | The center shall log route plans, particularly for special vehicles such as those containing hazardous materials, over-sized vehicles, or motorcades, with a traffic center. |
| <i>Requirement:</i> | 16 | The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used to determine vehicle and non-vehicle routes, trip planning, and on-line vehicle guidance. |
| <i>Requirement:</i> | 17 | The center shall provide the capability for center personnel to control route calculation parameters. |

*Element:***NJSP Dispatch - Troop A, B, C***Entity:***Emergency Management***Functional Area:* **Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

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| <i>Requirement:</i> | 1 | The center shall support the interface to the Emergency Telecommunications System (e.g. 911 or 7-digit call routing) to receive emergency notification information and provide it to the emergency system operator. |
| <i>Requirement:</i> | 2 | The center shall receive emergency call information from 911 services and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 3 | The center shall receive emergency call information from motorist call-boxes and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 4 | The center shall receive emergency call information from mayday service providers and present the possible incident information to the emergency system operator. |

Architecture**Northern New Jersey ITS Architecture***Element:* **NJSP Dispatch - Troop A, B, C***Entity:* **Emergency Management***Functional Area:* **Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

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| <i>Requirement:</i> | 5 The center shall receive emergency notification information from other public safety agencies and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 6 The center shall receive emergency notification information from public transit systems and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 7 The center shall receive emergency notification information from commercial vehicles, commercial vehicle check stations, or commercial fleet operators and present the possible incident information to the emergency system operator. This may include detection of non-permitted transport of security sensitive hazmat, hazardous cargo spills, etc. |
| <i>Requirement:</i> | 8 The center shall receive details of the cargo being carried by commercial vehicles from their commercial fleet manager for incidents involving potential hazardous materials. |
| <i>Requirement:</i> | 9 The center shall coordinate, correlate, and verify all emergency inputs, including those identified based on external calls and internal analysis of security sensor and surveillance data, and assign each a level of confidence. |
| <i>Requirement:</i> | 10 The center shall send a request for remote control of CCTV systems from a traffic management center in order to verify the reported incident. |
| <i>Requirement:</i> | 11 The center shall update the incident information log once the emergency system operator has verified the incident. |
| <i>Requirement:</i> | 12 The center shall provide the capability for digitized map data to act as the background to the emergency information presented to the emergency system operator. |
| <i>Requirement:</i> | 13 The center shall forward the verified emergency information to the responding agency based on the location and nature of the emergency. |

Functional Area: **Emergency Dispatch**

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

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| <i>Requirement:</i> | 1 The center shall dispatch emergency vehicles to respond to verified emergencies and provide suggested routing under center personnel control. |
| <i>Requirement:</i> | 2 The center shall store the current status of all emergency vehicles available for dispatch and those that have been dispatched. |
| <i>Requirement:</i> | 3 The center shall relay location and incident details to the responding vehicles. |
| <i>Requirement:</i> | 4 The center shall provide the capability to request traffic control measures from traffic management centers such as signal preemption, traffic barriers and road closures. |
| <i>Requirement:</i> | 5 The center shall track the location and status of emergency vehicles responding to an emergency and update the incident status based on information from the emergency vehicle. |
| <i>Requirement:</i> | 6 The center shall receive status information from care facilities to determine the appropriate facility and its location. |
| <i>Requirement:</i> | 7 The center shall store and maintain the emergency service responses in an action log. |
| <i>Requirement:</i> | 8 The center shall receive asset restriction information from maintenance centers to support the dispatching of appropriate emergency resources. |

Architecture

Northern New Jersey ITS Architecture

Element: **NJSP Dispatch - Troop A, B, C**

Entity: **Emergency Management**

Functional Area: **Emergency Dispatch**

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

Requirement: 9 The center shall receive traffic information, including closures, traffic conditions, etc. from traffic management centers.

Requirement: 10 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.

Requirement: 11 The center shall receive road network conditions and traffic images to support dispatch of emergency vehicles.

Requirement: 12 The center shall coordinate response to incidents with other Emergency Management centers to ensure appropriate resources are dispatched and utilized.

Functional Area: **Emergency Routing**

Routing of emergency vehicles to facilitate the quickest/safest arrival. Routes may be determined based on real-time traffic information and road conditions or routes may be provided by Traffic Management on request.

Requirement: 1 The center shall collect current traffic and road condition information from traffic management centers for emergency vehicle route calculation.

Requirement: 2 The center shall receive inputs from traffic management and maintenance centers on the location and status of traffic control equipment and work zones along potential emergency routes.

Requirement: 3 The center shall calculate emergency vehicle routes based on information from traffic management and maintenance centers.

Requirement: 4 In special circumstances such as during disasters and evacuations when normal routes are not available, the center shall request a route from the traffic management center.

Requirement: 5 The center shall provide the capability to request special traffic control measures from the traffic management center to facilitate emergency vehicle progress along the suggested route.

Requirement: 6 Once the route is calculated the route shall be provided to the dispatch function.

Functional Area: **Emergency Early Warning System**

Monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies in order to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to other ITS centers to notify the traveling public. Includes support for Child Abduction notices.

Requirement: 1 The center shall monitor information from Alerting and Advisory Systems such as the Information Sharing and Analysis Centers (ISACs), the National Infrastructure Protection Center (NIPC), the Homeland Security Advisory System (HSAS), etc. The information may include assessments (general incident and vulnerability awareness information), advisories (identification of threats or recommendations to increase preparedness levels), or alerts (information on imminent or in-progress emergencies).

Requirement: 2 The center shall provide the capability to correlate alerts and advisories, incident information, and security sensor and surveillance data.

Requirement: 3 The center shall broadcast wide-area alerts and advisories to traffic management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.

Requirement: 4 The center shall broadcast wide-area alerts and advisories to transit management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJSP Dispatch - Troop A, B, C***Entity:* **Emergency Management***Functional Area:* **Emergency Early Warning System**

Monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies in order to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to other ITS centers to notify the traveling public. Includes support for Child Abduction notices.

- Requirement:* 5 The center shall broadcast wide-area alerts and advisories to toll administration centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 6 The center shall broadcast wide-area alerts and advisories to traveler information service providers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 7 The center shall broadcast wide-area alerts and advisories to maintenance centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 8 The center shall broadcast wide-area alerts and advisories to other emergency management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 9 The center shall process status information from each of the centers that have been sent the wide-area alert.
- Requirement:* 10 The center shall coordinate the broadcast of wide-area alerts and advisories with other emergency management centers.
- Requirement:* 11 The center shall receive incident information from other transportation management centers to support the early warning system.
- Requirement:* 12 The center shall present the alert and advisory information and the status of the actions taken in response to the alert by the other centers to the emergency system operator as received from other system inputs.
- Requirement:* 13 The center shall support the entry of alert and advisory information directly from the emergency system operator.

Functional Area: **Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

- Requirement:* 1 The center shall provide strategic emergency response capabilities such as that of an Emergency Operations Center for large-scale incidents and disasters.
- Requirement:* 2 The center shall manage coordinated inter-agency responses to and recovery from large-scale emergencies. Such agencies include traffic management, transit, maintenance and construction management, rail operations, and other emergency management agencies.
- Requirement:* 3 The center shall provide the capability to implement response plans and track progress through the incident by exchanging incident information and distributing response status to allied agencies.
- Requirement:* 4 The center shall develop, coordinate with other agencies, and store emergency response plans.
- Requirement:* 5 The center shall track the availability of resources (including vehicles, roadway cleanup?, etc.), request additional resources from traffic, maintenance, or other emergency centers if needed.
- Requirement:* 6 The center shall allocate the appropriate emergency services, resources, and vehicle (s) to respond to incidents, and shall provide the capability to override the current allocation to suit the special needs of a current incident.
- Requirement:* 7 The center shall receive event scheduling information from Event Promoters.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJSP Dispatch - Troop A, B, C***Entity:* **Emergency Management***Functional Area:* **Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

- Requirement:* 8 The center shall receive hazardous materials incident information from commercial fleet operators.
- Requirement:* 9 The center shall provide the capability to request the safe disabling of a commercial vehicle during a hazardous materials incident.
- Requirement:* 10 The center shall provide the capability to request transit resource availability from transit centers for use during disaster and evacuation operations.
- Requirement:* 11 The center shall assimilate the status of the transit, traffic, rail, maintenance, and other emergency center services and systems to create an overall transportation system status, and disseminate to each of these centers and the traveling public via traveler information providers.
- Requirement:* 12 The center shall provide information to the media concerning the status of an emergency response.
- Requirement:* 13 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.
- Requirement:* 14 The center shall provide the capability for center personnel to provide inputs to the management of incidents, disasters and evacuations.

Functional Area: **Incident Command**

Tactical decision support, resource coordination, and communications integration among emergency management agencies for Incident Commands that are established by first responders to support local management of an incident.

- Requirement:* 1 The center shall provide tactical decision support, resource coordination, and communications integration for Incident Commands that are established by first responders to support local management of an incident.
- Requirement:* 2 The center shall provide incident command communications with public safety, emergency management, transportation, and other allied response agency centers.
- Requirement:* 3 The center shall track and maintain resource information and action plans pertaining to the incident command.
- Requirement:* 4 The center shall share incident command information with other public safety agencies including resource deployment status, hazardous material information, rail incident information, evacuation advice as well as traffic, road, and weather conditions.
- Requirement:* 5 The center shall assess the status of responding emergency vehicles as part of an incident command.

Functional Area: **Emergency Evacuation Support**

Evacuation planning and coordination to manage evacuation and reentry of a population in the vicinity of a disaster or other emergency that poses a risk to public safety.

- Requirement:* 1 The center shall manage inter-agency coordination of evacuation operations, from initial planning through the evacuation process and reentry.
- Requirement:* 2 The center shall develop and exchange evacuation plans with allied agencies prior to the occurrence of a disaster.
- Requirement:* 3 The center shall provide an interface to the emergency system operator to enter evacuation plans and procedures and present the operator with other agencies' plans.
- Requirement:* 4 The center shall coordinate evacuation destinations and shelter needs with shelter providers (e.g., the American Red Cross) in the region.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJSP Dispatch - Troop A, B, C***Entity:* **Emergency Management***Functional Area:* **Emergency Evacuation Support**

Evacuation planning and coordination to manage evacuation and reentry of a population in the vicinity of a disaster or other emergency that poses a risk to public safety.

- Requirement:* 5 The center shall provide evacuation information to traffic, transit, maintenance and construction, rail operations, and other emergency management centers as needed.
- Requirement:* 6 The center shall request resources from transit agencies as needed to support the evacuation.
- Requirement:* 7 The center shall request traffic management agencies to implement special traffic control strategies and to control evacuation traffic, including traffic on local streets and arterials as well as the major evacuation routes.
- Requirement:* 8 The center shall provide traveler information systems with evacuation guidance including basic information to assist potential evacuees in determining whether evacuation is necessary and when it is safe to return.
- Requirement:* 9 The center shall monitor the progress or status of the evacuation once it begins and exchange tactical plans, prepared during the incident, with allied agencies.
- Requirement:* 10 The center shall monitor the progress of the reentry process.
- Requirement:* 11 The center shall submit evacuation information to toll administration centers along with requests for changes in the toll services or fee collection during an evacuation.

Functional Area: **Emergency Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and emergency vehicles equipped with environmental sensors; used by the operator to more effectively manage incidents.

- Requirement:* 1 The center shall collect current and forecast road and weather information from weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
- Requirement:* 2 The center shall receive environmental probe information from its fleet of emergency vehicles.
- Requirement:* 3 The center shall collect current road and weather information from roadway maintenance operations.
- Requirement:* 4 The center shall assimilate current and forecast road conditions and surface weather information to support incident management.
- Requirement:* 5 The center shall present the current and forecast road and weather information to the emergency system operator.
- Requirement:* 6 The center shall provide aggregated or processed environmental probe information from its fleet of emergency vehicles to traffic management and maintenance centers.

Functional Area: **Center Secure Area Surveillance**

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 1 The center shall remotely monitor video images and audio surveillance data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The data may be raw or pre-processed in the field.
- Requirement:* 2 The center shall remotely monitor video images and audio surveillance data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The data may be raw or pre-processed in the field.

Architecture**Northern New Jersey ITS Architecture***Element:* NJSP Dispatch - Troop A, B, C*Entity:* Emergency Management*Functional Area:* **Center Secure Area Surveillance**

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 3 The center shall remotely monitor video images and audio surveillance data collected on-board transit vehicles. The data may be raw or pre-processed in the field.
- Requirement:* 4 The center shall exchange surveillance data with other emergency centers.
- Requirement:* 5 The center shall identify potential security threats based on collected security surveillance data.
- Requirement:* 6 The center shall verify potential security threats by correlating security surveillance data from multiple sources.
- Requirement:* 7 The center shall remotely control security surveillance devices in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways).
- Requirement:* 8 The center shall remotely control security surveillance devices in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers).
- Requirement:* 9 The center shall remotely control security surveillance devices on-board transit vehicles.
- Requirement:* 10 The center shall match traveler video images against a database from the Alerting and Advisory Systems of known images that may represent criminals and terrorists.
- Requirement:* 11 The center shall exchange traveler images with other emergency management centers to support traveler image matching.
- Requirement:* 12 The center shall respond to control data from center personnel regarding security surveillance data collection, processing, threat detection, and image matching.

Functional Area: **Center Secure Area Sensor Management**

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 1 The center shall remotely monitor and control security sensor data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), infrastructure condition and integrity, intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 2 The center shall remotely monitor and control security sensor data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 3 The center shall remotely monitor and control security sensor data collected on-board transit vehicles. The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors) and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 4 The center shall exchange security sensor data with other emergency centers.

Architecture**Northern New Jersey ITS Architecture***Element:***NJSP Dispatch - Troop A, B, C***Entity:***Emergency Management***Functional Area:* **Center Secure Area Sensor Management**

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 5 The center shall identify potential security threats based on collected security sensor data.
- Requirement:* 6 The center shall verify potential security threats by correlating security sensor data from multiple sources.
- Requirement:* 7 The center shall perform threat analysis based on correlations of security sensor and surveillance data.
- Requirement:* 8 The center shall exchange threat analysis data with Alerting and Advisory Systems and use that data in local threat analysis processing.
- Requirement:* 9 The center shall disseminate threat information to other agencies, including traffic, transit, maintenance, rail operations, and other emergency management centers.
- Requirement:* 10 The center shall respond to control data from center personnel regarding security sensor data collection, processing, threat detection, and threat analysis.

*Element:***NJSP Vehicles***Entity:***Emergency Vehicle Subsystem***Functional Area:* **On-board EV En Route Support**

On-board systems for gathering of dispatch and routing information for emergency vehicle personnel, vehicle tracking, communications with care facilities, and signal preemption via short range communication directly with traffic control equipment at the roadside.

- Requirement:* 1 The emergency vehicle, including roadway service patrols, shall compute the location of the emergency vehicle based on inputs from a vehicle location determination function.
- Requirement:* 2 The emergency vehicle, including roadway service patrols, shall send the vehicle's location and operational data to the center for emergency management and dispatch.
- Requirement:* 3 The emergency vehicle, including roadway service patrols, shall receive incident details and a suggested route when dispatched to a scene.
- Requirement:* 4 The emergency vehicle shall send the current en route status (including estimated time of arrival) and requests for emergency dispatch updates.
- Requirement:* 5 The emergency vehicle shall send requests to traffic signal control equipment at the roadside to preempt the signal.
- Requirement:* 6 The emergency vehicle shall provide the personnel on-board with dispatch information, including incident type and location, and forward an acknowledgment from personnel to the center that the vehicle is on its way to the incident scene.
- Requirement:* 7 The emergency vehicle shall send patient status information to the care facility along with a request for further information.
- Requirement:* 8 The emergency vehicle shall forward care facility status information to emergency vehicle personnel, including the location, specialized services, quality of care, waiting time, number of rooms available, and emergency room status of hospitals or emergency care providers.

Functional Area: **On-board EV Incident Management Communication**

On-board systems providing the direct interface between the emergency vehicle and incident management personnel at the incident site.

Architecture

Northern New Jersey ITS Architecture

*Element:***NJSP Vehicles**

*Entity:***Emergency Vehicle Subsystem**

Functional Area: **On-board EV Incident Management Communication**

On-board systems providing the direct interface between the emergency vehicle and incident management personnel at the incident site.

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| <i>Requirement:</i> | 1 The emergency vehicle shall receive dispatch instructions sufficient to enable emergency personnel in the field to implement an effective incident response. It includes local traffic, road, and weather conditions, hazardous material information, and the current status of resources that have been allocated to an incident. |
| <i>Requirement:</i> | 2 The emergency vehicle shall provide an interface to the center for emergency personnel to transmit information about the incident site such as the extent of injuries, identification of vehicles and people involved, hazardous material, etc. |
| <i>Requirement:</i> | 3 The emergency vehicle shall provide an interface to the center for emergency personnel to transmit information about the current incident response status such as the identification of the resources on site, site management strategies in effect, and current clearance status. |
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*Element:***NJSP/NJDOT Statewide Dispatch Center**

*Entity:***Emergency Management**

Functional Area: **Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

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| <i>Requirement:</i> | 1 The center shall support the interface to the Emergency Telecommunications System (e.g. 911 or 7-digit call routing) to receive emergency notification information and provide it to the emergency system operator. |
| <i>Requirement:</i> | 2 The center shall receive emergency call information from 911 services and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 3 The center shall receive emergency call information from motorist call-boxes and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 4 The center shall receive emergency call information from mayday service providers and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 5 The center shall receive emergency notification information from other public safety agencies and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 6 The center shall receive emergency notification information from public transit systems and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 7 The center shall receive emergency notification information from commercial vehicles, commercial vehicle check stations, or commercial fleet operators and present the possible incident information to the emergency system operator. This may include detection of non-permitted transport of security sensitive hazmat, hazardous cargo spills, etc. |
| <i>Requirement:</i> | 8 The center shall receive details of the cargo being carried by commercial vehicles from their commercial fleet manager for incidents involving potential hazardous materials. |
| <i>Requirement:</i> | 9 The center shall coordinate, correlate, and verify all emergency inputs, including those identified based on external calls and internal analysis of security sensor and surveillance data, and assign each a level of confidence. |
| <i>Requirement:</i> | 10 The center shall send a request for remote control of CCTV systems from a traffic management center in order to verify the reported incident. |
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Architecture**Northern New Jersey ITS Architecture***Element:* **NJSP/NJDOT Statewide Dispatch Center***Entity:* **Emergency Management***Functional Area:* **Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

Requirement: 11 The center shall update the incident information log once the emergency system operator has verified the incident.

Requirement: 12 The center shall provide the capability for digitized map data to act as the background to the emergency information presented to the emergency system operator.

Requirement: 13 The center shall forward the verified emergency information to the responding agency based on the location and nature of the emergency.

Functional Area: **Emergency Dispatch**

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

Requirement: 1 The center shall dispatch emergency vehicles to respond to verified emergencies and provide suggested routing under center personnel control.

Requirement: 2 The center shall store the current status of all emergency vehicles available for dispatch and those that have been dispatched.

Requirement: 3 The center shall relay location and incident details to the responding vehicles.

Requirement: 4 The center shall provide the capability to request traffic control measures from traffic management centers such as signal preemption, traffic barriers and road closures.

Requirement: 5 The center shall track the location and status of emergency vehicles responding to an emergency and update the incident status based on information from the emergency vehicle.

Requirement: 6 The center shall receive status information from care facilities to determine the appropriate facility and its location.

Requirement: 7 The center shall store and maintain the emergency service responses in an action log.

Requirement: 8 The center shall receive asset restriction information from maintenance centers to support the dispatching of appropriate emergency resources.

Requirement: 9 The center shall receive traffic information, including closures, traffic conditions, etc. from traffic management centers.

Requirement: 10 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.

Requirement: 11 The center shall receive road network conditions and traffic images to support dispatch of emergency vehicles.

Requirement: 12 The center shall coordinate response to incidents with other Emergency Management centers to ensure appropriate resources are dispatched and utilized.

Functional Area: **Emergency Routing**

Routing of emergency vehicles to facilitate the quickest/safest arrival. Routes may be determined based on real-time traffic information and road conditions or routes may be provided by Traffic Management on request.

Requirement: 1 The center shall collect current traffic and road condition information from traffic management centers for emergency vehicle route calculation.

Requirement: 2 The center shall receive inputs from traffic management and maintenance centers on the location and status of traffic control equipment and work zones along potential emergency routes.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJSP/NJDOT Statewide Dispatch Center***Entity:* **Emergency Management***Functional Area:* **Emergency Routing**

Routing of emergency vehicles to facilitate the quickest/safest arrival. Routes may be determined based on real-time traffic information and road conditions or routes may be provided by Traffic Management on request.

- Requirement:* 3 The center shall calculate emergency vehicle routes based on information from traffic management and maintenance centers.
- Requirement:* 4 In special circumstances such as during disasters and evacuations when normal routes are not available, the center shall request a route from the traffic management center.
- Requirement:* 5 The center shall provide the capability to request special traffic control measures from the traffic management center to facilitate emergency vehicle progress along the suggested route.
- Requirement:* 6 Once the route is calculated the route shall be provided to the dispatch function.

Functional Area: **Emergency Early Warning System**

Monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies in order to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to other ITS centers to notify the traveling public. Includes support for Child Abduction notices.

- Requirement:* 1 The center shall monitor information from Alerting and Advisory Systems such as the Information Sharing and Analysis Centers (ISACs), the National Infrastructure Protection Center (NIPC), the Homeland Security Advisory System (HSAS), etc. The information may include assessments (general incident and vulnerability awareness information), advisories (identification of threats or recommendations to increase preparedness levels), or alerts (information on imminent or in-progress emergencies).
- Requirement:* 2 The center shall provide the capability to correlate alerts and advisories, incident information, and security sensor and surveillance data.
- Requirement:* 3 The center shall broadcast wide-area alerts and advisories to traffic management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 4 The center shall broadcast wide-area alerts and advisories to transit management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 5 The center shall broadcast wide-area alerts and advisories to toll administration centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 6 The center shall broadcast wide-area alerts and advisories to traveler information service providers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 7 The center shall broadcast wide-area alerts and advisories to maintenance centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 8 The center shall broadcast wide-area alerts and advisories to other emergency management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 9 The center shall process status information from each of the centers that have been sent the wide-area alert.
- Requirement:* 10 The center shall coordinate the broadcast of wide-area alerts and advisories with other emergency management centers.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJSP/NJDOT Statewide Dispatch Center***Entity:* **Emergency Management***Functional Area:* **Emergency Early Warning System**

Monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies in order to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to other ITS centers to notify the traveling public. Includes support for Child Abduction notices.

- Requirement:* 11 The center shall receive incident information from other transportation management centers to support the early warning system.
- Requirement:* 12 The center shall present the alert and advisory information and the status of the actions taken in response to the alert by the other centers to the emergency system operator as received from other system inputs.
- Requirement:* 13 The center shall support the entry of alert and advisory information directly from the emergency system operator.

Functional Area: **Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

- Requirement:* 1 The center shall provide strategic emergency response capabilities such as that of an Emergency Operations Center for large-scale incidents and disasters.
- Requirement:* 2 The center shall manage coordinated inter-agency responses to and recovery from large-scale emergencies. Such agencies include traffic management, transit, maintenance and construction management, rail operations, and other emergency management agencies.
- Requirement:* 3 The center shall provide the capability to implement response plans and track progress through the incident by exchanging incident information and distributing response status to allied agencies.
- Requirement:* 4 The center shall develop, coordinate with other agencies, and store emergency response plans.
- Requirement:* 5 The center shall track the availability of resources (including vehicles, roadway cleanup?, etc.), request additional resources from traffic, maintenance, or other emergency centers if needed.
- Requirement:* 6 The center shall allocate the appropriate emergency services, resources, and vehicle (s) to respond to incidents, and shall provide the capability to override the current allocation to suit the special needs of a current incident.
- Requirement:* 7 The center shall receive event scheduling information from Event Promoters.
- Requirement:* 8 The center shall receive hazardous materials incident information from commercial fleet operators.
- Requirement:* 9 The center shall provide the capability to request the safe disabling of a commercial vehicle during a hazardous materials incident.
- Requirement:* 10 The center shall provide the capability to request transit resource availability from transit centers for use during disaster and evacuation operations.
- Requirement:* 11 The center shall assimilate the status of the transit, traffic, rail, maintenance, and other emergency center services and systems to create an overall transportation system status, and disseminate to each of these centers and the traveling public via traveler information providers.
- Requirement:* 12 The center shall provide information to the media concerning the status of an emergency response.
- Requirement:* 13 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.
- Requirement:* 14 The center shall provide the capability for center personnel to provide inputs to the management of incidents, disasters and evacuations.

Functional Area: **Incident Command**

Architecture**Northern New Jersey ITS Architecture***Element:* **NJSP/NJDOT Statewide Dispatch Center***Entity:* **Emergency Management***Functional Area:* **Incident Command**

Tactical decision support, resource coordination, and communications integration among emergency management agencies for Incident Commands that are established by first responders to support local management of an incident.

- Requirement:* 1 The center shall provide tactical decision support, resource coordination, and communications integration for Incident Commands that are established by first responders to support local management of an incident.
- Requirement:* 2 The center shall provide incident command communications with public safety, emergency management, transportation, and other allied response agency centers.
- Requirement:* 3 The center shall track and maintain resource information and action plans pertaining to the incident command.
- Requirement:* 4 The center shall share incident command information with other public safety agencies including resource deployment status, hazardous material information, rail incident information, evacuation advice as well as traffic, road, and weather conditions.
- Requirement:* 5 The center shall assess the status of responding emergency vehicles as part of an incident command.

Functional Area: **Emergency Evacuation Support**

Evacuation planning and coordination to manage evacuation and reentry of a population in the vicinity of a disaster or other emergency that poses a risk to public safety.

- Requirement:* 1 The center shall manage inter-agency coordination of evacuation operations, from initial planning through the evacuation process and reentry.
- Requirement:* 2 The center shall develop and exchange evacuation plans with allied agencies prior to the occurrence of a disaster.
- Requirement:* 3 The center shall provide an interface to the emergency system operator to enter evacuation plans and procedures and present the operator with other agencies' plans.
- Requirement:* 4 The center shall coordinate evacuation destinations and shelter needs with shelter providers (e.g., the American Red Cross) in the region.
- Requirement:* 5 The center shall provide evacuation information to traffic, transit, maintenance and construction, rail operations, and other emergency management centers as needed.
- Requirement:* 6 The center shall request resources from transit agencies as needed to support the evacuation.
- Requirement:* 7 The center shall request traffic management agencies to implement special traffic control strategies and to control evacuation traffic, including traffic on local streets and arterials as well as the major evacuation routes.
- Requirement:* 8 The center shall provide traveler information systems with evacuation guidance including basic information to assist potential evacuees in determining whether evacuation is necessary and when it is safe to return.
- Requirement:* 9 The center shall monitor the progress or status of the evacuation once it begins and exchange tactical plans, prepared during the incident, with allied agencies.
- Requirement:* 10 The center shall monitor the progress of the reentry process.
- Requirement:* 11 The center shall submit evacuation information to toll administration centers along with requests for changes in the toll services or fee collection during an evacuation.

Functional Area: **Emergency Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and emergency vehicles equipped with environmental sensors; used by the operator to more effectively manage incidents.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJSP/NJDOT Statewide Dispatch Center***Entity:* **Emergency Management***Functional Area:* **Emergency Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and emergency vehicles equipped with environmental sensors; used by the operator to more effectively manage incidents.

- Requirement:* 1 The center shall collect current and forecast road and weather information from weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
- Requirement:* 2 The center shall receive environmental probe information from its fleet of emergency vehicles.
- Requirement:* 3 The center shall collect current road and weather information from roadway maintenance operations.
- Requirement:* 4 The center shall assimilate current and forecast road conditions and surface weather information to support incident management.
- Requirement:* 5 The center shall present the current and forecast road and weather information to the emergency system operator.
- Requirement:* 6 The center shall provide aggregated or processed environmental probe information from its fleet of emergency vehicles to traffic management and maintenance centers.

Functional Area: **Center Secure Area Surveillance**

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 1 The center shall remotely monitor video images and audio surveillance data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The data may be raw or pre-processed in the field.
- Requirement:* 2 The center shall remotely monitor video images and audio surveillance data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The data may be raw or pre-processed in the field.
- Requirement:* 3 The center shall remotely monitor video images and audio surveillance data collected on-board transit vehicles. The data may be raw or pre-processed in the field.
- Requirement:* 4 The center shall exchange surveillance data with other emergency centers.
- Requirement:* 5 The center shall identify potential security threats based on collected security surveillance data.
- Requirement:* 6 The center shall verify potential security threats by correlating security surveillance data from multiple sources.
- Requirement:* 7 The center shall remotely control security surveillance devices in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways).
- Requirement:* 8 The center shall remotely control security surveillance devices in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers).
- Requirement:* 9 The center shall remotely control security surveillance devices on-board transit vehicles.
- Requirement:* 10 The center shall match traveler video images against a database from the Alerting and Advisory Systems of known images that may represent criminals and terrorists.
- Requirement:* 11 The center shall exchange traveler images with other emergency management centers to support traveler image matching.

Architecture**Northern New Jersey ITS Architecture****Element: NJSP/NJDOT Statewide Dispatch Center****Entity: Emergency Management****Functional Area: Center Secure Area Surveillance**

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:** 12 The center shall respond to control data from center personnel regarding security surveillance data collection, processing, threat detection, and image matching.

Functional Area: Center Secure Area Sensor Management

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:** 1 The center shall remotely monitor and control security sensor data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), infrastructure condition and integrity, intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.

- Requirement:** 2 The center shall remotely monitor and control security sensor data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.

- Requirement:** 3 The center shall remotely monitor and control security sensor data collected on-board transit vehicles. The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors) and object detection sensors. The data may be raw or pre-processed in the field.

- Requirement:** 4 The center shall exchange security sensor data with other emergency centers.

- Requirement:** 5 The center shall identify potential security threats based on collected security sensor data.

- Requirement:** 6 The center shall verify potential security threats by correlating security sensor data from multiple sources.

- Requirement:** 7 The center shall perform threat analysis based on correlations of security sensor and surveillance data.

- Requirement:** 8 The center shall exchange threat analysis data with Alerting and Advisory Systems and use that data in local threat analysis processing.

- Requirement:** 9 The center shall disseminate threat information to other agencies, including traffic, transit, maintenance, rail operations, and other emergency management centers.

- Requirement:** 10 The center shall respond to control data from center personnel regarding security sensor data collection, processing, threat detection, and threat analysis.

Functional Area: Center Secure Area Alarm Support

Collection and response to silent and audible alarms received from travelers in secure areas (such as transit stops, rest areas, park-and-ride lots) and from on-board transit vehicles.

- Requirement:** 1 The center shall collect silent and audible alarms received from travelers in secure areas (such as transit stops, rest areas, park and ride lots, modal interchange facilities).

- Requirement:** 2 The center shall collect silent and audible alarms received from transit vehicles, originated by the traveler or the transit vehicle operator.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJSP/NJDOT Statewide Dispatch Center***Entity:* **Emergency Management***Functional Area:* **Center Secure Area Alarm Support**

Collection and response to silent and audible alarms received from travelers in secure areas (such as transit stops, rest areas, park-and-ride lots) and from on-board transit vehicles.

- Requirement:* 3 After the alarm message has been received, the center shall generate an alarm acknowledgment to the sender.
- Requirement:* 4 After the alarm message becomes a verified incident, the center shall determine the appropriate response.
- Requirement:* 5 The center shall determine whether the alarm message indicates an emergency that requires the attention of public safety agencies, and forward alarm message data to the appropriate agency as necessary.
- Requirement:* 6 The center shall forward the alarm message to center personnel and respond to the traveler or transit vehicle operator as directed by the personnel.

Functional Area: **Mayday Support**

Collection and response to Mayday messages received from vehicles and drivers.

- Requirement:* 1 The center shall collect mayday messages from vehicles and drivers.
- Requirement:* 2 The center shall collect mayday messages from travelers via personal handheld devices.
- Requirement:* 3 The center shall acknowledge the request for emergency assistance, whether originated by the driver, automatically by the vehicle's safety systems, or by a traveler via a personal handheld device.
- Requirement:* 4 After the mayday becomes a verified incident, the center shall determine the appropriate response to the mayday message.
- Requirement:* 5 The center shall determine whether the mayday message indicates an emergency that requires the attention of public safety agencies, and forward mayday emergency data to the appropriate agency as necessary.
- Requirement:* 6 The center shall support the activation of remote controlled functions requested by a vehicle, such as requests to unlock doors.
- Requirement:* 7 The center shall request additional emergency details from or issue commands to the vehicle's security systems or vehicle driver if needed.
- Requirement:* 8 The center shall maintain a log of all mayday signals received from vehicles.
- Requirement:* 9 The center shall provide all mayday data to center personnel and respond to the vehicle, driver, or traveler using the portable handheld device as directed by the personnel.

Functional Area: **Service Patrol Management**

Dispatch and communication with roadway service patrol vehicles that monitor roads to aid motorists, offering rapid response to minor incidents.

- Requirement:* 1 The center shall dispatch roadway service patrol vehicles to identified incident locations.
- Requirement:* 2 The center shall store the current status of all service patrol vehicles available for dispatch and those that have been dispatched.
- Requirement:* 3 The center shall share incident information collected by the service patrol with traffic, maintenance and construction, and traveler information centers for incident management, incident notification to travelers, and incident cleanup.
- Requirement:* 4 The center shall track the location and status of service patrol vehicles.

Functional Area: **Emergency Data Collection**

Architecture**Northern New Jersey ITS Architecture***Element:* **NJSP/NJDOT Statewide Dispatch Center***Entity:* **Emergency Management***Functional Area:* **Emergency Data Collection**

Collection and storage of information related to Emergency Management. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect emergency service data, emergency vehicle management data, emergency vehicle data, sensor and surveillance data, threat data, and incident data.
- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.
- Requirement:* 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the emergency management data or for the data itself.
- Requirement:* 4 The center shall be able to produce sample products of the data available.

Entity: **Traffic Management***Functional Area:* **TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

- Requirement:* 1 The center shall remotely control traffic signal controllers.
- Requirement:* 2 The center shall accept notifications of right-of-way requests from pedestrians.
- Requirement:* 3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center.
- Requirement:* 4 The center shall collect traffic signal controller fault data from the field.
- Requirement:* 5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.

Functional Area: **TMC Freeway Management**

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

- Requirement:* 1 The center shall remotely control systems to manage use of the freeways, including ramp meters, mainline metering, and lane controls.
- Requirement:* 2 The center shall collect operational status from ramp meters, mainline metering, and lane controls and compare against the control information sent by the center.
- Requirement:* 3 The center shall collect fault data from ramp meters, mainline metering, and lane controls.
- Requirement:* 4 The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, mainline metering, and lane controls), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the ramps themselves.

Functional Area: **TMC Traffic Information Dissemination**

Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.

- Requirement:* 1 The center shall remotely control dynamic messages signs for dissemination of traffic and other information to drivers.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJSP/NJDOT Statewide Dispatch Center***Entity:* **Traffic Management***Functional Area:* **TMC Traffic Information Dissemination**

Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.

- Requirement:* 2 The center shall remotely control driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers.
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- Requirement:* 3 The center shall collect operational status for the driver information systems equipment (DMS, HAR, etc.).
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- Requirement:* 4 The center shall collect fault data for the driver information systems equipment (DMS, HAR, etc.) for repair.
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- Requirement:* 5 The center shall retrieve locally stored traffic information, including current and forecasted traffic information, road and weather conditions, traffic incident information, information on diversions and alternate routes, closures, and special traffic restrictions (lane/shoulder use, weight restrictions, width restrictions, HOV requirements), etc.
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- Requirement:* 6 The center shall distribute traffic data to maintenance and construction centers, transit centers, emergency management centers, and traveler information providers.
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- Requirement:* 7 The center shall distribute traffic data to the media upon request; the capability to provide the information in both data stream and graphical display shall be supported.
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- Requirement:* 8 The center shall provide the capability for center personnel to control the nature of the data that is available to non-traffic operations centers and the media.

Functional Area: **TMC Regional Traffic Control**

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

- Requirement:* 1 The center shall exchange traffic information with other traffic management centers, includes incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.
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- Requirement:* 2 The center shall exchange traffic control information with other traffic management centers, includes remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).

Functional Area: **TMC Incident Detection**

Remotely controls traffic and video sensors to support incident detection and verification; exchange information with other agencies including emergency management, maintenance and construction, alerting and advisory systems, event promoters, intermodal freight depots, and traveler information systems.

- Requirement:* 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.
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- Requirement:* 2 The center shall collect and store traffic flow and image data from the field equipment to detect and verify incidents.
-
- Requirement:* 3 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, and intermodal freight depots.
-
- Requirement:* 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJSP/NJDOT Statewide Dispatch Center***Entity:* **Traffic Management***Functional Area:* **TMC Incident Detection**

Remotely controls traffic and video sensors to support incident detection and verification; exchange information with other agencies including emergency management, maintenance and construction, alerting and advisory systems, event promoters, intermodal freight depots, and traveler information systems.

Requirement: 5 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field.

Requirement: 6 The center shall provide road network conditions and traffic images to emergency management centers to support the detection, verification, and classification of incidents.

Requirement: 7 The center shall provide video and traffic sensor control commands to the field equipment to detect and verify incidents.

Functional Area: **TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

Requirement: 1 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction for distribution to the public. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, and information and instructions necessary for the public to respond to the alert. This may also identify specific information that should not be released to the public.

Requirement: 2 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.

Requirement: 3 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field, provide special routing for emergency vehicles, and to provide responding emergency vehicles with signal preemption.

Requirement: 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.

Requirement: 5 The center shall respond to requests from emergency management to provide traffic management resources to implement special traffic control measures, assist in clean up, verify an incident, etc. This may also involve coordination with maintenance centers.

Requirement: 6 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, media, and rail operations centers.

Requirement: 7 The center shall provide road network conditions and traffic images to emergency management centers, maintenance and construction centers, and traveler information service providers.

Requirement: 8 The center shall exchange road network status assessment information with emergency management and maintenance centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.

Requirement: 9 The center shall coordinate information and controls with other traffic management centers.

Requirement: 10 The center shall receive inputs from emergency management and transit management centers to develop an overall status of the transportation system including emergency transit schedules in effect and current status and condition of the transportation infrastructure.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJSP/NJDOT Statewide Dispatch Center***Entity:* **Traffic Management***Functional Area:* **TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

- Requirement:* 11 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic incident management.

Functional Area: **TMC Evacuation Support**

Development, coordination, and execution of special traffic management strategies during evacuation and subsequent reentry of a population in the vicinity of a disaster or major emergency. Interfaces with emergency management and other traffic management centers.

- Requirement:* 1 The center shall coordinate planning for evacuation with emergency management centers - including pre-planning activities such as establishing routes, areas to be evacuated, timing, etc.
- Requirement:* 2 The center shall support requests from emergency management centers to preempt the current traffic control strategy, activate traffic control and closure systems such as gates and barriers, activate safeguard systems, or use driver information systems to support evacuation traffic control plans.
- Requirement:* 3 The center shall coordinate information and controls with other traffic management centers.
- Requirement:* 4 The center shall coordinate execution of evacuation strategies with emergency management centers - including activities such as setting closures and detours, establishing routes, updating areas to be evacuated, timing the process, etc.

Functional Area: **TMC Environmental Monitoring**

Management of environmental sensors and assimilation of collected data with other current and forecast road conditions and surface weather information from weather service providers and roadway maintenance operations.

- Requirement:* 1 The center shall remotely control environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures.
- Requirement:* 2 The center shall remotely control environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.
- Requirement:* 3 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services), data from roadway maintenance operations, and environmental data collected from sensors deployed on and about the roadway.
- Requirement:* 4 The center shall provide weather and road condition information to weather service providers and center personnel.
- Requirement:* 5 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.

Functional Area: **Barrier System Management**

Remotely controls barrier systems such as gates and other systems that manage entry to roadways, transportation facilities and infrastructure.

- Requirement:* 1 The center shall remotely control barrier systems for transportation facilities and infrastructure. Barrier systems include automated or remotely controlled gates, barriers and other systems that manage entry to roadways.
- Requirement:* 2 The center shall collect barrier system operational status.
- Requirement:* 3 The center shall collect barrier system fault data and send to the maintenance center for repair.

Architecture**Northern New Jersey ITS Architecture***Element:***NJSP/NJDOT Statewide Dispatch Center***Entity:***Traffic Management***Functional Area:* **Barrier System Management**

Remotely controls barrier systems such as gates and other systems that manage entry to roadways, transportation facilities and infrastructure.

- Requirement:* 4 The center shall accept requests for barrier system activation from other centers and from center personnel to support emergency response and detours.

Functional Area: **Safeguard System Management**

Remotely controls safeguard systems such as blast shields and tunnel exhaust systems that are used to mitigate the impact of incidents on transportation infrastructure.

- Requirement:* 1 The center shall remotely control safeguard systems, equipment used to mitigate the impact of incidents on transportation infrastructure (e.g., blast shields, tunnel exhaust systems, etc.)

- Requirement:* 2 The center shall collect safeguard system operational status.

- Requirement:* 3 The center shall collect safeguard system fault data and send to the maintenance center for repair.

- Requirement:* 4 The center shall accept requests for safeguard system activation from other centers and from center personnel to support emergency response.

Functional Area: **TMC Work Zone Traffic Management**

Coordination with maintenance systems using work zone images and traveler information systems (such as DMS), and distribution of work plans so that work zones are established that have minimum traffic impact.

- Requirement:* 1 The center shall receive work zone images from a maintenance center.

- Requirement:* 2 The center shall analyze work zone images for indications of a possible incident.

- Requirement:* 3 The center shall remotely control driver information systems (such as dynamic messages signs, highway advisory radios) to advise drivers of activity around a work zone.

- Requirement:* 4 The center shall collect operational status for the driver information systems equipment in work zones.

- Requirement:* 5 The center shall collect fault data for the driver information systems equipment in work zones for repair.

- Requirement:* 6 The center shall receive proposed maintenance and construction work plans, analyze the activity as a possible incident, and provide work plan feedback to the sending center.

Functional Area: **Traffic Data Collection**

Collection and storage of traffic management data. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect traffic management data such as operational data, event logs, etc.

- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

- Requirement:* 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the traffic data or for the data itself.

- Requirement:* 4 The center shall be able to produce sample products of the data available.

*Element:***NJT Access Link Dispatch***Entity:***Transit Management***Functional Area:* **Transit Center Tracking and Dispatch**

Monitoring transit vehicle locations via interactions with on-board systems and determining vehicle schedule adherence. Furnish users with real-time transit related information and maintain interface with digital map providers.

Architecture**Northern New Jersey ITS Architecture***Element:***NJT Access Link Dispatch***Entity:***Transit Management***Functional Area:* **Transit Center Tracking and Dispatch**

Monitoring transit vehicle locations via interactions with on-board systems and determining vehicle schedule adherence. Furnish users with real-time transit related information and maintain interface with digital map providers.

- Requirement:* 1 The center shall monitor the locations of all transit vehicles within its network.
- Requirement:* 2 The center shall determine adherence of transit vehicles to their assigned schedule.
- Requirement:* 3 The center shall collect trip monitoring data from on-board systems including transit vehicle mileage, fuel usage, passenger loading, availability, etc.
- Requirement:* 4 The center shall provide transit operational data to traveler information service providers.
- Requirement:* 5 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for transit tracking and dispatch.

Functional Area: **Transit Center Paratransit Operations**

Planning and scheduling of demand responsive transit (i.e. paratransit) services, includes automatic operator assignment and monitoring.

- Requirement:* 1 The center shall process trip requests for demand responsive transit services, i.e. paratransit. Sources of the requests may include traveler information service providers.
- Requirement:* 2 The center shall track the location and availability of transit vehicles for use in demand responsive transit (paratransit) operations.
- Requirement:* 3 The center shall generate demand responsive transit (paratransit) routes and schedules based on such factors as parameters input by the system operator, what other demand responsive transit schedules have been planned, the availability and location of vehicles, the relevance of any fixed transit routes and schedules, and road network information.
- Requirement:* 4 The center shall assign transit vehicle operators for confirmed demand responsive transit (paratransit) trips based on factors such as eligibility, route preferences, seniority, and transit vehicle availability.
- Requirement:* 5 The center shall exchange information with Maintenance and Construction Operations concerning work zones, roadway conditions, asset restrictions, work plans, etc.
- Requirement:* 6 The center shall disseminate up-to-date schedules and route information to other centers for demand responsive transit services (paratransit).

Functional Area: **Transit Center Security**

Monitor transit vehicle operator or traveler activated alarms; authenticate transit vehicle operators; remotely disable a transit vehicle; alert operators, travelers, and police to potential incidents identified by these security features.

- Requirement:* 1 The center shall monitor transit vehicle operational data to determine if the transit vehicle is off-route and assess whether a security incident is occurring.
- Requirement:* 2 The center shall receive reports of emergencies on-board transit vehicles entered directly by the transit vehicle operator or from a traveler through interfaces such as panic buttons or alarm switches.
- Requirement:* 3 The center shall support the back-office portion of functionality to authenticate transit vehicle operators.
- Requirement:* 4 The center shall exchange transit incident information along with other service data with other transit agencies.
- Requirement:* 5 The center shall receive information pertaining to a wide-area alert such as weather alerts, disaster situations, or child abductions. This information may come from Emergency Management or from other Alerting and Advisory Systems.

Architecture

Northern New Jersey ITS Architecture

Element: **NJT Access Link Dispatch**

Entity: **Transit Management**

Functional Area: **Transit Center Security**

Monitor transit vehicle operator or traveler activated alarms; authenticate transit vehicle operators; remotely disable a transit vehicle; alert operators, travelers, and police to potential incidents identified by these security features.

Requirement: 6 The center shall send wide-area alert information to travelers (on-board transit vehicles or at stations/stops) and transit vehicle operators.

Requirement: 7 The center shall coordinate the response to security incidents involving transit with other agencies including Emergency Management, other transit agencies, media, traffic management, and traveler information service providers.

Requirement: 8 The center shall receive threat information and status on the integrity of the transit infrastructure.

Requirement: 9 The center shall provide support to remotely disable (or reset the disabling of) a transit vehicle in service.

Functional Area: **Transit Garage Operations**

Assignment of transit vehicles and operators to routes or service areas in a fair manner while minimizing labor and overtime services, considering operator preferences, qualifications, accumulated work hours, and other information about each operator.

Requirement: 1 The center shall maintain records of a transit vehicle operator's performance. This may be done utilizing standardized performance evaluation criteria set forth by governmental regulations and transit operating company policies, assessing the transit vehicle operator's driving history, and assessing comments from the transit vehicle operator's supervisor(s) as well as noting any moving violations or accidents, supervisor comments, government regulations, and company policies.

Requirement: 2 The center shall assess the transit vehicle operator's availability based on previous work assignments, accumulated hours, plus health and vacation commitments.

Requirement: 3 The center shall assign transit vehicle operators to transit schedules based on their eligibility, route preferences, seniority, and transit vehicle availability.

Requirement: 4 The center shall provide an interface through which the transit vehicle operator information can be maintained - either from the transit vehicle operator, a transit system operator (i.e. center personnel), or other functions.

Functional Area: **Transit Center Information Services**

Provide interactive traveler information to travelers (on-board transit vehicles, at stops/stations, using personal devices), traveler information service providers, media, and other transit organizations. Includes routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, yellow pages, and special events.

Requirement: 1 The center shall provide travelers using public transportation with traffic and advisory information upon request. Such information may include transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events.

Requirement: 2 The center shall provide transit information to the media including details of deviations from schedule of regular transit services.

Requirement: 3 The center shall exchange transit schedules, real-time arrival information, fare schedules, and general transit service information with other transit organizations to support transit traveler information systems.

Requirement: 4 The center shall provide transit service information to traveler information service providers including routes, schedules, schedule adherence, and fare information as well as transit service information during evacuation.

Architecture

Northern New Jersey ITS Architecture

Element: **NJT Access Link Dispatch**

Entity: **Transit Management**

Functional Area: **Transit Center Information Services**

Provide interactive traveler information to travelers (on-board transit vehicles, at stops/stations, using personal devices), traveler information service providers, media, and other transit organizations. Includes routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, yellow pages, and special events.

Requirement: 5 The center shall enable yellow pages (including non-motorized transportation) information to be output to the traveler.

Requirement: 6 The center shall broadcast transit advisory data, including alerts and advisories pertaining to major emergencies, or man made disasters.

Functional Area: **Transit Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and vehicle probes. The information is monitored and forwarded to other agencies to more effectively manage transit operations.

Requirement: 1 The center shall assimilate current and forecast road conditions and surface weather information to more effectively manage transit operations.

Requirement: 2 The center shall collect current and forecast road and weather information from weather service providers and vehicle probes.

Requirement: 3 The center shall receive road network probe information from its fleet of transit vehicles.

Requirement: 4 The center shall provide road network probe information from its fleet of transit vehicles to traffic management as well as maintenance and construction management.

Functional Area: **Transit Center Multi-Modal Coordination**

Generate requests for transit priority on routes and at certain intersections. Coordinate schedules with other agencies and modes, including transit transfer cluster and transfer point information.

Requirement: 1 The center shall analyze transit vehicle schedule performance to determine the need for priority along certain routes or at certain intersections.

Requirement: 2 The center shall send requests for priority along routes or at intersections to traffic management.

Requirement: 3 The center shall coordinate schedules and services between transit agencies, traffic management, maintenance and construction operations, parking management, and other surface or air transportation modes.

Requirement: 4 The center shall share transfer cluster and transfer point information with multimodal transportation service providers, other transit agencies, and traveler information service providers. A transfer cluster is a collection of stops, stations, or terminals where transfers can be made conveniently.

Functional Area: **Transit Evacuation Support**

Support evacuation and subsequent reentry of a population in the vicinity of a disaster or other emergency. Coordinate regional evacuation plans and resources including transit and school bus fleets.

Requirement: 1 The center shall manage the use of transit resources to support evacuation and subsequent reentry of a population in the vicinity of a disaster or other emergency.

Requirement: 2 The center shall coordinate regional evacuation plans with Emergency Management - identifying the transit role in an evacuation and the transit resources that would be used.

Requirement: 3 The center shall coordinate the use of transit and school bus fleets during an evacuation, supporting evacuation of those with special needs and the general population.

Requirement: 4 The center shall adjust and update transit service and fare schedules and provide that information to other agencies as they coordinate evacuations.

Architecture

Northern New Jersey ITS Architecture

*Element:***NJT Access Link Dispatch**

*Entity:***Transit Management**

Functional Area: **Transit Data Collection**

Collection and storage of transit management data. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect transit management data such as transit fares and passenger use, transit services, paratransit operations, transit vehicle maintenance data, etc.
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- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.
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- Requirement:* 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the transit data or for the data itself.
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- Requirement:* 4 The center shall be able to produce sample products of the data available.
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*Element:***NJT Access Link Vehicles**

*Entity:***Transit Vehicle Subsystem**

Functional Area: **On-board Transit Trip Monitoring**

Support fleet management with automatic vehicle location (AVL) and automated mileage and fuel reporting and auditing.

- Requirement:* 1 The transit vehicle shall compute the location of the transit vehicle based on inputs from a vehicle location determination function.
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- Requirement:* 2 The transit vehicle shall support the computation of the location of a transit vehicle using on-board sensors to augment the location determination function. This may include proximity to the transit stops or other known reference points as well as recording trip length.
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- Requirement:* 3 The transit vehicle shall record transit trip monitoring data including vehicle mileage and fuel usage.
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- Requirement:* 4 The transit vehicle shall record transit trip monitoring data including operational status information such as doors open/closed, passenger loading, running times, etc.
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- Requirement:* 5 The transit vehicle shall send the transit vehicle trip monitoring data to center-based trip monitoring functions.
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Functional Area: **On-board Paratransit Operations**

On-board systems to manage paratransit and flexible-route dispatch requests, including multi-stop runs. Inputs based on the transit vehicle's type and passenger capacity.

- Requirement:* 1 The transit vehicle shall manage data input to sensor(s) on-board a transit vehicle to determine the vehicle's availability for use in demand responsive and flexible-route transit services based on identity, type, and passenger capacity.
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- Requirement:* 2 The transit vehicle shall receive the status of demand responsive or flexible-route transit schedules and passenger loading from the transit vehicle operator.
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- Requirement:* 3 The transit vehicle shall provide the transit vehicle operator instructions about the demand responsive or flexible-route transit schedule that has been confirmed from the center.
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Functional Area: **On-board Transit Fare and Load Management**

On-board systems provide variable and flexible fare collection using a travelers fare medium (stored value cards or other payment instrument). Collect data required to determine accurate ridership levels and fare statistics.

- Requirement:* 1 The transit vehicle shall detect embarking travelers on-board a transit vehicle and read data from the traveler card / payment instrument that they are carrying.
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- Requirement:* 2 The transit vehicle shall provide an image of all travelers which shall be used for violation processing of those who do not have a traveler card / payment instrument or whose transit fare transaction fails.
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Architecture**Northern New Jersey ITS Architecture***Element:***NJT Access Link Vehicles***Entity:***Transit Vehicle Subsystem***Functional Area:* **On-board Transit Fare and Load Management**

On-board systems provide variable and flexible fare collection using a travelers fare medium (stored value cards or other payment instrument). Collect data required to determine accurate ridership levels and fare statistics.

- Requirement:* 3 The transit vehicle shall determine the traveler's travel routing based on the transit vehicle's current location and the traveler's destination.
- Requirement:* 4 The transit vehicle shall calculate the traveler's fare based on the origin and destination provided by the traveler as well as factors such as the transit routing, transit fare category, traveler history, and route-specific information.
- Requirement:* 5 The transit vehicle shall have access to the complete range of transit services (routes and schedules) that are available to the traveler.
- Requirement:* 6 The transit vehicle shall provide a transit fare payment interface that is suitable for travelers with physical disabilities.
- Requirement:* 7 The transit vehicle shall include a database on-board the transit vehicle for use in fare processing from which the fares for all possible trips within the transit operational network can be determined.
- Requirement:* 8 The transit vehicle shall support an emergency fare structure overriding all other fares that can be activated during disasters, states of emergency or evacuations.
- Requirement:* 9 The transit vehicle shall support the support advanced payments for tolls, and/or parking lot charges, and/or transit fares via the traveler card / payment instrument.
- Requirement:* 10 The transit vehicle shall provide passenger loading and fare statistics data to the center.

Functional Area: **On-board Transit Security**

On-board video/audio surveillance systems, threat sensors, and object detection sensors to enhance security and safety on-board a transit vehicles. Also includes silent alarms activated by transit user or vehicle operator, operator authentication, and remote vehicle disabling.

- Requirement:* 1 The transit vehicle shall perform video and audio surveillance inside of transit vehicles and output raw video or audio data for either local monitoring (for processing or direct output to the transit vehicle operator), remote monitoring or for local storage (e.g., in an event recorder).
- Requirement:* 2 The transit vehicle shall perform local monitoring of video or audio surveillance data collected inside of transit vehicles, and identify potential incidents or threats based on received processing parameters.
- Requirement:* 3 The transit vehicle shall output an indication of potential incidents or threats and the processed video or audio information to the center along with the vehicle's current location.
- Requirement:* 4 The transit vehicle shall detect potential threats via sensors for chemical agents, toxic industrial chemicals, biological agents, explosives, and radiation.
- Requirement:* 5 The transit vehicle shall detect potential threats via object detection sensors(e.g. metal detectors).
- Requirement:* 6 The transit vehicle shall output an indication of potential incidents or threats and the processed sensor information to the center along with the vehicle's current location.
- Requirement:* 7 The transit vehicle shall accept sensor control data to allow remote control of the sensors.
- Requirement:* 8 The transit vehicle shall monitor and output surveillance and sensor equipment status and fault indications.
- Requirement:* 9 The transit vehicle shall accept emergency inputs from either the transit vehicle operator or a traveler through such interfaces as panic buttons, silent or audible alarms, etc.
- Requirement:* 10 The transit vehicle shall output reported emergencies to the center.
- Requirement:* 11 The transit vehicle shall receive acknowledgments of the emergency request from the center and output this acknowledgment to the transit vehicle operator or to the travelers.

Architecture**Northern New Jersey ITS Architecture***Element:***NJT Access Link Vehicles***Entity:***Transit Vehicle Subsystem***Functional Area:* **On-board Transit Security**

On-board video/audio surveillance systems, threat sensors, and object detection sensors to enhance security and safety on-board a transit vehicles. Also includes silent alarms activated by transit user or vehicle operator, operator authentication, and remote vehicle disabling.

Requirement: 12 The transit vehicle shall be capable of receiving an emergency message for broadcast to the travelers or to the transit vehicle operator.

Requirement: 13 The transit vehicle shall be capable of disabling or enabling the transit vehicle based on commands from the center or authentic inputs from the transit vehicle operator.

Requirement: 14 The transit vehicle shall perform authentication of the transit vehicle operator.

Functional Area: **On-board Transit Information Services**

On-board systems to furnish next-stop annunciation as well as interactive travel-related information, including routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, non-motorized transportation services, and special events.

Requirement: 1 The transit vehicle shall enable traffic and travel advisory information to be requested and output to the traveler. Such information may include transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events.

Requirement: 2 The transit vehicle shall enable yellow pages (including non-motorized transportation) information to be requested and output to the traveler.

Requirement: 3 The transit vehicle shall broadcast advisories about the imminent arrival of the transit vehicle at the next stop via an on-board automated annunciation system.

Requirement: 4 The transit vehicle shall support input and output forms that are suitable for travelers with physical disabilities.

Requirement: 5 The transit vehicle shall gather transit advisory data, including alerts and advisories pertaining to major emergencies, or man made disasters.

Requirement: 6 The transit vehicle shall tailor the output of the request traveler information based on the current location of the transit vehicle.

*Element:***NJT Bus Operations North***Entity:***Transit Management***Functional Area:* **Transit Center Tracking and Dispatch**

Monitoring transit vehicle locations via interactions with on-board systems and determining vehicle schedule adherence. Furnish users with real-time transit related information and maintain interface with digital map providers.

Requirement: 1 The center shall monitor the locations of all transit vehicles within its network.

Requirement: 2 The center shall determine adherence of transit vehicles to their assigned schedule.

Requirement: 3 The center shall collect trip monitoring data from on-board systems including transit vehicle mileage, fuel usage, passenger loading, availability, etc.

Requirement: 4 The center shall provide transit operational data to traveler information service providers.

Requirement: 5 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for transit tracking and dispatch.

Functional Area: **Transit Center Fixed-Route Operations**

Architecture**Northern New Jersey ITS Architecture***Element:* **NJT Bus Operations North***Entity:* **Transit Management***Functional Area:* **Transit Center Fixed-Route Operations**

Planning and scheduling associated with fixed and flexible route transit services, automatically updates customer service operator systems, and provides current vehicle schedule adherence and optimum scenarios for schedule adjustment.

- Requirement:* 1 The center shall generate transit routes and schedules based on such factors as parameters input by the system operator, road network conditions, operational data on current routes and schedules, and digitized map data.
- Requirement:* 2 The center shall provide the interface to the system operator to control the generation of new routes and schedules (transit services) including the ability to review and update the parameters used by the routes and schedules generation processes and to initiate these processes
- Requirement:* 3 The center shall be able to generate special routes and schedules to support an incident, disaster, evacuation, or other emergency.
- Requirement:* 4 The center shall accept requests from traffic management to change routes and schedules as part of the implementation of demand management strategies.
- Requirement:* 5 The center shall collect transit operational data for use in the generation of routes and schedules.
- Requirement:* 6 The center shall assign transit vehicle operators based on factors such as eligibility, route preferences, seniority, and transit vehicle availability.
- Requirement:* 7 The center shall manage large deviations of individual transit vehicles, deviations in rural areas, and deviations of large numbers of vehicles.
- Requirement:* 8 The center shall generate the necessary corrective actions which may involve more than the vehicles concerned and more far reaching action, such as, the introduction of extra vehicles, wide area signal priority by traffic management, the premature termination of some services, etc.
- Requirement:* 9 The center shall exchange information with Maintenance and Construction Operations concerning work zones, roadway conditions, asset restrictions, work plans, etc.
- Requirement:* 10 The center shall disseminate up-to-date schedules and route information to other centers for fixed and flexible route services.

Functional Area: **Transit Center Security**

Monitor transit vehicle operator or traveler activated alarms; authenticate transit vehicle operators; remotely disable a transit vehicle; alert operators, travelers, and police to potential incidents identified by these security features.

- Requirement:* 1 The center shall monitor transit vehicle operational data to determine if the transit vehicle is off-route and assess whether a security incident is occurring.
- Requirement:* 2 The center shall receive reports of emergencies on-board transit vehicles entered directly by the transit vehicle operator or from a traveler through interfaces such as panic buttons or alarm switches.
- Requirement:* 3 The center shall support the back-office portion of functionality to authenticate transit vehicle operators.
- Requirement:* 4 The center shall exchange transit incident information along with other service data with other transit agencies.
- Requirement:* 5 The center shall receive information pertaining to a wide-area alert such as weather alerts, disaster situations, or child abductions. This information may come from Emergency Management or from other Alerting and Advisory Systems.
- Requirement:* 6 The center shall send wide-area alert information to travelers (on-board transit vehicles or at stations/stops) and transit vehicle operators.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJT Bus Operations North***Entity:* **Transit Management***Functional Area:* **Transit Center Security**

Monitor transit vehicle operator or traveler activated alarms; authenticate transit vehicle operators; remotely disable a transit vehicle; alert operators, travelers, and police to potential incidents identified by these security features.

Requirement: 7 The center shall coordinate the response to security incidents involving transit with other agencies including Emergency Management, other transit agencies, media, traffic management, and traveler information service providers.

Requirement: 8 The center shall receive threat information and status on the integrity of the transit infrastructure.

Requirement: 9 The center shall provide support to remotely disable (or reset the disabling of) a transit vehicle in service.

Functional Area: **Transit Garage Operations**

Assignment of transit vehicles and operators to routes or service areas in a fair manner while minimizing labor and overtime services, considering operator preferences, qualifications, accumulated work hours, and other information about each operator.

Requirement: 1 The center shall maintain records of a transit vehicle operator's performance. This may be done utilizing standardized performance evaluation criteria set forth by governmental regulations and transit operating company policies, assessing the transit vehicle operator's driving history, and assessing comments from the transit vehicle operator's supervisor(s) as well as noting any moving violations or accidents, supervisor comments, government regulations, and company policies.

Requirement: 2 The center shall assess the transit vehicle operator's availability based on previous work assignments, accumulated hours, plus health and vacation commitments.

Requirement: 3 The center shall assign transit vehicle operators to transit schedules based on their eligibility, route preferences, seniority, and transit vehicle availability.

Requirement: 4 The center shall provide an interface through which the transit vehicle operator information can be maintained - either from the transit vehicle operator, a transit system operator (i.e. center personnel), or other functions.

Functional Area: **Transit Center Information Services**

Provide interactive traveler information to travelers (on-board transit vehicles, at stops/stations, using personal devices), traveler information service providers, media, and other transit organizations. Includes routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, yellow pages, and special events.

Requirement: 1 The center shall provide travelers using public transportation with traffic and advisory information upon request. Such information may include transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events.

Requirement: 2 The center shall provide transit information to the media including details of deviations from schedule of regular transit services.

Requirement: 3 The center shall exchange transit schedules, real-time arrival information, fare schedules, and general transit service information with other transit organizations to support transit traveler information systems.

Requirement: 4 The center shall provide transit service information to traveler information service providers including routes, schedules, schedule adherence, and fare information as well as transit service information during evacuation.

Requirement: 5 The center shall enable yellow pages (including non-motorized transportation) information to be output to the traveler.

Requirement: 6 The center shall broadcast transit advisory data, including alerts and advisories pertaining to major emergencies, or man made disasters.

Architecture

Northern New Jersey ITS Architecture

Element: **NJT Bus Operations North**

Entity: **Transit Management**

Functional Area: **Transit Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and vehicle probes. The information is monitored and forwarded to other agencies to more effectively manage transit operations.

Requirement: 1 The center shall assimilate current and forecast road conditions and surface weather information to more effectively manage transit operations.

Requirement: 2 The center shall collect current and forecast road and weather information from weather service providers and vehicle probes.

Requirement: 3 The center shall receive road network probe information from its fleet of transit vehicles.

Requirement: 4 The center shall provide road network probe information from its fleet of transit vehicles to traffic management as well as maintenance and construction management.

Functional Area: **Transit Center Multi-Modal Coordination**

Generate requests for transit priority on routes and at certain intersections. Coordinate schedules with other agencies and modes, including transit transfer cluster and transfer point information.

Requirement: 1 The center shall analyze transit vehicle schedule performance to determine the need for priority along certain routes or at certain intersections.

Requirement: 2 The center shall send requests for priority along routes or at intersections to traffic management.

Requirement: 3 The center shall coordinate schedules and services between transit agencies, traffic management, maintenance and construction operations, parking management, and other surface or air transportation modes.

Requirement: 4 The center shall share transfer cluster and transfer point information with multimodal transportation service providers, other transit agencies, and traveler information service providers. A transfer cluster is a collection of stops, stations, or terminals where transfers can be made conveniently.

Functional Area: **Transit Evacuation Support**

Support evacuation and subsequent reentry of a population in the vicinity of a disaster or other emergency. Coordinate regional evacuation plans and resources including transit and school bus fleets.

Requirement: 1 The center shall manage the use of transit resources to support evacuation and subsequent reentry of a population in the vicinity of a disaster or other emergency.

Requirement: 2 The center shall coordinate regional evacuation plans with Emergency Management - identifying the transit role in an evacuation and the transit resources that would be used.

Requirement: 3 The center shall coordinate the use of transit and school bus fleets during an evacuation, supporting evacuation of those with special needs and the general population.

Requirement: 4 The center shall adjust and update transit service and fare schedules and provide that information to other agencies as they coordinate evacuations.

Functional Area: **Transit Data Collection**

Collection and storage of transit management data. For use by operations personnel or data archives in the region.

Requirement: 1 The center shall collect transit management data such as transit fares and passenger use, transit services, paratransit operations, transit vehicle maintenance data, etc.

Requirement: 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

Architecture

Northern New Jersey ITS Architecture

Element: **NJT Bus Operations North**

Entity: **Transit Management**

Functional Area: **Transit Data Collection**

Collection and storage of transit management data. For use by operations personnel or data archives in the region.

Requirement: 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the transit data or for the data itself.

Requirement: 4 The center shall be able to produce sample products of the data available.

Element: **NJT Bus Vehicles**

Entity: **Transit Vehicle Subsystem**

Functional Area: **On-board Transit Trip Monitoring**

Support fleet management with automatic vehicle location (AVL) and automated mileage and fuel reporting and auditing.

Requirement: 1 The transit vehicle shall compute the location of the transit vehicle based on inputs from a vehicle location determination function.

Requirement: 2 The transit vehicle shall support the computation of the location of a transit vehicle using on-board sensors to augment the location determination function. This may include proximity to the transit stops or other known reference points as well as recording trip length.

Requirement: 3 The transit vehicle shall record transit trip monitoring data including vehicle mileage and fuel usage.

Requirement: 4 The transit vehicle shall record transit trip monitoring data including operational status information such as doors open/closed, passenger loading, running times, etc.

Requirement: 5 The transit vehicle shall send the transit vehicle trip monitoring data to center-based trip monitoring functions.

Functional Area: **On-board Fixed Route Schedule Management**

Collecting of data for schedule generation and adjustment on-board a transit vehicle. Supports communication between the vehicle, operator, and center.

Requirement: 1 The transit vehicle shall receive transit route information for its assigned route including transit service instructions, traffic information, road conditions, and other information for the operator.

Requirement: 2 The transit vehicle shall use the route information and its current location to determine the deviation from the predetermined schedule.

Requirement: 3 The transit vehicle shall calculate the estimated times of arrival (ETA) at transit stops.

Requirement: 4 The transit vehicle shall determine scenarios to correct the schedule deviation.

Requirement: 5 The transit vehicle shall provide the schedule deviations and instructions for schedule corrections to the transit vehicle operator if the deviation is small, or the transit vehicle is operating in an urban area.

Requirement: 6 The transit vehicle shall send the schedule deviation and estimated arrival time information to the center.

Requirement: 7 The transit vehicle shall support the operations of a flexible route service. This may include requests for route deviations that would then lead to schedule corrective actions.

Functional Area: **On-board Transit Fare and Load Management**

On-board systems provide variable and flexible fare collection using a travelers fare medium (stored value cards or other payment instrument). Collect data required to determine accurate ridership levels and fare statistics.

Requirement: 1 The transit vehicle shall detect embarking travelers on-board a transit vehicle and read data from the traveler card / payment instrument that they are carrying.

Requirement: 2 The transit vehicle shall provide an image of all travelers which shall be used for violation processing of those who do not have a traveler card / payment instrument or whose transit fare transaction fails.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJT Bus Vehicles***Entity:* **Transit Vehicle Subsystem***Functional Area:* **On-board Transit Fare and Load Management**

On-board systems provide variable and flexible fare collection using a travelers fare medium (stored value cards or other payment instrument). Collect data required to determine accurate ridership levels and fare statistics.

- Requirement:* 3 The transit vehicle shall determine the traveler's travel routing based on the transit vehicle's current location and the traveler's destination.
- Requirement:* 4 The transit vehicle shall calculate the traveler's fare based on the origin and destination provided by the traveler as well as factors such as the transit routing, transit fare category, traveler history, and route-specific information.
- Requirement:* 5 The transit vehicle shall have access to the complete range of transit services (routes and schedules) that are available to the traveler.
- Requirement:* 6 The transit vehicle shall provide a transit fare payment interface that is suitable for travelers with physical disabilities.
- Requirement:* 7 The transit vehicle shall include a database on-board the transit vehicle for use in fare processing from which the fares for all possible trips within the transit operational network can be determined.
- Requirement:* 8 The transit vehicle shall support an emergency fare structure overriding all other fares that can be activated during disasters, states of emergency or evacuations.
- Requirement:* 9 The transit vehicle shall support the support advanced payments for tolls, and/or parking lot charges, and/or transit fares via the traveler card / payment instrument.
- Requirement:* 10 The transit vehicle shall provide passenger loading and fare statistics data to the center.

Functional Area: **On-board Transit Security**

On-board video/audio surveillance systems, threat sensors, and object detection sensors to enhance security and safety on-board a transit vehicles. Also includes silent alarms activated by transit user or vehicle operator, operator authentication, and remote vehicle disabling.

- Requirement:* 1 The transit vehicle shall perform video and audio surveillance inside of transit vehicles and output raw video or audio data for either local monitoring (for processing or direct output to the transit vehicle operator), remote monitoring or for local storage (e.g., in an event recorder).
- Requirement:* 2 The transit vehicle shall perform local monitoring of video or audio surveillance data collected inside of transit vehicles, and identify potential incidents or threats based on received processing parameters.
- Requirement:* 3 The transit vehicle shall output an indication of potential incidents or threats and the processed video or audio information to the center along with the vehicle's current location.
- Requirement:* 4 The transit vehicle shall detect potential threats via sensors for chemical agents, toxic industrial chemicals, biological agents, explosives, and radiation.
- Requirement:* 5 The transit vehicle shall detect potential threats via object detection sensors(e.g. metal detectors).
- Requirement:* 6 The transit vehicle shall output an indication of potential incidents or threats and the processed sensor information to the center along with the vehicle's current location.
- Requirement:* 7 The transit vehicle shall accept sensor control data to allow remote control of the sensors.
- Requirement:* 8 The transit vehicle shall monitor and output surveillance and sensor equipment status and fault indications.
- Requirement:* 9 The transit vehicle shall accept emergency inputs from either the transit vehicle operator or a traveler through such interfaces as panic buttons, silent or audible alarms, etc.
- Requirement:* 10 The transit vehicle shall output reported emergencies to the center.
- Requirement:* 11 The transit vehicle shall receive acknowledgments of the emergency request from the center and output this acknowledgment to the transit vehicle operator or to the travelers.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJT Bus Vehicles***Entity:* **Transit Vehicle Subsystem***Functional Area:* **On-board Transit Security**

On-board video/audio surveillance systems, threat sensors, and object detection sensors to enhance security and safety on-board a transit vehicles. Also includes silent alarms activated by transit user or vehicle operator, operator authentication, and remote vehicle disabling.

Requirement: 12 The transit vehicle shall be capable of receiving an emergency message for broadcast to the travelers or to the transit vehicle operator.

Requirement: 13 The transit vehicle shall be capable of disabling or enabling the transit vehicle based on commands from the center or authentic inputs from the transit vehicle operator.

Requirement: 14 The transit vehicle shall perform authentication of the transit vehicle operator.

Functional Area: **On-board Maintenance**

On-board systems to collect and process transit vehicle maintenance data including mileage and vehicle operating conditions for use in scheduling future vehicle maintenance.

Requirement: 1 The transit vehicle shall collect and process vehicle mileage data available to sensors on-board.

Requirement: 2 The transit vehicle shall collect and process the transit vehicle's operating conditions such as engine temperature, oil pressure, brake wear, internal lighting, environmental controls, etc.

Requirement: 3 The transit vehicle shall transmit vehicle maintenance data to the center to be used for scheduling future vehicle maintenance.

Functional Area: **On-board Transit Signal Priority**

On-board systems to provides request signal priority through short range communication directly with traffic control equipment at the roadside (intersections, crossings, ramp meters, etc.).

Requirement: 1 The transit vehicle shall determine the schedule deviation and estimated times of arrival (ETA) at transit stops.

Requirement: 2 The transit vehicle shall send priority requests to traffic signal controllers at intersections, pedestrian crossings, and multimodal crossings on the roads (surface streets) and freeway (ramp controls) network that enable a transit vehicle schedule deviation to be corrected.

Requirement: 3 The transit vehicle shall send the schedule deviation data and status of priority requests to the transit vehicle operator.

Functional Area: **On-board Transit Information Services**

On-board systems to furnish next-stop annunciation as well as interactive travel-related information, including routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, non-motorized transportation services, and special events.

Requirement: 1 The transit vehicle shall enable traffic and travel advisory information to be requested and output to the traveler. Such information may include transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events.

Requirement: 2 The transit vehicle shall enable yellow pages (including non-motorized transportation) information to be requested and output to the traveler.

Requirement: 3 The transit vehicle shall broadcast advisories about the imminent arrival of the transit vehicle at the next stop via an on-board automated annunciation system.

Requirement: 4 The transit vehicle shall support input and output forms that are suitable for travelers with physical disabilities.

Requirement: 5 The transit vehicle shall gather transit advisory data, including alerts and advisories pertaining to major emergencies, or man made disasters.

Architecture

Northern New Jersey ITS Architecture

Element: **NJT Bus Vehicles**

Entity: **Transit Vehicle Subsystem**

Functional Area: **On-board Transit Information Services**

On-board systems to furnish next-stop annunciation as well as interactive travel-related information, including routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, non-motorized transportation services, and special events.

- Requirement:* 6 The transit vehicle shall tailor the output of the request traveler information based on the current location of the transit vehicle.
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Element: **NJT Corporate Customer Information / Display Systems**

Entity: **Remote Traveler Support**

Functional Area: **Traveler Secure Area Surveillance**

Security surveillance devices that monitor traveler-frequented areas such as transit stops and rest stops.

- Requirement:* 1 The field element shall include video and/or audio surveillance of traveler secure areas including transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and traveler information centers).
- Requirement:* 2 The field element shall be remotely controlled by a center.
- Requirement:* 3 The field element shall provide equipment status and fault indication of surveillance equipment to a center.
- Requirement:* 4 The field element shall provide raw video or audio data.
- Requirement:* 5 The field element shall remotely process video and audio data and provide an indication of potential incidents or threats to a center.
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Functional Area: **Traveler Secure Area Sensor Monitoring**

Security sensors monitoring traveler-frequented areas such as transit stops, park-and-ride lots, and rest stops for environmental threats, intrusion and motion, and object detection.

- Requirement:* 1 The field element shall include security sensors that monitor conditions in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers).
- Requirement:* 2 The field element shall be remotely controlled by a center.
- Requirement:* 3 The field element shall provide equipment status and fault indication of security sensor equipment to a center.
- Requirement:* 4 The field element shall include environmental threat sensors (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological).
- Requirement:* 5 The field element shall include motion and intrusion detection sensors.
- Requirement:* 6 The field element shall include object detection sensors (such as metal detectors).
- Requirement:* 7 The field element shall provide raw security sensor data.
- Requirement:* 8 The field element shall remotely process security sensor data and provide an indication of potential incidents or threats to a center.
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Functional Area: **Remote Traveler Security**

Public traveler interface that provides the capability for travelers to report an emergency or activate a panic button to summon assistance in areas such as transit stops, park-and-ride areas, etc.

- Requirement:* 1 The public interface for travelers shall provide the capability for a traveler to report an emergency and summon assistance from secure areas such as transit stops, transit stations, modal transfer facilities, rest stops, park-and-ride areas, travel information areas, and emergency pull off areas.
- Requirement:* 2 When initiated by a traveler, the public interface for travelers shall forward a request for assistance to an emergency management function and acknowledge the request.
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Architecture**Northern New Jersey ITS Architecture****Element: NJT Corporate Customer Information / Display Systems****Entity: Remote Traveler Support****Functional Area: Remote Traveler Security**

Public traveler interface that provides the capability for travelers to report an emergency or activate a panic button to summon assistance in areas such as transit stops, park-and-ride areas, etc.

- Requirement:* 3 The public interface for travelers shall provide the capability to broadcast a message to advise or warn a traveler.
- Requirement:* 4 The public interface for travelers shall accept input and provide information to the traveler in a form suitable for travelers with physical disabilities.

Functional Area: Remote Transit Information Services

Public traveler interface that provides real-time travel-related information at transit stops and multi-modal transfer points, including general annunciation, display of imminent arrival information, the latest available information on transit routes, schedules, transfer options, bicycle accessibility, fares, real-time schedule adherence, current incidents, weather conditions, and special events

- Requirement:* 1 The public interface for travelers shall collect and provide real-time travel-related information at transit stops, multi-modal transfer points, and other public transportation areas.
- Requirement:* 2 The public interface for travelers shall collect and present to the transit traveler information on transit routes, schedules, and real-time schedule adherence.
- Requirement:* 3 The public interface for travelers shall provide support for general annunciation and/or display of imminent arrival information and other information of general interest to transit users.
- Requirement:* 4 The public interface for travelers shall present information to the traveler in a form suitable for travelers with physical disabilities.

Element: NJT Corporate Customer Information Center Systems**Entity: Information Service Provider****Functional Area: Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

- Requirement:* 1 The center shall collect, process, store, and disseminate customized traffic and highway condition information to travelers, including incident information, detours and road closures, recommended routes, and current speeds on specific routes upon request.
- Requirement:* 2 The center shall collect, process, store, and disseminate customized maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities upon request.
- Requirement:* 3 The center shall collect, process, store, and disseminate customized transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers upon request.
- Requirement:* 4 The center shall collect, process, store, and disseminate customized parking information to travelers, including location, availability, and fees upon request.
- Requirement:* 5 The center shall collect, process, store, and disseminate customized toll fee information to travelers upon request.
- Requirement:* 6 The center shall collect, process, store, and disseminate customized weather information to travelers upon request.
- Requirement:* 7 The center shall collect, process, store, and disseminate customized multimodal transportation service information (for example, from ferry and airline operators), including transfer points and other information, to travelers upon request.
- Requirement:* 8 The center shall collect, process, store, and disseminate customized event information to travelers upon request.

Architecture**Northern New Jersey ITS Architecture****Element: NJT Corporate Customer Information Center Systems****Entity: Information Service Provider****Functional Area: Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

- Requirement:* 9 The center shall collect, process, store, and disseminate customized air quality information to travelers upon request.
- Requirement:* 10 The center shall provide all traveler information based on the traveler's current location or a specific location identified by the traveler, and filter or customize the provided information accordingly.
- Requirement:* 11 The center shall accept traveler profiles for determining the type of personalized data to send to the traveler.
- Requirement:* 12 The center shall manage payment for services, such as tolls, transit fares, parking lot charges, map updates, and advanced payment for tolls, and provide transaction success or failure details.
- Requirement:* 13 The center shall support requests for traveler information and advanced payment for traveler services from commercial fleet operators.
- Requirement:* 14 The center shall provide the capability to exchange information with another traveler information service provider current or predicted data for road links that are outside the area served by the local supplier.
- Requirement:* 15 The center shall manage updates of digitized map data and provide updates to traveler interface systems upon request.
- Requirement:* 16 The center shall provide the capability to support requests from the media for traffic and incident data.
- Requirement:* 17 The center shall provide the capability for a system operator to control the type and update frequency of traveler information.

Functional Area: Infrastructure Provided Route Selection

Generation of pre-trip and enroute trip plans for travelers (and vehicles) based on current traffic conditions, work zones, weather, and travelers constraints and preferences. Includes end-to-end trips using multiple modes, such as bicycle, transit, etc.

- Requirement:* 1 The center shall provide the capability to provide specific pre-trip and enroute directions to travelers (and drivers), including costs, arrival times, and transfer points.
- Requirement:* 2 The center shall include bicycle routes, walkways, skyways, and multi-use trails in the pre-trip and enroute directions it provides to travelers.
- Requirement:* 3 The center shall support on-line route guidance for travelers using personal devices (such as PDAs).
- Requirement:* 4 The center shall support on-line route guidance for drivers in vehicles.
- Requirement:* 5 The center shall support on-line route guidance for specialty vehicles, such as commercial vehicles.
- Requirement:* 6 The center shall generate route plans based on current and/or predicted conditions of the road network, scheduled maintenance and construction work activities, and work zone activities.
- Requirement:* 7 The center shall generate route plans based on transit services, including fares, schedules, and requirements for travelers with special needs.
- Requirement:* 8 The center shall generate route plans based on current asset restrictions, such as height and weight restrictions on tunnels or bridges.
- Requirement:* 9 The center shall generate route plans based on current or forecasted weather.
- Requirement:* 10 The center shall generate route plans based on ferry, rail, air, or other multimodal transportation data.
- Requirement:* 11 The center shall exchange route segment information with other centers outside the area served by the local center.

Architecture**Northern New Jersey ITS Architecture****Element: NJT Corporate Customer Information Center Systems****Entity: Information Service Provider****Functional Area: Infrastructure Provided Route Selection**

Generation of pre-trip and enroute trip plans for travelers (and vehicles) based on current traffic conditions, work zones, weather, and travelers constraints and preferences. Includes end-to-end trips using multiple modes, such as bicycle, transit, etc.

- Requirement:* 12 The center shall generate trips based on the use of more than one mode of transport.
- Requirement:* 13 The center shall use the preferences and constraints specified by the traveler in the trip request to select the most appropriate mode of transport.
- Requirement:* 14 The center shall provide the capability for the traveler to confirm the proposed trip plan.
- Requirement:* 15 The center shall log route plans, particularly for special vehicles such as those containing hazardous materials, over-sized vehicles, or motorcades, with a traffic center.
- Requirement:* 16 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used to determine vehicle and non-vehicle routes, trip planning, and on-line vehicle guidance.
- Requirement:* 17 The center shall provide the capability for center personnel to control route calculation parameters.

Entity: Transit Management**Functional Area: Transit Center Fixed-Route Operations**

Planning and scheduling associated with fixed and flexible route transit services, automatically updates customer service operator systems, and provides current vehicle schedule adherence and optimum scenarios for schedule adjustment.

- Requirement:* 1 The center shall generate transit routes and schedules based on such factors as parameters input by the system operator, road network conditions, operational data on current routes and schedules, and digitized map data.
- Requirement:* 2 The center shall provide the interface to the system operator to control the generation of new routes and schedules (transit services) including the ability to review and update the parameters used by the routes and schedules generation processes and to initiate these processes
- Requirement:* 3 The center shall be able to generate special routes and schedules to support an incident, disaster, evacuation, or other emergency.
- Requirement:* 4 The center shall accept requests from traffic management to change routes and schedules as part of the implementation of demand management strategies.
- Requirement:* 5 The center shall collect transit operational data for use in the generation of routes and schedules.
- Requirement:* 6 The center shall assign transit vehicle operators based on factors such as eligibility, route preferences, seniority, and transit vehicle availability.
- Requirement:* 7 The center shall manage large deviations of individual transit vehicles, deviations in rural areas, and deviations of large numbers of vehicles.
- Requirement:* 8 The center shall generate the necessary corrective actions which may involve more than the vehicles concerned and more far reaching action, such as, the introduction of extra vehicles, wide area signal priority by traffic management, the premature termination of some services, etc.
- Requirement:* 9 The center shall exchange information with Maintenance and Construction Operations concerning work zones, roadway conditions, asset restrictions, work plans, etc.
- Requirement:* 10 The center shall disseminate up-to-date schedules and route information to other centers for fixed and flexible route services.

Functional Area: Transit Center Paratransit Operations

Architecture**Northern New Jersey ITS Architecture****Element: NJT Corporate Customer Information Center Systems****Entity: Transit Management****Functional Area: Transit Center Paratransit Operations**

Planning and scheduling of demand responsive transit (i.e. paratransit) services, includes automatic operator assignment and monitoring.

- Requirement:* 1 The center shall process trip requests for demand responsive transit services, i.e. paratransit. Sources of the requests may include traveler information service providers.
- Requirement:* 2 The center shall track the location and availability of transit vehicles for use in demand responsive transit (paratransit) operations.
- Requirement:* 3 The center shall generate demand responsive transit (paratransit) routes and schedules based on such factors as parameters input by the system operator, what other demand responsive transit schedules have been planned, the availability and location of vehicles, the relevance of any fixed transit routes and schedules, and road network information.
- Requirement:* 4 The center shall assign transit vehicle operators for confirmed demand responsive transit (paratransit) trips based on factors such as eligibility, route preferences, seniority, and transit vehicle availability.
- Requirement:* 5 The center shall exchange information with Maintenance and Construction Operations concerning work zones, roadway conditions, asset restrictions, work plans, etc.
- Requirement:* 6 The center shall disseminate up-to-date schedules and route information to other centers for demand responsive transit services (paratransit).

Functional Area: Transit Center Security

Monitor transit vehicle operator or traveler activated alarms; authenticate transit vehicle operators; remotely disable a transit vehicle; alert operators, travelers, and police to potential incidents identified by these security features.

- Requirement:* 1 The center shall monitor transit vehicle operational data to determine if the transit vehicle is off-route and assess whether a security incident is occurring.
- Requirement:* 2 The center shall receive reports of emergencies on-board transit vehicles entered directly by the transit vehicle operator or from a traveler through interfaces such as panic buttons or alarm switches.
- Requirement:* 3 The center shall support the back-office portion of functionality to authenticate transit vehicle operators.
- Requirement:* 4 The center shall exchange transit incident information along with other service data with other transit agencies.
- Requirement:* 5 The center shall receive information pertaining to a wide-area alert such as weather alerts, disaster situations, or child abductions. This information may come from Emergency Management or from other Alerting and Advisory Systems.
- Requirement:* 6 The center shall send wide-area alert information to travelers (on-board transit vehicles or at stations/stops) and transit vehicle operators.
- Requirement:* 7 The center shall coordinate the response to security incidents involving transit with other agencies including Emergency Management, other transit agencies, media, traffic management, and traveler information service providers.
- Requirement:* 8 The center shall receive threat information and status on the integrity of the transit infrastructure.
- Requirement:* 9 The center shall provide support to remotely disable (or reset the disabling of) a transit vehicle in service.

Functional Area: Transit Garage Operations

Assignment of transit vehicles and operators to routes or service areas in a fair manner while minimizing labor and overtime services, considering operator preferences, qualifications, accumulated work hours, and other information about each operator.

Architecture**Northern New Jersey ITS Architecture****Element: NJT Corporate Customer Information Center Systems****Entity: Transit Management****Functional Area: Transit Garage Operations**

Assignment of transit vehicles and operators to routes or service areas in a fair manner while minimizing labor and overtime services, considering operator preferences, qualifications, accumulated work hours, and other information about each operator.

- Requirement:* 1 The center shall maintain records of a transit vehicle operator's performance. This may be done utilizing standardized performance evaluation criteria set forth by governmental regulations and transit operating company policies, assessing the transit vehicle operator's driving history, and assessing comments from the transit vehicle operator's supervisor(s) as well as noting any moving violations or accidents, supervisor comments, government regulations, and company policies.
- Requirement:* 2 The center shall assess the transit vehicle operator's availability based on previous work assignments, accumulated hours, plus health and vacation commitments.
- Requirement:* 3 The center shall assign transit vehicle operators to transit schedules based on their eligibility, route preferences, seniority, and transit vehicle availability.
- Requirement:* 4 The center shall provide an interface through which the transit vehicle operator information can be maintained - either from the transit vehicle operator, a transit system operator (i.e. center personnel), or other functions.

Functional Area: Transit Garage Maintenance

Collect operational and maintenance data from transit vehicles, manage vehicle service histories, automatically generate preventative maintenance schedules, and provide information to service personnel.

- Requirement:* 1 The center shall collect operational and maintenance data from transit vehicles.
- Requirement:* 2 The center shall monitor the condition of a transit vehicle to analyze brake, drive train, sensors, fuel, steering, tire, processor, communications equipment, and transit vehicle mileage to identify mileage based maintenance, out-of-specification or imminent failure conditions.
- Requirement:* 3 The center shall generate transit vehicle maintenance schedules, includes what and when the maintenance or repair is to be performed.
- Requirement:* 4 The center shall generate transit vehicle availability listings, current and forecast, to support transit vehicle assignment planning based, in part, on the transit vehicle maintenance schedule.
- Requirement:* 5 The center shall assign technicians to a transit vehicle maintenance schedule, based upon such factors as personnel eligibility, work assignments, preferences and seniority.
- Requirement:* 6 The center shall verify that the transit vehicle maintenance activities were performed correctly, using the transit vehicle's status, the maintenance personnel's work assignment, and the transit maintenance schedules.
- Requirement:* 7 The center shall generate a time-stamped maintenance log of all maintenance activities performed on a transit vehicle.
- Requirement:* 8 The center shall provide the transit system operator with the capability to update transit vehicle maintenance information and receive reports on all transit vehicle operations data.

Functional Area: Transit Center Information Services

Provide interactive traveler information to travelers (on-board transit vehicles, at stops/stations, using personal devices), traveler information service providers, media, and other transit organizations. Includes routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, yellow pages, and special events.

- Requirement:* 1 The center shall provide travelers using public transportation with traffic and advisory information upon request. Such information may include transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events.

Architecture**Northern New Jersey ITS Architecture****Element: NJT Corporate Customer Information Center Systems****Entity: Transit Management****Functional Area: Transit Center Information Services**

Provide interactive traveler information to travelers (on-board transit vehicles, at stops/stations, using personal devices), traveler information service providers, media, and other transit organizations. Includes routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, yellow pages, and special events.

- Requirement:** 2 The center shall provide transit information to the media including details of deviations from schedule of regular transit services.
- Requirement:** 3 The center shall exchange transit schedules, real-time arrival information, fare schedules, and general transit service information with other transit organizations to support transit traveler information systems.
- Requirement:** 4 The center shall provide transit service information to traveler information service providers including routes, schedules, schedule adherence, and fare information as well as transit service information during evacuation.
- Requirement:** 5 The center shall enable yellow pages (including non-motorized transportation) information to be output to the traveler.
- Requirement:** 6 The center shall broadcast transit advisory data, including alerts and advisories pertaining to major emergencies, or man made disasters.

Functional Area: Transit Center Multi-Modal Coordination

Generate requests for transit priority on routes and at certain intersections. Coordinate schedules with other agencies and modes, including transit transfer cluster and transfer point information.

- Requirement:** 1 The center shall analyze transit vehicle schedule performance to determine the need for priority along certain routes or at certain intersections.
- Requirement:** 2 The center shall send requests for priority along routes or at intersections to traffic management.
- Requirement:** 3 The center shall coordinate schedules and services between transit agencies, traffic management, maintenance and construction operations, parking management, and other surface or air transportation modes.
- Requirement:** 4 The center shall share transfer cluster and transfer point information with multimodal transportation service providers, other transit agencies, and traveler information service providers. A transfer cluster is a collection of stops, stations, or terminals where transfers can be made conveniently.

Functional Area: Transit Evacuation Support

Support evacuation and subsequent reentry of a population in the vicinity of a disaster or other emergency. Coordinate regional evacuation plans and resources including transit and school bus fleets.

- Requirement:** 1 The center shall manage the use of transit resources to support evacuation and subsequent reentry of a population in the vicinity of a disaster or other emergency.
- Requirement:** 2 The center shall coordinate regional evacuation plans with Emergency Management - identifying the transit role in an evacuation and the transit resources that would be used.
- Requirement:** 3 The center shall coordinate the use of transit and school bus fleets during an evacuation, supporting evacuation of those with special needs and the general population.
- Requirement:** 4 The center shall adjust and update transit service and fare schedules and provide that information to other agencies as they coordinate evacuations.

Element: NJT Emergency Command Center**Entity: Emergency Management****Functional Area: Emergency Call-Taking**

Architecture**Northern New Jersey ITS Architecture***Element:***NJT Emergency Command Center***Entity:***Emergency Management***Functional Area:* **Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

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| <i>Requirement:</i> | 1 The center shall support the interface to the Emergency Telecommunications System (e.g. 911 or 7-digit call routing) to receive emergency notification information and provide it to the emergency system operator. |
| <i>Requirement:</i> | 2 The center shall receive emergency call information from 911 services and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 3 The center shall receive emergency call information from motorist call-boxes and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 4 The center shall receive emergency call information from mayday service providers and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 5 The center shall receive emergency notification information from other public safety agencies and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 6 The center shall receive emergency notification information from public transit systems and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 7 The center shall receive emergency notification information from commercial vehicles, commercial vehicle check stations, or commercial fleet operators and present the possible incident information to the emergency system operator. This may include detection of non-permitted transport of security sensitive hazmat, hazardous cargo spills, etc. |
| <i>Requirement:</i> | 8 The center shall receive details of the cargo being carried by commercial vehicles from their commercial fleet manager for incidents involving potential hazardous materials. |
| <i>Requirement:</i> | 9 The center shall coordinate, correlate, and verify all emergency inputs, including those identified based on external calls and internal analysis of security sensor and surveillance data, and assign each a level of confidence. |
| <i>Requirement:</i> | 10 The center shall send a request for remote control of CCTV systems from a traffic management center in order to verify the reported incident. |
| <i>Requirement:</i> | 11 The center shall update the incident information log once the emergency system operator has verified the incident. |
| <i>Requirement:</i> | 12 The center shall provide the capability for digitized map data to act as the background to the emergency information presented to the emergency system operator. |
| <i>Requirement:</i> | 13 The center shall forward the verified emergency information to the responding agency based on the location and nature of the emergency. |

Functional Area: **Emergency Dispatch**

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

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| <i>Requirement:</i> | 1 The center shall dispatch emergency vehicles to respond to verified emergencies and provide suggested routing under center personnel control. |
| <i>Requirement:</i> | 2 The center shall store the current status of all emergency vehicles available for dispatch and those that have been dispatched. |
| <i>Requirement:</i> | 3 The center shall relay location and incident details to the responding vehicles. |

Architecture**Northern New Jersey ITS Architecture***Element:***NJT Emergency Command Center***Entity:***Emergency Management***Functional Area:* **Emergency Dispatch**

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

- Requirement:* 4 The center shall provide the capability to request traffic control measures from traffic management centers such as signal preemption, traffic barriers and road closures.
- Requirement:* 5 The center shall track the location and status of emergency vehicles responding to an emergency and update the incident status based on information from the emergency vehicle.
- Requirement:* 6 The center shall receive status information from care facilities to determine the appropriate facility and its location.
- Requirement:* 7 The center shall store and maintain the emergency service responses in an action log.
- Requirement:* 8 The center shall receive asset restriction information from maintenance centers to support the dispatching of appropriate emergency resources.
- Requirement:* 9 The center shall receive traffic information, including closures, traffic conditions, etc. from traffic management centers.
- Requirement:* 10 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.
- Requirement:* 11 The center shall receive road network conditions and traffic images to support dispatch of emergency vehicles.
- Requirement:* 12 The center shall coordinate response to incidents with other Emergency Management centers to ensure appropriate resources are dispatched and utilized.

*Element:***NJT Facility Security Equipment***Entity:***Remote Traveler Support***Functional Area:* **Traveler Secure Area Surveillance**

Security surveillance devices that monitor traveler-frequented areas such as transit stops and rest stops.

- Requirement:* 1 The field element shall include video and/or audio surveillance of traveler secure areas including transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and traveler information centers).
- Requirement:* 2 The field element shall be remotely controlled by a center.
- Requirement:* 3 The field element shall provide equipment status and fault indication of surveillance equipment to a center.
- Requirement:* 4 The field element shall provide raw video or audio data.
- Requirement:* 5 The field element shall remotely process video and audio data and provide an indication of potential incidents or threats to a center.

Functional Area: **Traveler Secure Area Sensor Monitoring**

Security sensors monitoring traveler-frequented areas such as transit stops, park-and-ride lots, and rest stops for environmental threats, intrusion and motion, and object detection.

- Requirement:* 1 The field element shall include security sensors that monitor conditions in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers).
- Requirement:* 2 The field element shall be remotely controlled by a center.
- Requirement:* 3 The field element shall provide equipment status and fault indication of security sensor equipment to a center.

Architecture**Northern New Jersey ITS Architecture***Element:***NJT Facility Security Equipment***Entity:***Remote Traveler Support***Functional Area:* **Traveler Secure Area Sensor Monitoring**

Security sensors monitoring traveler-frequented areas such as transit stops, park-and-ride lots, and rest stops for environmental threats, intrusion and motion, and object detection.

Requirement: 4 The field element shall include environmental threat sensors (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological).

Requirement: 5 The field element shall include motion and intrusion detection sensors.

Requirement: 6 The field element shall include object detection sensors (such as metal detectors).

Requirement: 7 The field element shall provide raw security sensor data.

Requirement: 8 The field element shall remotely process security sensor data and provide an indication of potential incidents or threats to a center.

Functional Area: **Remote Traveler Security**

Public traveler interface that provides the capability for travelers to report an emergency or activate a panic button to summon assistance in areas such as transit stops, park-and-ride areas, etc.

Requirement: 1 The public interface for travelers shall provide the capability for a traveler to report an emergency and summon assistance from secure areas such as transit stops, transit stations, modal transfer facilities, rest stops, park-and-ride areas, travel information areas, and emergency pull off areas.

Requirement: 2 When initiated by a traveler, the public interface for travelers shall forward a request for assistance to an emergency management function and acknowledge the request.

Requirement: 3 The public interface for travelers shall provide the capability to broadcast a message to advise or warn a traveler.

Requirement: 4 The public interface for travelers shall accept input and provide information to the traveler in a form suitable for travelers with physical disabilities.

*Entity:***Security Monitoring Subsystem***Functional Area:* **Field Secure Area Surveillance**

Security surveillance devices (audio/video) that monitor facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, and transit railways or guideways).

Requirement: 1 The field element shall include video and/or audio surveillance of secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways).

Functional Area: **Field Secure Area Sensor Monitoring**

Security sensors monitoring facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, and transit railways or guideways) for environmental threats, intrusion and motion, object detection, and infrastructure integrity.

Requirement: 1 The field element shall include security sensors that monitor conditions of secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways).

Functional Area: **Field Secure Area Surveillance**

Security surveillance devices (audio/video) that monitor facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, and transit railways or guideways).

Requirement: 2 The field element shall be remotely controlled by a center.

Functional Area: **Field Secure Area Sensor Monitoring**

Architecture**Northern New Jersey ITS Architecture***Element:***NJT Facility Security Equipment***Entity:***Security Monitoring Subsystem***Functional Area:* **Field Secure Area Sensor Monitoring**

Security sensors monitoring facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, and transit railways or guideways) for environmental threats, intrusion and motion, object detection, and infrastructure integrity.

Requirement: 2 The field element shall be remotely controlled by a center.

Requirement: 3 The field element shall provide equipment status and fault indication of security sensor equipment to a center.

Functional Area: **Field Secure Area Surveillance**

Security surveillance devices (audio/video) that monitor facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, and transit railways or guideways).

Requirement: 3 The field element shall provide equipment status and fault indication of surveillance equipment to a center.

Requirement: 4 The field element shall provide raw video or audio data.

Functional Area: **Field Secure Area Sensor Monitoring**

Security sensors monitoring facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, and transit railways or guideways) for environmental threats, intrusion and motion, object detection, and infrastructure integrity.

Requirement: 4 The field element shall include environmental threat sensors (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological).

Requirement: 5 The field element shall include infrastructure condition and integrity monitoring sensors.

Functional Area: **Field Secure Area Surveillance**

Security surveillance devices (audio/video) that monitor facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, and transit railways or guideways).

Requirement: 5 The field element shall remotely process video and audio data and provide an indication of potential incidents or threats to a center.

Functional Area: **Field Secure Area Sensor Monitoring**

Security sensors monitoring facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, and transit railways or guideways) for environmental threats, intrusion and motion, object detection, and infrastructure integrity.

Requirement: 6 The field element shall include motion and intrusion detection sensors.

Requirement: 7 The field element shall include object detection sensors (such as metal detectors).

Requirement: 8 The field element shall provide raw security sensor data.

Requirement: 9 The field element shall remotely process security sensor data and provide an indication of potential incidents or threats to a center.

*Element:***NJT Fare Card Reader***Entity:***Remote Traveler Support***Functional Area:* **Remote Transit Fare Management**

Public traveler interface, such as a kiosk, that provides the capability for the traveler to use a common fare medium for transit fares, tolls, and/or parking lot charges, to calculate the amount due and identify payment problems.

Requirement: 1 The public interface for travelers shall accept and process current transit passenger fare collection information.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJT Fare Card Reader***Entity:* **Remote Traveler Support***Functional Area:* **Remote Transit Fare Management**

Public traveler interface, such as a kiosk, that provides the capability for the traveler to use a common fare medium for transit fares, tolls, and/or parking lot charges, to calculate the amount due and identify payment problems.

- Requirement:* 2 The public interface for travelers shall calculate a fare based on the origin and destination provided by the traveler, in conjunction with transit routing, transit fare category, and transit user history.
- Requirement:* 3 The public interface for travelers shall provide an interface to a transit user traveler card in support of payment for transit fares, tolls, and/or parking lot charges. The stored credit value data from the card shall be collected and updated based on the fare or other charges, or the credit identity shall be collected.
- Requirement:* 4 The public interface for travelers shall provide information to the center for financial authorization and transaction processing.
- Requirement:* 5 The public interface for travelers shall provide an image of all travelers purchasing rides or services to be used for violation processing.
- Requirement:* 6 The public interface for travelers shall determine the routing based on the traveler's destination and the location of the closest transit stop from which a route request is being made.
- Requirement:* 7 The public interface for travelers shall create passenger loading and fare statistics data based upon data collected at a transit stop.
- Requirement:* 8 The public interface for travelers shall present information to the traveler in a form suitable for travelers with physical disabilities.

Entity: **Transit Vehicle Subsystem***Functional Area:* **On-board Transit Fare and Load Management**

On-board systems provide variable and flexible fare collection using a travelers fare medium (stored value cards or other payment instrument). Collect data required to determine accurate ridership levels and fare statistics.

- Requirement:* 1 The transit vehicle shall detect embarking travelers on-board a transit vehicle and read data from the traveler card / payment instrument that they are carrying.
- Requirement:* 2 The transit vehicle shall provide an image of all travelers which shall be used for violation processing of those who do not have a traveler card / payment instrument or whose transit fare transaction fails.
- Requirement:* 3 The transit vehicle shall determine the traveler's travel routing based on the transit vehicle's current location and the traveler's destination.
- Requirement:* 4 The transit vehicle shall calculate the traveler's fare based on the origin and destination provided by the traveler as well as factors such as the transit routing, transit fare category, traveler history, and route-specific information.
- Requirement:* 5 The transit vehicle shall have access to the complete range of transit services (routes and schedules) that are available to the traveler.
- Requirement:* 6 The transit vehicle shall provide a transit fare payment interface that is suitable for travelers with physical disabilities.
- Requirement:* 7 The transit vehicle shall include a database on-board the transit vehicle for use in fare processing from which the fares for all possible trips within the transit operational network can be determined.
- Requirement:* 8 The transit vehicle shall support an emergency fare structure overriding all other fares that can be activated during disasters, states of emergency or evacuations.
- Requirement:* 9 The transit vehicle shall support the support advanced payments for tolls, and/or parking lot charges, and/or transit fares via the traveler card / payment instrument.
- Requirement:* 10 The transit vehicle shall provide passenger loading and fare statistics data to the center.

Architecture

Northern New Jersey ITS Architecture

Element: **NJT Fare Card Reader**

Entity: **Transit Vehicle Subsystem**

Element: **NJT Fare Point of Sale**

Entity: **Remote Traveler Support**

Functional Area: Traveler Secure Area Surveillance

 Security surveillance devices that monitor traveler-frequented areas such as transit stops and rest stops.

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| <i>Requirement:</i> | 1 The field element shall include video and/or audio surveillance of traveler secure areas including transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and traveler information centers). |
| <i>Requirement:</i> | 2 The field element shall be remotely controlled by a center. |
| <i>Requirement:</i> | 3 The field element shall provide equipment status and fault indication of surveillance equipment to a center. |
| <i>Requirement:</i> | 4 The field element shall provide raw video or audio data. |
| <i>Requirement:</i> | 5 The field element shall remotely process video and audio data and provide an indication of potential incidents or threats to a center. |
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Functional Area: Traveler Secure Area Sensor Monitoring

 Security sensors monitoring traveler-frequented areas such as transit stops, park-and-ride lots, and rest stops for environmental threats, intrusion and motion, and object detection.

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| <i>Requirement:</i> | 1 The field element shall include security sensors that monitor conditions in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). |
| <i>Requirement:</i> | 2 The field element shall be remotely controlled by a center. |
| <i>Requirement:</i> | 3 The field element shall provide equipment status and fault indication of security sensor equipment to a center. |
| <i>Requirement:</i> | 4 The field element shall include environmental threat sensors (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological). |
| <i>Requirement:</i> | 5 The field element shall include motion and intrusion detection sensors. |
| <i>Requirement:</i> | 6 The field element shall include object detection sensors (such as metal detectors). |
| <i>Requirement:</i> | 7 The field element shall provide raw security sensor data. |
| <i>Requirement:</i> | 8 The field element shall remotely process security sensor data and provide an indication of potential incidents or threats to a center. |
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Functional Area: Remote Traveler Security

 Public traveler interface that provides the capability for travelers to report an emergency or activate a panic button to summon assistance in areas such as transit stops, park-and-ride areas, etc.

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| <i>Requirement:</i> | 1 The public interface for travelers shall provide the capability for a traveler to report an emergency and summon assistance from secure areas such as transit stops, transit stations, modal transfer facilities, rest stops, park-and-ride areas, travel information areas, and emergency pull off areas. |
| <i>Requirement:</i> | 2 When initiated by a traveler, the public interface for travelers shall forward a request for assistance to an emergency management function and acknowledge the request. |
| <i>Requirement:</i> | 3 The public interface for travelers shall provide the capability to broadcast a message to advise or warn a traveler. |
| <i>Requirement:</i> | 4 The public interface for travelers shall accept input and provide information to the traveler in a form suitable for travelers with physical disabilities. |
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Architecture**Northern New Jersey ITS Architecture***Element:***NJT Fare Point of Sale***Entity:***Remote Traveler Support***Functional Area:* **Remote Transit Information Services**

Public traveler interface that provides real-time travel-related information at transit stops and multi-modal transfer points, including general annunciation, display of imminent arrival information, the latest available information on transit routes, schedules, transfer options, bicycle accessibility, fares, real-time schedule adherence, current incidents, weather conditions, and special events

Requirement: 1 The public interface for travelers shall collect and provide real-time travel-related information at transit stops, multi-modal transfer points, and other public transportation areas.

Requirement: 2 The public interface for travelers shall collect and present to the transit traveler information on transit routes, schedules, and real-time schedule adherence.

Requirement: 3 The public interface for travelers shall provide support for general annunciation and/or display of imminent arrival information and other information of general interest to transit users.

Requirement: 4 The public interface for travelers shall present information to the traveler in a form suitable for travelers with physical disabilities.

Functional Area: **Remote Transit Fare Management**

Public traveler interface, such as a kiosk, that provides the capability for the traveler to use a common fare medium for transit fares, tolls, and/or parking lot charges, to calculate the amount due and identify payment problems.

Requirement: 1 The public interface for travelers shall accept and process current transit passenger fare collection information.

Requirement: 2 The public interface for travelers shall calculate a fare based on the origin and destination provided by the traveler, in conjunction with transit routing, transit fare category, and transit user history.

Requirement: 3 The public interface for travelers shall provide an interface to a transit user traveler card in support of payment for transit fares, tolls, and/or parking lot charges. The stored credit value data from the card shall be collected and updated based on the fare or other charges, or the credit identity shall be collected.

Requirement: 4 The public interface for travelers shall provide information to the center for financial authorization and transaction processing.

Requirement: 5 The public interface for travelers shall provide an image of all travelers purchasing rides or services to be used for violation processing.

Requirement: 6 The public interface for travelers shall determine the routing based on the traveler's destination and the location of the closest transit stop from which a route request is being made.

Requirement: 7 The public interface for travelers shall create passenger loading and fare statistics data based upon data collected at a transit stop.

Requirement: 8 The public interface for travelers shall present information to the traveler in a form suitable for travelers with physical disabilities.

*Element:***NJT LRT - Hudson-Bergen Operations Center***Entity:***Transit Management***Functional Area:* **Transit Center Tracking and Dispatch**

Monitoring transit vehicle locations via interactions with on-board systems and determining vehicle schedule adherence. Furnish users with real-time transit related information and maintain interface with digital map providers.

Requirement: 1 The center shall monitor the locations of all transit vehicles within its network.

Requirement: 2 The center shall determine adherence of transit vehicles to their assigned schedule.

Architecture

Northern New Jersey ITS Architecture

Element: **NJT LRT - Hudson-Bergen Operations Center**

Entity: **Transit Management**

Functional Area: **Transit Center Tracking and Dispatch**

Monitoring transit vehicle locations via interactions with on-board systems and determining vehicle schedule adherence. Furnish users with real-time transit related information and maintain interface with digital map providers.

Requirement: 3 The center shall collect trip monitoring data from on-board systems including transit vehicle mileage, fuel usage, passenger loading, availability, etc.

Requirement: 4 The center shall provide transit operational data to traveler information service providers.

Requirement: 5 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for transit tracking and dispatch.

Functional Area: **Transit Center Fixed-Route Operations**

Planning and scheduling associated with fixed and flexible route transit services, automatically updates customer service operator systems, and provides current vehicle schedule adherence and optimum scenarios for schedule adjustment.

Requirement: 1 The center shall generate transit routes and schedules based on such factors as parameters input by the system operator, road network conditions, operational data on current routes and schedules, and digitized map data.

Requirement: 2 The center shall provide the interface to the system operator to control the generation of new routes and schedules (transit services) including the ability to review and update the parameters used by the routes and schedules generation processes and to initiate these processes

Requirement: 3 The center shall be able to generate special routes and schedules to support an incident, disaster, evacuation, or other emergency.

Requirement: 4 The center shall accept requests from traffic management to change routes and schedules as part of the implementation of demand management strategies.

Requirement: 5 The center shall collect transit operational data for use in the generation of routes and schedules.

Requirement: 6 The center shall assign transit vehicle operators based on factors such as eligibility, route preferences, seniority, and transit vehicle availability.

Requirement: 7 The center shall manage large deviations of individual transit vehicles, deviations in rural areas, and deviations of large numbers of vehicles.

Requirement: 8 The center shall generate the necessary corrective actions which may involve more than the vehicles concerned and more far reaching action, such as, the introduction of extra vehicles, wide area signal priority by traffic management, the premature termination of some services, etc.

Requirement: 9 The center shall exchange information with Maintenance and Construction Operations concerning work zones, roadway conditions, asset restrictions, work plans, etc.

Requirement: 10 The center shall disseminate up-to-date schedules and route information to other centers for fixed and flexible route services.

Functional Area: **Transit Center Security**

Monitor transit vehicle operator or traveler activated alarms; authenticate transit vehicle operators; remotely disable a transit vehicle; alert operators, travelers, and police to potential incidents identified by these security features.

Requirement: 1 The center shall monitor transit vehicle operational data to determine if the transit vehicle is off-route and assess whether a security incident is occurring.

Requirement: 2 The center shall receive reports of emergencies on-board transit vehicles entered directly by the transit vehicle operator or from a traveler through interfaces such as panic buttons or alarm switches.

Architecture**Northern New Jersey ITS Architecture****Element: NJT LRT - Hudson-Bergen Operations Center****Entity: Transit Management****Functional Area: Transit Center Security**

Monitor transit vehicle operator or traveler activated alarms; authenticate transit vehicle operators; remotely disable a transit vehicle; alert operators, travelers, and police to potential incidents identified by these security features.

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| <i>Requirement:</i> | 3 | The center shall support the back-office portion of functionality to authenticate transit vehicle operators. |
| <i>Requirement:</i> | 4 | The center shall exchange transit incident information along with other service data with other transit agencies. |
| <i>Requirement:</i> | 5 | The center shall receive information pertaining to a wide-area alert such as weather alerts, disaster situations, or child abductions. This information may come from Emergency Management or from other Alerting and Advisory Systems. |
| <i>Requirement:</i> | 6 | The center shall send wide-area alert information to travelers (on-board transit vehicles or at stations/stops) and transit vehicle operators. |
| <i>Requirement:</i> | 7 | The center shall coordinate the response to security incidents involving transit with other agencies including Emergency Management, other transit agencies, media, traffic management, and traveler information service providers. |
| <i>Requirement:</i> | 8 | The center shall receive threat information and status on the integrity of the transit infrastructure. |
| <i>Requirement:</i> | 9 | The center shall provide support to remotely disable (or reset the disabling of) a transit vehicle in service. |

Functional Area: Transit Garage Operations

Assignment of transit vehicles and operators to routes or service areas in a fair manner while minimizing labor and overtime services, considering operator preferences, qualifications, accumulated work hours, and other information about each operator.

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| <i>Requirement:</i> | 1 | The center shall maintain records of a transit vehicle operator's performance. This may be done utilizing standardized performance evaluation criteria set forth by governmental regulations and transit operating company policies, assessing the transit vehicle operator's driving history, and assessing comments from the transit vehicle operator's supervisor(s) as well as noting any moving violations or accidents, supervisor comments, government regulations, and company policies. |
| <i>Requirement:</i> | 2 | The center shall assess the transit vehicle operator's availability based on previous work assignments, accumulated hours, plus health and vacation commitments. |
| <i>Requirement:</i> | 3 | The center shall assign transit vehicle operators to transit schedules based on their eligibility, route preferences, seniority, and transit vehicle availability. |
| <i>Requirement:</i> | 4 | The center shall provide an interface through which the transit vehicle operator information can be maintained - either from the transit vehicle operator, a transit system operator (i.e. center personnel), or other functions. |

Functional Area: Transit Center Information Services

Provide interactive traveler information to travelers (on-board transit vehicles, at stops/stations, using personal devices), traveler information service providers, media, and other transit organizations. Includes routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, yellow pages, and special events.

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| <i>Requirement:</i> | 1 | The center shall provide travelers using public transportation with traffic and advisory information upon request. Such information may include transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events. |
| <i>Requirement:</i> | 2 | The center shall provide transit information to the media including details of deviations from schedule of regular transit services. |

Architecture

Northern New Jersey ITS Architecture

Element: **NJT LRT - Hudson-Bergen Operations Center**

Entity: **Transit Management**

Functional Area: **Transit Center Information Services**

Provide interactive traveler information to travelers (on-board transit vehicles, at stops/stations, using personal devices), traveler information service providers, media, and other transit organizations. Includes routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, yellow pages, and special events.

Requirement: 3 The center shall exchange transit schedules, real-time arrival information, fare schedules, and general transit service information with other transit organizations to support transit traveler information systems.

Requirement: 4 The center shall provide transit service information to traveler information service providers including routes, schedules, schedule adherence, and fare information as well as transit service information during evacuation.

Requirement: 5 The center shall enable yellow pages (including non-motorized transportation) information to be output to the traveler.

Requirement: 6 The center shall broadcast transit advisory data, including alerts and advisories pertaining to major emergencies, or man made disasters.

Functional Area: **Transit Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and vehicle probes. The information is monitored and forwarded to other agencies to more effectively manage transit operations.

Requirement: 1 The center shall assimilate current and forecast road conditions and surface weather information to more effectively manage transit operations.

Requirement: 2 The center shall collect current and forecast road and weather information from weather service providers and vehicle probes.

Requirement: 3 The center shall receive road network probe information from its fleet of transit vehicles.

Requirement: 4 The center shall provide road network probe information from its fleet of transit vehicles to traffic management as well as maintenance and construction management.

Functional Area: **Transit Center Multi-Modal Coordination**

Generate requests for transit priority on routes and at certain intersections. Coordinate schedules with other agencies and modes, including transit transfer cluster and transfer point information.

Requirement: 1 The center shall analyze transit vehicle schedule performance to determine the need for priority along certain routes or at certain intersections.

Requirement: 2 The center shall send requests for priority along routes or at intersections to traffic management.

Requirement: 3 The center shall coordinate schedules and services between transit agencies, traffic management, maintenance and construction operations, parking management, and other surface or air transportation modes.

Requirement: 4 The center shall share transfer cluster and transfer point information with multimodal transportation service providers, other transit agencies, and traveler information service providers. A transfer cluster is a collection of stops, stations, or terminals where transfers can be made conveniently.

Functional Area: **Transit Evacuation Support**

Support evacuation and subsequent reentry of a population in the vicinity of a disaster or other emergency. Coordinate regional evacuation plans and resources including transit and school bus fleets.

Requirement: 1 The center shall manage the use of transit resources to support evacuation and subsequent reentry of a population in the vicinity of a disaster or other emergency.

Architecture**Northern New Jersey ITS Architecture***Element:***NJT LRT - Hudson-Bergen Operations Center***Entity:***Transit Management***Functional Area:* **Transit Evacuation Support**

Support evacuation and subsequent reentry of a population in the vicinity of a disaster or other emergency. Coordinate regional evacuation plans and resources including transit and school bus fleets.

Requirement: 2 The center shall coordinate regional evacuation plans with Emergency Management - identifying the transit role in an evacuation and the transit resources that would be used.

Requirement: 3 The center shall coordinate the use of transit and school bus fleets during an evacuation, supporting evacuation of those with special needs and the general population.

Requirement: 4 The center shall adjust and update transit service and fare schedules and provide that information to other agencies as they coordinate evacuations.

Functional Area: **Transit Data Collection**

Collection and storage of transit management data. For use by operations personnel or data archives in the region.

Requirement: 1 The center shall collect transit management data such as transit fares and passenger use, transit services, paratransit operations, transit vehicle maintenance data, etc.

Requirement: 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

Requirement: 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the transit data or for the data itself.

Requirement: 4 The center shall be able to produce sample products of the data available.

*Element:***NJT LRT - Hudson-Bergen Rail Vehicles***Entity:***Transit Vehicle Subsystem***Functional Area:* **On-board Transit Trip Monitoring**

Support fleet management with automatic vehicle location (AVL) and automated mileage and fuel reporting and auditing.

Requirement: 1 The transit vehicle shall compute the location of the transit vehicle based on inputs from a vehicle location determination function.

Requirement: 2 The transit vehicle shall support the computation of the location of a transit vehicle using on-board sensors to augment the location determination function. This may include proximity to the transit stops or other known reference points as well as recording trip length.

Requirement: 3 The transit vehicle shall record transit trip monitoring data including vehicle mileage and fuel usage.

Requirement: 4 The transit vehicle shall record transit trip monitoring data including operational status information such as doors open/closed, passenger loading, running times, etc.

Requirement: 5 The transit vehicle shall send the transit vehicle trip monitoring data to center-based trip monitoring functions.

Functional Area: **On-board Fixed Route Schedule Management**

Collecting of data for schedule generation and adjustment on-board a transit vehicle. Supports communication between the vehicle, operator, and center.

Requirement: 1 The transit vehicle shall receive transit route information for its assigned route including transit service instructions, traffic information, road conditions, and other information for the operator.

Requirement: 2 The transit vehicle shall use the route information and its current location to determine the deviation from the predetermined schedule.

Requirement: 3 The transit vehicle shall calculate the estimated times of arrival (ETA) at transit stops.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJT LRT - Hudson-Bergen Rail Vehicles***Entity:* **Transit Vehicle Subsystem***Functional Area:* **On-board Fixed Route Schedule Management**

Collecting of data for schedule generation and adjustment on-board a transit vehicle. Supports communication between the vehicle, operator, and center.

- Requirement:* 4 The transit vehicle shall determine scenarios to correct the schedule deviation.
- Requirement:* 5 The transit vehicle shall provide the schedule deviations and instructions for schedule corrections to the transit vehicle operator if the deviation is small, or the transit vehicle is operating in an urban area.
- Requirement:* 6 The transit vehicle shall send the schedule deviation and estimated arrival time information to the center.
- Requirement:* 7 The transit vehicle shall support the operations of a flexible route service. This may include requests for route deviations that would then lead to schedule corrective actions.

Functional Area: **On-board Transit Security**

On-board video/audio surveillance systems, threat sensors, and object detection sensors to enhance security and safety on-board a transit vehicles. Also includes silent alarms activated by transit user or vehicle operator, operator authentication, and remote vehicle disabling.

- Requirement:* 1 The transit vehicle shall perform video and audio surveillance inside of transit vehicles and output raw video or audio data for either local monitoring (for processing or direct output to the transit vehicle operator), remote monitoring or for local storage (e.g., in an event recorder).
- Requirement:* 2 The transit vehicle shall perform local monitoring of video or audio surveillance data collected inside of transit vehicles, and identify potential incidents or threats based on received processing parameters.
- Requirement:* 3 The transit vehicle shall output an indication of potential incidents or threats and the processed video or audio information to the center along with the vehicle's current location.
- Requirement:* 4 The transit vehicle shall detect potential threats via sensors for chemical agents, toxic industrial chemicals, biological agents, explosives, and radiation.
- Requirement:* 5 The transit vehicle shall detect potential threats via object detection sensors(e.g. metal detectors).
- Requirement:* 6 The transit vehicle shall output an indication of potential incidents or threats and the processed sensor information to the center along with the vehicle's current location.
- Requirement:* 7 The transit vehicle shall accept sensor control data to allow remote control of the sensors.
- Requirement:* 8 The transit vehicle shall monitor and output surveillance and sensor equipment status and fault indications.
- Requirement:* 9 The transit vehicle shall accept emergency inputs from either the transit vehicle operator or a traveler through such interfaces as panic buttons, silent or audible alarms, etc.
- Requirement:* 10 The transit vehicle shall output reported emergencies to the center.
- Requirement:* 11 The transit vehicle shall receive acknowledgments of the emergency request from the center and output this acknowledgment to the transit vehicle operator or to the travelers.
- Requirement:* 12 The transit vehicle shall be capable of receiving an emergency message for broadcast to the travelers or to the transit vehicle operator.
- Requirement:* 13 The transit vehicle shall be capable of disabling or enabling the transit vehicle based on commands from the center or authentic inputs from the transit vehicle operator.
- Requirement:* 14 The transit vehicle shall perform authentication of the transit vehicle operator.

Functional Area: **On-board Transit Signal Priority**

On-board systems to provides request signal priority through short range communication directly with traffic control equipment at the roadside (intersections, crossings, ramp meters, etc.).

Architecture**Northern New Jersey ITS Architecture***Element:***NJT LRT - Hudson-Bergen Rail Vehicles***Entity:***Transit Vehicle Subsystem***Functional Area:* **On-board Transit Signal Priority**

On-board systems to provides request signal priority through short range communication directly with traffic control equipment at the roadside (intersections, crossings, ramp meters, etc.).

- Requirement:* 1 The transit vehicle shall determine the schedule deviation and estimated times of arrival (ETA) at transit stops.
- Requirement:* 2 The transit vehicle shall send priority requests to traffic signal controllers at intersections, pedestrian crossings, and multimodal crossings on the roads (surface streets) and freeway (ramp controls) network that enable a transit vehicle schedule deviation to be corrected.
- Requirement:* 3 The transit vehicle shall send the schedule deviation data and status of priority requests to the transit vehicle operator.

Functional Area: **On-board Transit Information Services**

On-board systems to furnish next-stop annunciation as well as interactive travel-related information, including routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, non-motorized transportation services, and special events.

- Requirement:* 1 The transit vehicle shall enable traffic and travel advisory information to be requested and output to the traveler. Such information may include transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events.
- Requirement:* 2 The transit vehicle shall enable yellow pages (including non-motorized transportation) information to be requested and output to the traveler.
- Requirement:* 3 The transit vehicle shall broadcast advisories about the imminent arrival of the transit vehicle at the next stop via an on-board automated annunciation system.
- Requirement:* 4 The transit vehicle shall support input and output forms that are suitable for travelers with physical disabilities.
- Requirement:* 5 The transit vehicle shall gather transit advisory data, including alerts and advisories pertaining to major emergencies, or man made disasters.
- Requirement:* 6 The transit vehicle shall tailor the output of the request traveler information based on the current location of the transit vehicle.

*Element:***NJT LRT - Newark City Subway Operations Center***Entity:***Transit Management***Functional Area:* **Transit Center Tracking and Dispatch**

Monitoring transit vehicle locations via interactions with on-board systems and determining vehicle schedule adherence. Furnish users with real-time transit related information and maintain interface with digital map providers.

- Requirement:* 1 The center shall monitor the locations of all transit vehicles within its network.
- Requirement:* 2 The center shall determine adherence of transit vehicles to their assigned schedule.
- Requirement:* 3 The center shall collect trip monitoring data from on-board systems including transit vehicle mileage, fuel usage, passenger loading, availability, etc.
- Requirement:* 4 The center shall provide transit operational data to traveler information service providers.
- Requirement:* 5 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for transit tracking and dispatch.

Functional Area: **Transit Center Fixed-Route Operations**

Architecture**Northern New Jersey ITS Architecture****Element: NJT LRT - Newark City Subway Operations Center****Entity: Transit Management****Functional Area: Transit Center Fixed-Route Operations**

Planning and scheduling associated with fixed and flexible route transit services, automatically updates customer service operator systems, and provides current vehicle schedule adherence and optimum scenarios for schedule adjustment.

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| <i>Requirement:</i> | 1 The center shall generate transit routes and schedules based on such factors as parameters input by the system operator, road network conditions, operational data on current routes and schedules, and digitized map data. |
| <i>Requirement:</i> | 2 The center shall provide the interface to the system operator to control the generation of new routes and schedules (transit services) including the ability to review and update the parameters used by the routes and schedules generation processes and to initiate these processes |
| <i>Requirement:</i> | 3 The center shall be able to generate special routes and schedules to support an incident, disaster, evacuation, or other emergency. |
| <i>Requirement:</i> | 4 The center shall accept requests from traffic management to change routes and schedules as part of the implementation of demand management strategies. |
| <i>Requirement:</i> | 5 The center shall collect transit operational data for use in the generation of routes and schedules. |
| <i>Requirement:</i> | 6 The center shall assign transit vehicle operators based on factors such as eligibility, route preferences, seniority, and transit vehicle availability. |
| <i>Requirement:</i> | 7 The center shall manage large deviations of individual transit vehicles, deviations in rural areas, and deviations of large numbers of vehicles. |
| <i>Requirement:</i> | 8 The center shall generate the necessary corrective actions which may involve more than the vehicles concerned and more far reaching action, such as, the introduction of extra vehicles, wide area signal priority by traffic management, the premature termination of some services, etc. |
| <i>Requirement:</i> | 9 The center shall exchange information with Maintenance and Construction Operations concerning work zones, roadway conditions, asset restrictions, work plans, etc. |
| <i>Requirement:</i> | 10 The center shall disseminate up-to-date schedules and route information to other centers for fixed and flexible route services. |

Functional Area: Transit Center Security

Monitor transit vehicle operator or traveler activated alarms; authenticate transit vehicle operators; remotely disable a transit vehicle; alert operators, travelers, and police to potential incidents identified by these security features.

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| <i>Requirement:</i> | 1 The center shall monitor transit vehicle operational data to determine if the transit vehicle is off-route and assess whether a security incident is occurring. |
| <i>Requirement:</i> | 2 The center shall receive reports of emergencies on-board transit vehicles entered directly by the transit vehicle operator or from a traveler through interfaces such as panic buttons or alarm switches. |
| <i>Requirement:</i> | 3 The center shall support the back-office portion of functionality to authenticate transit vehicle operators. |
| <i>Requirement:</i> | 4 The center shall exchange transit incident information along with other service data with other transit agencies. |
| <i>Requirement:</i> | 5 The center shall receive information pertaining to a wide-area alert such as weather alerts, disaster situations, or child abductions. This information may come from Emergency Management or from other Alerting and Advisory Systems. |
| <i>Requirement:</i> | 6 The center shall send wide-area alert information to travelers (on-board transit vehicles or at stations/stops) and transit vehicle operators. |

Architecture**Northern New Jersey ITS Architecture***Element:* **NJT LRT - Newark City Subway Operations Center***Entity:* **Transit Management***Functional Area:* **Transit Center Security**

Monitor transit vehicle operator or traveler activated alarms; authenticate transit vehicle operators; remotely disable a transit vehicle; alert operators, travelers, and police to potential incidents identified by these security features.

Requirement: 7 The center shall coordinate the response to security incidents involving transit with other agencies including Emergency Management, other transit agencies, media, traffic management, and traveler information service providers.

Requirement: 8 The center shall receive threat information and status on the integrity of the transit infrastructure.

Requirement: 9 The center shall provide support to remotely disable (or reset the disabling of) a transit vehicle in service.

Functional Area: **Transit Garage Operations**

Assignment of transit vehicles and operators to routes or service areas in a fair manner while minimizing labor and overtime services, considering operator preferences, qualifications, accumulated work hours, and other information about each operator.

Requirement: 1 The center shall maintain records of a transit vehicle operator's performance. This may be done utilizing standardized performance evaluation criteria set forth by governmental regulations and transit operating company policies, assessing the transit vehicle operator's driving history, and assessing comments from the transit vehicle operator's supervisor(s) as well as noting any moving violations or accidents, supervisor comments, government regulations, and company policies.

Requirement: 2 The center shall assess the transit vehicle operator's availability based on previous work assignments, accumulated hours, plus health and vacation commitments.

Requirement: 3 The center shall assign transit vehicle operators to transit schedules based on their eligibility, route preferences, seniority, and transit vehicle availability.

Requirement: 4 The center shall provide an interface through which the transit vehicle operator information can be maintained - either from the transit vehicle operator, a transit system operator (i.e. center personnel), or other functions.

Functional Area: **Transit Center Information Services**

Provide interactive traveler information to travelers (on-board transit vehicles, at stops/stations, using personal devices), traveler information service providers, media, and other transit organizations. Includes routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, yellow pages, and special events.

Requirement: 1 The center shall provide travelers using public transportation with traffic and advisory information upon request. Such information may include transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events.

Requirement: 2 The center shall provide transit information to the media including details of deviations from schedule of regular transit services.

Requirement: 3 The center shall exchange transit schedules, real-time arrival information, fare schedules, and general transit service information with other transit organizations to support transit traveler information systems.

Requirement: 4 The center shall provide transit service information to traveler information service providers including routes, schedules, schedule adherence, and fare information as well as transit service information during evacuation.

Requirement: 5 The center shall enable yellow pages (including non-motorized transportation) information to be output to the traveler.

Requirement: 6 The center shall broadcast transit advisory data, including alerts and advisories pertaining to major emergencies, or man made disasters.

Architecture**Northern New Jersey ITS Architecture****Element: NJT LRT - Newark City Subway Operations Center****Entity: Transit Management****Functional Area: Transit Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and vehicle probes. The information is monitored and forwarded to other agencies to more effectively manage transit operations.

Requirement: 1 The center shall assimilate current and forecast road conditions and surface weather information to more effectively manage transit operations.

Requirement: 2 The center shall collect current and forecast road and weather information from weather service providers and vehicle probes.

Requirement: 3 The center shall receive road network probe information from its fleet of transit vehicles.

Requirement: 4 The center shall provide road network probe information from its fleet of transit vehicles to traffic management as well as maintenance and construction management.

Functional Area: Transit Center Multi-Modal Coordination

Generate requests for transit priority on routes and at certain intersections. Coordinate schedules with other agencies and modes, including transit transfer cluster and transfer point information.

Requirement: 1 The center shall analyze transit vehicle schedule performance to determine the need for priority along certain routes or at certain intersections.

Requirement: 2 The center shall send requests for priority along routes or at intersections to traffic management.

Requirement: 3 The center shall coordinate schedules and services between transit agencies, traffic management, maintenance and construction operations, parking management, and other surface or air transportation modes.

Requirement: 4 The center shall share transfer cluster and transfer point information with multimodal transportation service providers, other transit agencies, and traveler information service providers. A transfer cluster is a collection of stops, stations, or terminals where transfers can be made conveniently.

Functional Area: Transit Evacuation Support

Support evacuation and subsequent reentry of a population in the vicinity of a disaster or other emergency. Coordinate regional evacuation plans and resources including transit and school bus fleets.

Requirement: 1 The center shall manage the use of transit resources to support evacuation and subsequent reentry of a population in the vicinity of a disaster or other emergency.

Requirement: 2 The center shall coordinate regional evacuation plans with Emergency Management - identifying the transit role in an evacuation and the transit resources that would be used.

Requirement: 3 The center shall coordinate the use of transit and school bus fleets during an evacuation, supporting evacuation of those with special needs and the general population.

Requirement: 4 The center shall adjust and update transit service and fare schedules and provide that information to other agencies as they coordinate evacuations.

Functional Area: Transit Data Collection

Collection and storage of transit management data. For use by operations personnel or data archives in the region.

Requirement: 1 The center shall collect transit management data such as transit fares and passenger use, transit services, paratransit operations, transit vehicle maintenance data, etc.

Requirement: 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

Architecture

Northern New Jersey ITS Architecture

Element: **NJT LRT - Newark City Subway Operations Center**

Entity: **Transit Management**

Functional Area: **Transit Data Collection**

Collection and storage of transit management data. For use by operations personnel or data archives in the region.

Requirement: 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the transit data or for the data itself.

Requirement: 4 The center shall be able to produce sample products of the data available.

Element: **NJT LRT - Newark City Subway Vehicles**

Entity: **Transit Vehicle Subsystem**

Functional Area: **On-board Transit Trip Monitoring**

Support fleet management with automatic vehicle location (AVL) and automated mileage and fuel reporting and auditing.

Requirement: 1 The transit vehicle shall compute the location of the transit vehicle based on inputs from a vehicle location determination function.

Requirement: 2 The transit vehicle shall support the computation of the location of a transit vehicle using on-board sensors to augment the location determination function. This may include proximity to the transit stops or other known reference points as well as recording trip length.

Requirement: 3 The transit vehicle shall record transit trip monitoring data including vehicle mileage and fuel usage.

Requirement: 4 The transit vehicle shall record transit trip monitoring data including operational status information such as doors open/closed, passenger loading, running times, etc.

Requirement: 5 The transit vehicle shall send the transit vehicle trip monitoring data to center-based trip monitoring functions.

Functional Area: **On-board Fixed Route Schedule Management**

Collecting of data for schedule generation and adjustment on-board a transit vehicle. Supports communication between the vehicle, operator, and center.

Requirement: 1 The transit vehicle shall receive transit route information for its assigned route including transit service instructions, traffic information, road conditions, and other information for the operator.

Requirement: 2 The transit vehicle shall use the route information and its current location to determine the deviation from the predetermined schedule.

Requirement: 3 The transit vehicle shall calculate the estimated times of arrival (ETA) at transit stops.

Requirement: 4 The transit vehicle shall determine scenarios to correct the schedule deviation.

Requirement: 5 The transit vehicle shall provide the schedule deviations and instructions for schedule corrections to the transit vehicle operator if the deviation is small, or the transit vehicle is operating in an urban area.

Requirement: 6 The transit vehicle shall send the schedule deviation and estimated arrival time information to the center.

Requirement: 7 The transit vehicle shall support the operations of a flexible route service. This may include requests for route deviations that would then lead to schedule corrective actions.

Functional Area: **On-board Transit Security**

On-board video/audio surveillance systems, threat sensors, and object detection sensors to enhance security and safety on-board a transit vehicles. Also includes silent alarms activated by transit user or vehicle operator, operator authentication, and remote vehicle disabling.

Requirement: 1 The transit vehicle shall perform video and audio surveillance inside of transit vehicles and output raw video or audio data for either local monitoring (for processing or direct output to the transit vehicle operator), remote monitoring or for local storage (e.g., in an event recorder).

Architecture**Northern New Jersey ITS Architecture****Element: NJT LRT - Newark City Subway Vehicles****Entity: Transit Vehicle Subsystem****Functional Area: On-board Transit Security**

On-board video/audio surveillance systems, threat sensors, and object detection sensors to enhance security and safety on-board a transit vehicles. Also includes silent alarms activated by transit user or vehicle operator, operator authentication, and remote vehicle disabling.

- Requirement:* 2 The transit vehicle shall perform local monitoring of video or audio surveillance data collected inside of transit vehicles, and identify potential incidents or threats based on received processing parameters.
- Requirement:* 3 The transit vehicle shall output an indication of potential incidents or threats and the processed video or audio information to the center along with the vehicle's current location.
- Requirement:* 4 The transit vehicle shall detect potential threats via sensors for chemical agents, toxic industrial chemicals, biological agents, explosives, and radiation.
- Requirement:* 5 The transit vehicle shall detect potential threats via object detection sensors(e.g. metal detectors).
- Requirement:* 6 The transit vehicle shall output an indication of potential incidents or threats and the processed sensor information to the center along with the vehicle's current location.
- Requirement:* 7 The transit vehicle shall accept sensor control data to allow remote control of the sensors.
- Requirement:* 8 The transit vehicle shall monitor and output surveillance and sensor equipment status and fault indications.
- Requirement:* 9 The transit vehicle shall accept emergency inputs from either the transit vehicle operator or a traveler through such interfaces as panic buttons, silent or audible alarms, etc.
- Requirement:* 10 The transit vehicle shall output reported emergencies to the center.
- Requirement:* 11 The transit vehicle shall receive acknowledgments of the emergency request from the center and output this acknowledgment to the transit vehicle operator or to the travelers.
- Requirement:* 12 The transit vehicle shall be capable of receiving an emergency message for broadcast to the travelers or to the transit vehicle operator.
- Requirement:* 13 The transit vehicle shall be capable of disabling or enabling the transit vehicle based on commands from the center or authentic inputs from the transit vehicle operator.
- Requirement:* 14 The transit vehicle shall perform authentication of the transit vehicle operator.

Functional Area: On-board Transit Signal Priority

On-board systems to provides request signal priority through short range communication directly with traffic control equipment at the roadside (intersections, crossings, ramp meters, etc.).

- Requirement:* 1 The transit vehicle shall determine the schedule deviation and estimated times of arrival (ETA) at transit stops.
- Requirement:* 2 The transit vehicle shall send priority requests to traffic signal controllers at intersections, pedestrian crossings, and multimodal crossings on the roads (surface streets) and freeway (ramp controls) network that enable a transit vehicle schedule deviation to be corrected.
- Requirement:* 3 The transit vehicle shall send the schedule deviation data and status of priority requests to the transit vehicle operator.

Functional Area: On-board Transit Information Services

On-board systems to furnish next-stop annunciation as well as interactive travel-related information, including routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, non-motorized transportation services, and special events.

- Requirement:* 1 The transit vehicle shall enable traffic and travel advisory information to be requested and output to the traveler. Such information may include transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events.

Architecture

Northern New Jersey ITS Architecture

*Element:***NJT LRT - Newark City Subway Vehicles**

*Entity:***Transit Vehicle Subsystem**

Functional Area: **On-board Transit Information Services**

On-board systems to furnish next-stop annunciation as well as interactive travel-related information, including routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, non-motorized transportation services, and special events.

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| <i>Requirement:</i> | 2 The transit vehicle shall enable yellow pages (including non-motorized transportation) information to be requested and output to the traveler. |
| <i>Requirement:</i> | 3 The transit vehicle shall broadcast advisories about the imminent arrival of the transit vehicle at the next stop via an on-board automated annunciation system. |
| <i>Requirement:</i> | 4 The transit vehicle shall support input and output forms that are suitable for travelers with physical disabilities. |
| <i>Requirement:</i> | 5 The transit vehicle shall gather transit advisory data, including alerts and advisories pertaining to major emergencies, or man made disasters. |
| <i>Requirement:</i> | 6 The transit vehicle shall tailor the output of the request traveler information based on the current location of the transit vehicle. |
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*Element:***NJT LRT Customer Display Systems**

*Entity:***Remote Traveler Support**

Functional Area: **Remote Transit Information Services**

Public traveler interface that provides real-time travel-related information at transit stops and multi-modal transfer points, including general annunciation, display of imminent arrival information, the latest available information on transit routes, schedules, transfer options, bicycle accessibility, fares, real-time schedule adherence, current incidents, weather conditions, and special events

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| <i>Requirement:</i> | 1 The public interface for travelers shall collect and provide real-time travel-related information at transit stops, multi-modal transfer points, and other public transportation areas. |
| <i>Requirement:</i> | 2 The public interface for travelers shall collect and present to the transit traveler information on transit routes, schedules, and real-time schedule adherence. |
| <i>Requirement:</i> | 3 The public interface for travelers shall provide support for general annunciation and/or display of imminent arrival information and other information of general interest to transit users. |
| <i>Requirement:</i> | 4 The public interface for travelers shall present information to the traveler in a form suitable for travelers with physical disabilities. |
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*Element:***NJT LRT In-Vehicle Display Systems**

*Entity:***Remote Traveler Support**

Functional Area: **Remote Transit Information Services**

Public traveler interface that provides real-time travel-related information at transit stops and multi-modal transfer points, including general annunciation, display of imminent arrival information, the latest available information on transit routes, schedules, transfer options, bicycle accessibility, fares, real-time schedule adherence, current incidents, weather conditions, and special events

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| <i>Requirement:</i> | 1 The public interface for travelers shall collect and provide real-time travel-related information at transit stops, multi-modal transfer points, and other public transportation areas. |
| <i>Requirement:</i> | 2 The public interface for travelers shall collect and present to the transit traveler information on transit routes, schedules, and real-time schedule adherence. |
| <i>Requirement:</i> | 3 The public interface for travelers shall provide support for general annunciation and/or display of imminent arrival information and other information of general interest to transit users. |
| <i>Requirement:</i> | 4 The public interface for travelers shall present information to the traveler in a form suitable for travelers with physical disabilities. |
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Architecture**Northern New Jersey ITS Architecture***Element:***NJT Police Dispatch / Command Center***Entity:***Emergency Management***Functional Area:* **Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

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| <i>Requirement:</i> | 1 The center shall support the interface to the Emergency Telecommunications System (e.g. 911 or 7-digit call routing) to receive emergency notification information and provide it to the emergency system operator. |
| <i>Requirement:</i> | 2 The center shall receive emergency call information from 911 services and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 3 The center shall receive emergency call information from motorist call-boxes and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 4 The center shall receive emergency call information from mayday service providers and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 5 The center shall receive emergency notification information from other public safety agencies and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 6 The center shall receive emergency notification information from public transit systems and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 7 The center shall receive emergency notification information from commercial vehicles, commercial vehicle check stations, or commercial fleet operators and present the possible incident information to the emergency system operator. This may include detection of non-permitted transport of security sensitive hazmat, hazardous cargo spills, etc. |
| <i>Requirement:</i> | 8 The center shall receive details of the cargo being carried by commercial vehicles from their commercial fleet manager for incidents involving potential hazardous materials. |
| <i>Requirement:</i> | 9 The center shall coordinate, correlate, and verify all emergency inputs, including those identified based on external calls and internal analysis of security sensor and surveillance data, and assign each a level of confidence. |
| <i>Requirement:</i> | 10 The center shall send a request for remote control of CCTV systems from a traffic management center in order to verify the reported incident. |
| <i>Requirement:</i> | 11 The center shall update the incident information log once the emergency system operator has verified the incident. |
| <i>Requirement:</i> | 12 The center shall provide the capability for digitized map data to act as the background to the emergency information presented to the emergency system operator. |
| <i>Requirement:</i> | 13 The center shall forward the verified emergency information to the responding agency based on the location and nature of the emergency. |

Functional Area: **Emergency Dispatch**

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

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| <i>Requirement:</i> | 1 The center shall dispatch emergency vehicles to respond to verified emergencies and provide suggested routing under center personnel control. |
| <i>Requirement:</i> | 2 The center shall store the current status of all emergency vehicles available for dispatch and those that have been dispatched. |
| <i>Requirement:</i> | 3 The center shall relay location and incident details to the responding vehicles. |

Architecture**Northern New Jersey ITS Architecture***Element:* **NJT Police Dispatch / Command Center***Entity:* **Emergency Management***Functional Area:* **Emergency Dispatch**

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

Requirement: 4 The center shall provide the capability to request traffic control measures from traffic management centers such as signal preemption, traffic barriers and road closures.

Requirement: 5 The center shall track the location and status of emergency vehicles responding to an emergency and update the incident status based on information from the emergency vehicle.

Requirement: 6 The center shall receive status information from care facilities to determine the appropriate facility and its location.

Requirement: 7 The center shall store and maintain the emergency service responses in an action log.

Requirement: 8 The center shall receive asset restriction information from maintenance centers to support the dispatching of appropriate emergency resources.

Requirement: 9 The center shall receive traffic information, including closures, traffic conditions, etc. from traffic management centers.

Requirement: 10 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.

Requirement: 11 The center shall receive road network conditions and traffic images to support dispatch of emergency vehicles.

Requirement: 12 The center shall coordinate response to incidents with other Emergency Management centers to ensure appropriate resources are dispatched and utilized.

Functional Area: **Emergency Routing**

Routing of emergency vehicles to facilitate the quickest/safest arrival. Routes may be determined based on real-time traffic information and road conditions or routes may be provided by Traffic Management on request.

Requirement: 1 The center shall collect current traffic and road condition information from traffic management centers for emergency vehicle route calculation.

Requirement: 2 The center shall receive inputs from traffic management and maintenance centers on the location and status of traffic control equipment and work zones along potential emergency routes.

Requirement: 3 The center shall calculate emergency vehicle routes based on information from traffic management and maintenance centers.

Requirement: 4 In special circumstances such as during disasters and evacuations when normal routes are not available, the center shall request a route from the traffic management center.

Requirement: 5 The center shall provide the capability to request special traffic control measures from the traffic management center to facilitate emergency vehicle progress along the suggested route.

Requirement: 6 Once the route is calculated the route shall be provided to the dispatch function.

Functional Area: **Emergency Early Warning System**

Monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies in order to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to other ITS centers to notify the traveling public. Includes support for Child Abduction notices.

Requirement: 1 The center shall monitor information from Alerting and Advisory Systems such as the Information Sharing and Analysis Centers (ISACs), the National Infrastructure Protection Center (NIPC), the Homeland Security Advisory System (HSAS), etc. The information may include assessments (general incident and vulnerability awareness information), advisories (identification of threats or recommendations to increase preparedness levels), or alerts (information on imminent or in-progress emergencies).

Architecture**Northern New Jersey ITS Architecture***Element:* **NJT Police Dispatch / Command Center***Entity:* **Emergency Management***Functional Area:* **Emergency Early Warning System**

Monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies in order to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to other ITS centers to notify the traveling public. Includes support for Child Abduction notices.

- Requirement:* 2 The center shall provide the capability to correlate alerts and advisories, incident information, and security sensor and surveillance data.
- Requirement:* 3 The center shall broadcast wide-area alerts and advisories to traffic management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 4 The center shall broadcast wide-area alerts and advisories to transit management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 5 The center shall broadcast wide-area alerts and advisories to toll administration centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 6 The center shall broadcast wide-area alerts and advisories to traveler information service providers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 7 The center shall broadcast wide-area alerts and advisories to maintenance centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 8 The center shall broadcast wide-area alerts and advisories to other emergency management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 9 The center shall process status information from each of the centers that have been sent the wide-area alert.
- Requirement:* 10 The center shall coordinate the broadcast of wide-area alerts and advisories with other emergency management centers.
- Requirement:* 11 The center shall receive incident information from other transportation management centers to support the early warning system.
- Requirement:* 12 The center shall present the alert and advisory information and the status of the actions taken in response to the alert by the other centers to the emergency system operator as received from other system inputs.
- Requirement:* 13 The center shall support the entry of alert and advisory information directly from the emergency system operator.

Functional Area: **Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

- Requirement:* 1 The center shall provide strategic emergency response capabilities such as that of an Emergency Operations Center for large-scale incidents and disasters.
- Requirement:* 2 The center shall manage coordinated inter-agency responses to and recovery from large-scale emergencies. Such agencies include traffic management, transit, maintenance and construction management, rail operations, and other emergency management agencies.
- Requirement:* 3 The center shall provide the capability to implement response plans and track progress through the incident by exchanging incident information and distributing response status to allied agencies.

Architecture**Northern New Jersey ITS Architecture****Element: NJT Police Dispatch / Command Center****Entity: Emergency Management****Functional Area: Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

- Requirement:* 4 The center shall develop, coordinate with other agencies, and store emergency response plans.
- Requirement:* 5 The center shall track the availability of resources (including vehicles, roadway cleanup?, etc.), request additional resources from traffic, maintenance, or other emergency centers if needed.
- Requirement:* 6 The center shall allocate the appropriate emergency services, resources, and vehicle (s) to respond to incidents, and shall provide the capability to override the current allocation to suit the special needs of a current incident.
- Requirement:* 7 The center shall receive event scheduling information from Event Promoters.
- Requirement:* 8 The center shall receive hazardous materials incident information from commercial fleet operators.
- Requirement:* 9 The center shall provide the capability to request the safe disabling of a commercial vehicle during a hazardous materials incident.
- Requirement:* 10 The center shall provide the capability to request transit resource availability from transit centers for use during disaster and evacuation operations.
- Requirement:* 11 The center shall assimilate the status of the transit, traffic, rail, maintenance, and other emergency center services and systems to create an overall transportation system status, and disseminate to each of these centers and the traveling public via traveler information providers.
- Requirement:* 12 The center shall provide information to the media concerning the status of an emergency response.
- Requirement:* 13 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.
- Requirement:* 14 The center shall provide the capability for center personnel to provide inputs to the management of incidents, disasters and evacuations.

Functional Area: Incident Command

Tactical decision support, resource coordination, and communications integration among emergency management agencies for Incident Commands that are established by first responders to support local management of an incident.

- Requirement:* 1 The center shall provide tactical decision support, resource coordination, and communications integration for Incident Commands that are established by first responders to support local management of an incident.
- Requirement:* 2 The center shall provide incident command communications with public safety, emergency management, transportation, and other allied response agency centers.
- Requirement:* 3 The center shall track and maintain resource information and action plans pertaining to the incident command.
- Requirement:* 4 The center shall share incident command information with other public safety agencies including resource deployment status, hazardous material information, rail incident information, evacuation advice as well as traffic, road, and weather conditions.
- Requirement:* 5 The center shall assess the status of responding emergency vehicles as part of an incident command.

Functional Area: Emergency Evacuation Support

Evacuation planning and coordination to manage evacuation and reentry of a population in the vicinity of a disaster or other emergency that poses a risk to public safety.

- Requirement:* 1 The center shall manage inter-agency coordination of evacuation operations, from initial planning through the evacuation process and reentry.

Architecture**Northern New Jersey ITS Architecture****Element: NJT Police Dispatch / Command Center****Entity: Emergency Management****Functional Area: Emergency Evacuation Support**

Evacuation planning and coordination to manage evacuation and reentry of a population in the vicinity of a disaster or other emergency that poses a risk to public safety.

- Requirement:* 2 The center shall develop and exchange evacuation plans with allied agencies prior to the occurrence of a disaster.
- Requirement:* 3 The center shall provide an interface to the emergency system operator to enter evacuation plans and procedures and present the operator with other agencies' plans.
- Requirement:* 4 The center shall coordinate evacuation destinations and shelter needs with shelter providers (e.g., the American Red Cross) in the region.
- Requirement:* 5 The center shall provide evacuation information to traffic, transit, maintenance and construction, rail operations, and other emergency management centers as needed.
- Requirement:* 6 The center shall request resources from transit agencies as needed to support the evacuation.
- Requirement:* 7 The center shall request traffic management agencies to implement special traffic control strategies and to control evacuation traffic, including traffic on local streets and arterials as well as the major evacuation routes.
- Requirement:* 8 The center shall provide traveler information systems with evacuation guidance including basic information to assist potential evacuees in determining whether evacuation is necessary and when it is safe to return.
- Requirement:* 9 The center shall monitor the progress or status of the evacuation once it begins and exchange tactical plans, prepared during the incident, with allied agencies.
- Requirement:* 10 The center shall monitor the progress of the reentry process.
- Requirement:* 11 The center shall submit evacuation information to toll administration centers along with requests for changes in the toll services or fee collection during an evacuation.

Functional Area: Emergency Environmental Monitoring

Current and forecast road and weather information assimilated from weather service providers and emergency vehicles equipped with environmental sensors; used by the operator to more effectively manage incidents.

- Requirement:* 1 The center shall collect current and forecast road and weather information from weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
- Requirement:* 2 The center shall receive environmental probe information from its fleet of emergency vehicles.
- Requirement:* 3 The center shall collect current road and weather information from roadway maintenance operations.
- Requirement:* 4 The center shall assimilate current and forecast road conditions and surface weather information to support incident management.
- Requirement:* 5 The center shall present the current and forecast road and weather information to the emergency system operator.
- Requirement:* 6 The center shall provide aggregated or processed environmental probe information from its fleet of emergency vehicles to traffic management and maintenance centers.

Functional Area: Center Secure Area Surveillance

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJT Police Dispatch / Command Center***Entity:* **Emergency Management***Functional Area:* **Center Secure Area Surveillance**

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:*
- 1 The center shall remotely monitor video images and audio surveillance data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The data may be raw or pre-processed in the field.
 - 2 The center shall remotely monitor video images and audio surveillance data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The data may be raw or pre-processed in the field.
 - 3 The center shall remotely monitor video images and audio surveillance data collected on-board transit vehicles. The data may be raw or pre-processed in the field.
 - 4 The center shall exchange surveillance data with other emergency centers.
 - 5 The center shall identify potential security threats based on collected security surveillance data.
 - 6 The center shall verify potential security threats by correlating security surveillance data from multiple sources.
 - 7 The center shall remotely control security surveillance devices in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways).
 - 8 The center shall remotely control security surveillance devices in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers).
 - 9 The center shall remotely control security surveillance devices on-board transit vehicles.
 - 10 The center shall match traveler video images against a database from the Alerting and Advisory Systems of known images that may represent criminals and terrorists.
 - 11 The center shall exchange traveler images with other emergency management centers to support traveler image matching.
 - 12 The center shall respond to control data from center personnel regarding security surveillance data collection, processing, threat detection, and image matching.

Functional Area: **Center Secure Area Sensor Management**

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:*
- 1 The center shall remotely monitor and control security sensor data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), infrastructure condition and integrity, intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.

Architecture**Northern New Jersey ITS Architecture***Element:***NJT Police Dispatch / Command Center***Entity:***Emergency Management***Functional Area:* **Center Secure Area Sensor Management**

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 2 The center shall remotely monitor and control security sensor data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 3 The center shall remotely monitor and control security sensor data collected on-board transit vehicles. The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors) and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 4 The center shall exchange security sensor data with other emergency centers.
- Requirement:* 5 The center shall identify potential security threats based on collected security sensor data.
- Requirement:* 6 The center shall verify potential security threats by correlating security sensor data from multiple sources.
- Requirement:* 7 The center shall perform threat analysis based on correlations of security sensor and surveillance data.
- Requirement:* 8 The center shall exchange threat analysis data with Alerting and Advisory Systems and use that data in local threat analysis processing.
- Requirement:* 9 The center shall disseminate threat information to other agencies, including traffic, transit, maintenance, rail operations, and other emergency management centers.
- Requirement:* 10 The center shall respond to control data from center personnel regarding security sensor data collection, processing, threat detection, and threat analysis.

Functional Area: **Center Secure Area Alarm Support**

Collection and response to silent and audible alarms received from travelers in secure areas (such as transit stops, rest areas, park-and-ride lots) and from on-board transit vehicles.

- Requirement:* 1 The center shall collect silent and audible alarms received from travelers in secure areas (such as transit stops, rest areas, park and ride lots, modal interchange facilities).
- Requirement:* 2 The center shall collect silent and audible alarms received from transit vehicles, originated by the traveler or the transit vehicle operator.
- Requirement:* 3 After the alarm message has been received, the center shall generate an alarm acknowledgment to the sender.
- Requirement:* 4 After the alarm message becomes a verified incident, the center shall determine the appropriate response.
- Requirement:* 5 The center shall determine whether the alarm message indicates an emergency that requires the attention of public safety agencies, and forward alarm message data to the appropriate agency as necessary.
- Requirement:* 6 The center shall forward the alarm message to center personnel and respond to the traveler or transit vehicle operator as directed by the personnel.

Functional Area: **Mayday Support**

Collection and response to Mayday messages received from vehicles and drivers.

Architecture**Northern New Jersey ITS Architecture***Element:***NJT Police Dispatch / Command Center***Entity:***Emergency Management***Functional Area:* **Mayday Support**

Collection and response to Mayday messages received from vehicles and drivers.

- Requirement:* 1 The center shall collect mayday messages from vehicles and drivers.
- Requirement:* 2 The center shall collect mayday messages from travelers via personal handheld devices.
- Requirement:* 3 The center shall acknowledge the request for emergency assistance, whether originated by the driver, automatically by the vehicle's safety systems, or by a traveler via a personal handheld device.
- Requirement:* 4 After the mayday becomes a verified incident, the center shall determine the appropriate response to the mayday message.
- Requirement:* 5 The center shall determine whether the mayday message indicates an emergency that requires the attention of public safety agencies, and forward mayday emergency data to the appropriate agency as necessary.
- Requirement:* 6 The center shall support the activation of remote controlled functions requested by a vehicle, such as requests to unlock doors.
- Requirement:* 7 The center shall request additional emergency details from or issue commands to the vehicle's security systems or vehicle driver if needed.
- Requirement:* 8 The center shall maintain a log of all mayday signals received from vehicles.
- Requirement:* 9 The center shall provide all mayday data to center personnel and respond to the vehicle, driver, or traveler using the portable handheld device as directed by the personnel.

Functional Area: **Emergency Data Collection**

Collection and storage of information related to Emergency Management. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect emergency service data, emergency vehicle management data, emergency vehicle data, sensor and surveillance data, threat data, and incident data.
- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.
- Requirement:* 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the emergency management data or for the data itself.
- Requirement:* 4 The center shall be able to produce sample products of the data available.

*Element:***NJT Public Transportation Management System (PTMS)***Entity:***Archived Data Management Subsystem***Functional Area:* **ITS Data Repository**

Collect and maintain data and data catalogs from one or more data sources. May include quality checks, error notification, and archive coordination.

- Requirement:* 1 The center shall collect data to be archived from one or more data sources.
- Requirement:* 2 The center shall collect data catalogs from one or more data sources. A catalog describes the data contained in the collection of archived data and may include descriptions of the schema or structure of the data, a description of the contents of the data; e.g., time range of entries, number of entries; or a sample of the data (e. g. a thumbnail).
- Requirement:* 3 The center shall store the archived data in a focused repository that is suited to a particular set of ITS data users.
- Requirement:* 4 The center shall include capabilities for performing quality checks on the incoming archived data.

Architecture**Northern New Jersey ITS Architecture****Element: NJT Public Transportation Management System (PTMS)****Entity: Archived Data Management Subsystem****Functional Area: ITS Data Repository**

Collect and maintain data and data catalogs from one or more data sources. May include quality checks, error notification, and archive coordination.

- Requirement:* 5 The center shall include capabilities for error notification on the incoming archived data.
- Requirement:* 6 The center shall include capabilities for archive to archive coordination.
- Requirement:* 7 The center shall support a broad range of archived data management implementations, ranging from simple data marts that collect a focused set of data and serve a particular user community to large-scale data warehouses that collect, integrate, and summarize transportation data from multiple sources and serve a broad array of users within a region.
- Requirement:* 8 The center shall perform quality checks on received data.
- Requirement:* 9 The center shall provide the capability to execute methods on the incoming data such as cleansing, summarizations, aggregations, or transformations applied to the data before it is stored in the archive.
- Requirement:* 10 The center shall respond to requests from the administrator interface function to maintain the archive data.
- Requirement:* 11 When data or a catalog of data is received from the archive, the center shall generate the requested data product for the users systems.
- Requirement:* 12 For archive data requiring financial payment, the center shall process the financial requests and manage an interface to a Financial Institution.

Functional Area: Traffic and Roadside Data Archival

Collects and archives traffic and environmental information directly from the roadside for use in off-line planning, research, and analysis.

- Requirement:* 1 The center shall manage the collection of archive data directly from collection equipment located at the roadside.
- Requirement:* 2 The center shall collect traffic sensor information from roadside devices.
- Requirement:* 3 The center shall collect environmental sensor information that from roadside devices.
- Requirement:* 4 The center shall respond to requests from the Archive Data Administer to input the parameters that control the collection process.
- Requirement:* 5 The center shall send the request for data and control parameters to the field equipment where the information is collected and returned.
- Requirement:* 6 The center shall record the status about the imported traffic and roadside data.
- Requirement:* 7 The center shall use the status information to adjust the collection of traffic and roadside data.

Functional Area: Government Reporting Systems Support

Selects and formats data residing in an ITS archive to facilitate local, state, and federal government data reporting requirements.

- Requirement:* 1 The center shall provide data from an ITS archive to federal, state, or local government reporting systems.
- Requirement:* 2 The center shall provide the capability to select data from an ITS archive for use in government reports.
- Requirement:* 3 The center shall provide the capability to format data from an ITS archive suitable for input into government reports.
- Requirement:* 4 The center shall support requests for ITS archived data from Government Reporting Systems.

Architecture**Northern New Jersey ITS Architecture***Element:***NJT Public Transportation Management System (PTMS)***Entity:***Archived Data Management Subsystem***Functional Area:* **Government Reporting Systems Support**

Selects and formats data residing in an ITS archive to facilitate local, state, and federal government data reporting requirements.

- Requirement:* 5 The center shall provide the applicable meta-data for any ITS archived data to satisfy government reporting system requests. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

*Element:***NJT Rail Archive***Entity:***Archived Data Management Subsystem***Functional Area:* **ITS Data Repository**

Collect and maintain data and data catalogs from one or more data sources. May include quality checks, error notification, and archive coordination.

- Requirement:* 1 The center shall collect data to be archived from one or more data sources.
- Requirement:* 2 The center shall collect data catalogs from one or more data sources. A catalog describes the data contained in the collection of archived data and may include descriptions of the schema or structure of the data, a description of the contents of the data; e.g., time range of entries, number of entries; or a sample of the data (e. g. a thumbnail).
- Requirement:* 3 The center shall store the archived data in a focused repository that is suited to a particular set of ITS data users.
- Requirement:* 4 The center shall include capabilities for performing quality checks on the incoming archived data.
- Requirement:* 5 The center shall include capabilities for error notification on the incoming archived data.
- Requirement:* 6 The center shall include capabilities for archive to archive coordination.
- Requirement:* 7 The center shall support a broad range of archived data management implementations, ranging from simple data marts that collect a focused set of data and serve a particular user community to large-scale data warehouses that collect, integrate, and summarize transportation data from multiple sources and serve a broad array of users within a region.
- Requirement:* 8 The center shall perform quality checks on received data.
- Requirement:* 9 The center shall provide the capability to execute methods on the incoming data such as cleansing, summarizations, aggregations, or transformations applied to the data before it is stored in the archive.
- Requirement:* 10 The center shall respond to requests from the administrator interface function to maintain the archive data.
- Requirement:* 11 When data or a catalog of data is received from the archive, the center shall generate the requested data product for the users systems.
- Requirement:* 12 For archive data requiring financial payment, the center shall process the financial requests and manage an interface to a Financial Institution.

Functional Area: **Traffic and Roadside Data Archival**

Collects and archives traffic and environmental information directly from the roadside for use in off-line planning, research, and analysis.

- Requirement:* 1 The center shall manage the collection of archive data directly from collection equipment located at the roadside.
- Requirement:* 2 The center shall collect traffic sensor information from roadside devices.
- Requirement:* 3 The center shall collect environmental sensor information that from roadside devices.
- Requirement:* 4 The center shall respond to requests from the Archive Data Administer to input the parameters that control the collection process.

Architecture**Northern New Jersey ITS Architecture***Element:***NJT Rail Archive***Entity:***Archived Data Management Subsystem***Functional Area:* **Traffic and Roadside Data Archival**

Collects and archives traffic and environmental information directly from the roadside for use in off-line planning, research, and analysis.

Requirement: 5 The center shall send the request for data and control parameters to the field equipment where the information is collected and returned.

Requirement: 6 The center shall record the status about the imported traffic and roadside data.

Requirement: 7 The center shall use the status information to adjust the collection of traffic and roadside data.

Functional Area: **Government Reporting Systems Support**

Selects and formats data residing in an ITS archive to facilitate local, state, and federal government data reporting requirements.

Requirement: 1 The center shall provide data from an ITS archive to federal, state, or local government reporting systems.

Requirement: 2 The center shall provide the capability to select data from an ITS archive for use in government reports.

Requirement: 3 The center shall provide the capability to format data from an ITS archive suitable for input into government reports.

Requirement: 4 The center shall support requests for ITS archived data from Government Reporting Systems.

Requirement: 5 The center shall provide the applicable meta-data for any ITS archived data to satisfy government reporting system requests. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

Functional Area: **Virtual Data Warehouse Services**

Provides access to data from geographically dispersed archives and coordinates information exchange with a local data warehouse. Also provides the specialized publishing, directory services, and transaction management functions associated with coordinating remote archives.

Requirement: 1 The center shall provide capabilities to access "in-place" data from geographically dispersed archives. These capabilities may include analysis, data fusion, or data mining.

Requirement: 2 The center shall coordinate information exchange with a local data warehouse.

Requirement: 3 The center shall provide the specialized publishing, directory services, and transaction management functions associated with coordinating remote archives.

Requirement: 4 The center shall support the collection of archived data from other archives on an as-needed basis. (This minimizes the need to duplicate the comprehensive set of data from the remote archives in the local data warehouse.)

Requirement: 5 The center shall use data collected from different archives to build a set of global schema including the data archive definitions for the local archive plus any archives known to the local archive.

Requirement: 6 The center shall provide the local archived data schema to other archive systems.

*Element:***NJT Rail Drawbridge Control System***Entity:***Roadway Subsystem***Functional Area:* **Multimodal Crossing Control**

Field elements to monitor and control traffic at multimodal crossings, such as draw bridges and other crossings between highway traffic and other modes; does not include highway-rail intersection.

Architecture**Northern New Jersey ITS Architecture****Element:NJT Rail Drawbridge Control System****Entity:Roadway Subsystem****Functional Area: Multimodal Crossing Control**

Field elements to monitor and control traffic at multimodal crossings, such as draw bridges and other crossings between highway traffic and other modes; does not include highway-rail intersection.

- Requirement:**
- 1 The field element shall include sensors to monitor requests from non-highway traffic to cross at multimodal crossings for specified durations (such as draw bridges and miscellaneous other interference crossings between highway traffic and other modes such as river traffic, aircraft, etc.); the sensors are under center control.
 - 2 The field element shall include signals to control traffic at multimodal crossings on surface streets, under center control.
 - 3 The field element shall include driver information systems (such as dynamic messages signs, highway advisory radios (HAR), and equipment that controls warning lights and gates) that advise drivers at multimodal crossings, under center control.
 - 4 The field element shall provide operational status for the sensors, signals, and driver information systems equipment at multimodal crossings to the center.
 - 5 The field element shall provide fault data for the sensors, signals, and driver information systems equipment at multimodal crossings to the center for repair.
 - 6 The field element shall forward all requests for right-of-way at multimodal crossings to the controlling center.

Element:NJT Rail Infrastructure Security Equipment**Entity:Security Monitoring Subsystem****Functional Area: Field Secure Area Surveillance**

Security surveillance devices (audio/video) that monitor facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, and transit railways or guideways).

- Requirement:**
- 1 The field element shall include video and/or audio surveillance of secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways).

Functional Area: Field Secure Area Sensor Monitoring

Security sensors monitoring facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, and transit railways or guideways) for environmental threats, intrusion and motion, object detection, and infrastructure integrity.

- Requirement:**
- 1 The field element shall include security sensors that monitor conditions of secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways).

Functional Area: Field Secure Area Surveillance

Security surveillance devices (audio/video) that monitor facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, and transit railways or guideways).

- Requirement:**
- 2 The field element shall be remotely controlled by a center.

Functional Area: Field Secure Area Sensor Monitoring

Security sensors monitoring facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, and transit railways or guideways) for environmental threats, intrusion and motion, object detection, and infrastructure integrity.

- Requirement:**
- 2 The field element shall be remotely controlled by a center.

Functional Area: Field Secure Area Surveillance

Architecture**Northern New Jersey ITS Architecture****Element:NJT Rail Infrastructure Security Equipment****Entity:Security Monitoring Subsystem****Functional Area: Field Secure Area Surveillance**

Security surveillance devices (audio/video) that monitor facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, and transit railways or guideways).

Requirement: 3 The field element shall provide equipment status and fault indication of surveillance equipment to a center.

Functional Area: Field Secure Area Sensor Monitoring

Security sensors monitoring facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, and transit railways or guideways) for environmental threats, intrusion and motion, object detection, and infrastructure integrity.

Requirement: 3 The field element shall provide equipment status and fault indication of security sensor equipment to a center.

Functional Area: Field Secure Area Surveillance

Security surveillance devices (audio/video) that monitor facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, and transit railways or guideways).

Requirement: 4 The field element shall provide raw video or audio data.

Functional Area: Field Secure Area Sensor Monitoring

Security sensors monitoring facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, and transit railways or guideways) for environmental threats, intrusion and motion, object detection, and infrastructure integrity.

Requirement: 4 The field element shall include environmental threat sensors (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological).

Requirement: 5 The field element shall include infrastructure condition and integrity monitoring sensors.

Functional Area: Field Secure Area Surveillance

Security surveillance devices (audio/video) that monitor facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, and transit railways or guideways).

Requirement: 5 The field element shall remotely process video and audio data and provide an indication of potential incidents or threats to a center.

Functional Area: Field Secure Area Sensor Monitoring

Security sensors monitoring facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, and transit railways or guideways) for environmental threats, intrusion and motion, object detection, and infrastructure integrity.

Requirement: 6 The field element shall include motion and intrusion detection sensors.

Requirement: 7 The field element shall include object detection sensors (such as metal detectors).

Requirement: 8 The field element shall provide raw security sensor data.

Requirement: 9 The field element shall remotely process security sensor data and provide an indication of potential incidents or threats to a center.

Element:NJT Rail Operations Center Systems**Entity:Emergency Management****Functional Area: Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

Architecture**Northern New Jersey ITS Architecture***Element:***NJT Rail Operations Center Systems***Entity:***Emergency Management***Functional Area:* **Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

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| <i>Requirement:</i> | 1 The center shall support the interface to the Emergency Telecommunications System (e.g. 911 or 7-digit call routing) to receive emergency notification information and provide it to the emergency system operator. |
| <i>Requirement:</i> | 2 The center shall receive emergency call information from 911 services and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 3 The center shall receive emergency call information from motorist call-boxes and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 4 The center shall receive emergency call information from mayday service providers and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 5 The center shall receive emergency notification information from other public safety agencies and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 6 The center shall receive emergency notification information from public transit systems and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 7 The center shall receive emergency notification information from commercial vehicles, commercial vehicle check stations, or commercial fleet operators and present the possible incident information to the emergency system operator. This may include detection of non-permitted transport of security sensitive hazmat, hazardous cargo spills, etc. |
| <i>Requirement:</i> | 8 The center shall receive details of the cargo being carried by commercial vehicles from their commercial fleet manager for incidents involving potential hazardous materials. |
| <i>Requirement:</i> | 9 The center shall coordinate, correlate, and verify all emergency inputs, including those identified based on external calls and internal analysis of security sensor and surveillance data, and assign each a level of confidence. |
| <i>Requirement:</i> | 10 The center shall send a request for remote control of CCTV systems from a traffic management center in order to verify the reported incident. |
| <i>Requirement:</i> | 11 The center shall update the incident information log once the emergency system operator has verified the incident. |
| <i>Requirement:</i> | 12 The center shall provide the capability for digitized map data to act as the background to the emergency information presented to the emergency system operator. |
| <i>Requirement:</i> | 13 The center shall forward the verified emergency information to the responding agency based on the location and nature of the emergency. |

Functional Area: **Emergency Dispatch**

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

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| <i>Requirement:</i> | 1 The center shall dispatch emergency vehicles to respond to verified emergencies and provide suggested routing under center personnel control. |
| <i>Requirement:</i> | 2 The center shall store the current status of all emergency vehicles available for dispatch and those that have been dispatched. |
| <i>Requirement:</i> | 3 The center shall relay location and incident details to the responding vehicles. |

Architecture**Northern New Jersey ITS Architecture***Element:***NJT Rail Operations Center Systems***Entity:***Emergency Management***Functional Area:* **Emergency Dispatch**

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

Requirement: 4 The center shall provide the capability to request traffic control measures from traffic management centers such as signal preemption, traffic barriers and road closures.

Requirement: 5 The center shall track the location and status of emergency vehicles responding to an emergency and update the incident status based on information from the emergency vehicle.

Requirement: 6 The center shall receive status information from care facilities to determine the appropriate facility and its location.

Requirement: 7 The center shall store and maintain the emergency service responses in an action log.

Requirement: 8 The center shall receive asset restriction information from maintenance centers to support the dispatching of appropriate emergency resources.

Requirement: 9 The center shall receive traffic information, including closures, traffic conditions, etc. from traffic management centers.

Requirement: 10 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.

Requirement: 11 The center shall receive road network conditions and traffic images to support dispatch of emergency vehicles.

Requirement: 12 The center shall coordinate response to incidents with other Emergency Management centers to ensure appropriate resources are dispatched and utilized.

Functional Area: **Emergency Early Warning System**

Monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies in order to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to other ITS centers to notify the traveling public. Includes support for Child Abduction notices.

Requirement: 1 The center shall monitor information from Alerting and Advisory Systems such as the Information Sharing and Analysis Centers (ISACs), the National Infrastructure Protection Center (NIPC), the Homeland Security Advisory System (HSAS), etc. The information may include assessments (general incident and vulnerability awareness information), advisories (identification of threats or recommendations to increase preparedness levels), or alerts (information on imminent or in-progress emergencies).

Requirement: 2 The center shall provide the capability to correlate alerts and advisories, incident information, and security sensor and surveillance data.

Requirement: 3 The center shall broadcast wide-area alerts and advisories to traffic management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.

Requirement: 4 The center shall broadcast wide-area alerts and advisories to transit management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.

Requirement: 5 The center shall broadcast wide-area alerts and advisories to toll administration centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.

Requirement: 6 The center shall broadcast wide-area alerts and advisories to traveler information service providers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.

Architecture**Northern New Jersey ITS Architecture***Element:***NJT Rail Operations Center Systems***Entity:***Emergency Management***Functional Area:* **Emergency Early Warning System**

Monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies in order to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to other ITS centers to notify the traveling public. Includes support for Child Abduction notices.

- Requirement:* 7 The center shall broadcast wide-area alerts and advisories to maintenance centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 8 The center shall broadcast wide-area alerts and advisories to other emergency management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 9 The center shall process status information from each of the centers that have been sent the wide-area alert.
- Requirement:* 10 The center shall coordinate the broadcast of wide-area alerts and advisories with other emergency management centers.
- Requirement:* 11 The center shall receive incident information from other transportation management centers to support the early warning system.
- Requirement:* 12 The center shall present the alert and advisory information and the status of the actions taken in response to the alert by the other centers to the emergency system operator as received from other system inputs.
- Requirement:* 13 The center shall support the entry of alert and advisory information directly from the emergency system operator.

Functional Area: **Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

- Requirement:* 1 The center shall provide strategic emergency response capabilities such as that of an Emergency Operations Center for large-scale incidents and disasters.
- Requirement:* 2 The center shall manage coordinated inter-agency responses to and recovery from large-scale emergencies. Such agencies include traffic management, transit, maintenance and construction management, rail operations, and other emergency management agencies.
- Requirement:* 3 The center shall provide the capability to implement response plans and track progress through the incident by exchanging incident information and distributing response status to allied agencies.
- Requirement:* 4 The center shall develop, coordinate with other agencies, and store emergency response plans.
- Requirement:* 5 The center shall track the availability of resources (including vehicles, roadway cleanup?, etc.), request additional resources from traffic, maintenance, or other emergency centers if needed.
- Requirement:* 6 The center shall allocate the appropriate emergency services, resources, and vehicle (s) to respond to incidents, and shall provide the capability to override the current allocation to suit the special needs of a current incident.
- Requirement:* 7 The center shall receive event scheduling information from Event Promoters.
- Requirement:* 8 The center shall receive hazardous materials incident information from commercial fleet operators.
- Requirement:* 9 The center shall provide the capability to request the safe disabling of a commercial vehicle during a hazardous materials incident.
- Requirement:* 10 The center shall provide the capability to request transit resource availability from transit centers for use during disaster and evacuation operations.

Architecture**Northern New Jersey ITS Architecture***Element:***NJT Rail Operations Center Systems***Entity:***Emergency Management***Functional Area:* **Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

Requirement: 11 The center shall assimilate the status of the transit, traffic, rail, maintenance, and other emergency center services and systems to create an overall transportation system status, and disseminate to each of these centers and the traveling public via traveler information providers.

Requirement: 12 The center shall provide information to the media concerning the status of an emergency response.

Requirement: 13 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.

Requirement: 14 The center shall provide the capability for center personnel to provide inputs to the management of incidents, disasters and evacuations.

Functional Area: **Incident Command**

Tactical decision support, resource coordination, and communications integration among emergency management agencies for Incident Commands that are established by first responders to support local management of an incident.

Requirement: 1 The center shall provide tactical decision support, resource coordination, and communications integration for Incident Commands that are established by first responders to support local management of an incident.

Requirement: 2 The center shall provide incident command communications with public safety, emergency management, transportation, and other allied response agency centers.

Requirement: 3 The center shall track and maintain resource information and action plans pertaining to the incident command.

Requirement: 4 The center shall share incident command information with other public safety agencies including resource deployment status, hazardous material information, rail incident information, evacuation advice as well as traffic, road, and weather conditions.

Requirement: 5 The center shall assess the status of responding emergency vehicles as part of an incident command.

Functional Area: **Emergency Evacuation Support**

Evacuation planning and coordination to manage evacuation and reentry of a population in the vicinity of a disaster or other emergency that poses a risk to public safety.

Requirement: 1 The center shall manage inter-agency coordination of evacuation operations, from initial planning through the evacuation process and reentry.

Requirement: 2 The center shall develop and exchange evacuation plans with allied agencies prior to the occurrence of a disaster.

Requirement: 3 The center shall provide an interface to the emergency system operator to enter evacuation plans and procedures and present the operator with other agencies' plans.

Requirement: 4 The center shall coordinate evacuation destinations and shelter needs with shelter providers (e.g., the American Red Cross) in the region.

Requirement: 5 The center shall provide evacuation information to traffic, transit, maintenance and construction, rail operations, and other emergency management centers as needed.

Requirement: 6 The center shall request resources from transit agencies as needed to support the evacuation.

Requirement: 7 The center shall request traffic management agencies to implement special traffic control strategies and to control evacuation traffic, including traffic on local streets and arterials as well as the major evacuation routes.

Architecture**Northern New Jersey ITS Architecture***Element:***NJT Rail Operations Center Systems***Entity:***Emergency Management***Functional Area:* **Emergency Evacuation Support**

Evacuation planning and coordination to manage evacuation and reentry of a population in the vicinity of a disaster or other emergency that poses a risk to public safety.

- Requirement:* 8 The center shall provide traveler information systems with evacuation guidance including basic information to assist potential evacuees in determining whether evacuation is necessary and when it is safe to return.
- Requirement:* 9 The center shall monitor the progress or status of the evacuation once it begins and exchange tactical plans, prepared during the incident, with allied agencies.
- Requirement:* 10 The center shall monitor the progress of the reentry process.
- Requirement:* 11 The center shall submit evacuation information to toll administration centers along with requests for changes in the toll services or fee collection during an evacuation.

Functional Area: **Emergency Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and emergency vehicles equipped with environmental sensors; used by the operator to more effectively manage incidents.

- Requirement:* 1 The center shall collect current and forecast road and weather information from weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
- Requirement:* 2 The center shall receive environmental probe information from its fleet of emergency vehicles.
- Requirement:* 3 The center shall collect current road and weather information from roadway maintenance operations.
- Requirement:* 4 The center shall assimilate current and forecast road conditions and surface weather information to support incident management.
- Requirement:* 5 The center shall present the current and forecast road and weather information to the emergency system operator.
- Requirement:* 6 The center shall provide aggregated or processed environmental probe information from its fleet of emergency vehicles to traffic management and maintenance centers.

Functional Area: **Center Secure Area Surveillance**

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 1 The center shall remotely monitor video images and audio surveillance data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The data may be raw or pre-processed in the field.
- Requirement:* 2 The center shall remotely monitor video images and audio surveillance data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The data may be raw or pre-processed in the field.
- Requirement:* 3 The center shall remotely monitor video images and audio surveillance data collected on-board transit vehicles. The data may be raw or pre-processed in the field.
- Requirement:* 4 The center shall exchange surveillance data with other emergency centers.
- Requirement:* 5 The center shall identify potential security threats based on collected security surveillance data.
- Requirement:* 6 The center shall verify potential security threats by correlating security surveillance data from multiple sources.

Architecture**Northern New Jersey ITS Architecture***Element:***NJT Rail Operations Center Systems***Entity:***Emergency Management***Functional Area:* **Center Secure Area Surveillance**

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

Requirement: 7 The center shall remotely control security surveillance devices in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways).

Requirement: 8 The center shall remotely control security surveillance devices in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers).

Requirement: 9 The center shall remotely control security surveillance devices on-board transit vehicles.

Requirement: 10 The center shall match traveler video images against a database from the Alerting and Advisory Systems of known images that may represent criminals and terrorists.

Requirement: 11 The center shall exchange traveler images with other emergency management centers to support traveler image matching.

Requirement: 12 The center shall respond to control data from center personnel regarding security surveillance data collection, processing, threat detection, and image matching.

Functional Area: **Center Secure Area Sensor Management**

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

Requirement: 1 The center shall remotely monitor and control security sensor data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), infrastructure condition and integrity, intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.

Requirement: 2 The center shall remotely monitor and control security sensor data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.

Requirement: 3 The center shall remotely monitor and control security sensor data collected on-board transit vehicles. The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors) and object detection sensors. The data may be raw or pre-processed in the field.

Requirement: 4 The center shall exchange security sensor data with other emergency centers.

Requirement: 5 The center shall identify potential security threats based on collected security sensor data.

Requirement: 6 The center shall verify potential security threats by correlating security sensor data from multiple sources.

Requirement: 7 The center shall perform threat analysis based on correlations of security sensor and surveillance data.

Requirement: 8 The center shall exchange threat analysis data with Alerting and Advisory Systems and use that data in local threat analysis processing.

Architecture**Northern New Jersey ITS Architecture***Element:***NJT Rail Operations Center Systems***Entity:***Emergency Management***Functional Area:* **Center Secure Area Sensor Management**

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

Requirement: 9 The center shall disseminate threat information to other agencies, including traffic, transit, maintenance, rail operations, and other emergency management centers.

Requirement: 10 The center shall respond to control data from center personnel regarding security sensor data collection, processing, threat detection, and threat analysis.

Functional Area: **Center Secure Area Alarm Support**

Collection and response to silent and audible alarms received from travelers in secure areas (such as transit stops, rest areas, park-and-ride lots) and from on-board transit vehicles.

Requirement: 1 The center shall collect silent and audible alarms received from travelers in secure areas (such as transit stops, rest areas, park and ride lots, modal interchange facilities).

Requirement: 2 The center shall collect silent and audible alarms received from transit vehicles, originated by the traveler or the transit vehicle operator.

Requirement: 3 After the alarm message has been received, the center shall generate an alarm acknowledgment to the sender.

Requirement: 4 After the alarm message becomes a verified incident, the center shall determine the appropriate response.

Requirement: 5 The center shall determine whether the alarm message indicates an emergency that requires the attention of public safety agencies, and forward alarm message data to the appropriate agency as necessary.

Requirement: 6 The center shall forward the alarm message to center personnel and respond to the traveler or transit vehicle operator as directed by the personnel.

Functional Area: **Mayday Support**

Collection and response to Mayday messages received from vehicles and drivers.

Requirement: 1 The center shall collect mayday messages from vehicles and drivers.

Requirement: 2 The center shall collect mayday messages from travelers via personal handheld devices.

Requirement: 3 The center shall acknowledge the request for emergency assistance, whether originated by the driver, automatically by the vehicle's safety systems, or by a traveler via a personal handheld device.

Requirement: 4 After the mayday becomes a verified incident, the center shall determine the appropriate response to the mayday message.

Requirement: 5 The center shall determine whether the mayday message indicates an emergency that requires the attention of public safety agencies, and forward mayday emergency data to the appropriate agency as necessary.

Requirement: 6 The center shall support the activation of remote controlled functions requested by a vehicle, such as requests to unlock doors.

Requirement: 7 The center shall request additional emergency details from or issue commands to the vehicle's security systems or vehicle driver if needed.

Requirement: 8 The center shall maintain a log of all mayday signals received from vehicles.

Requirement: 9 The center shall provide all mayday data to center personnel and respond to the vehicle, driver, or traveler using the portable handheld device as directed by the personnel.

Architecture**Northern New Jersey ITS Architecture***Element:***NJT Rail Operations Center Systems***Entity:***Emergency Management***Functional Area:* **Emergency Data Collection**

Collection and storage of information related to Emergency Management. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect emergency service data, emergency vehicle management data, emergency vehicle data, sensor and surveillance data, threat data, and incident data.
- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.
- Requirement:* 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the emergency management data or for the data itself.
- Requirement:* 4 The center shall be able to produce sample products of the data available.

*Entity:***Transit Management***Functional Area:* **Transit Center Tracking and Dispatch**

Monitoring transit vehicle locations via interactions with on-board systems and determining vehicle schedule adherence. Furnish users with real-time transit related information and maintain interface with digital map providers.

- Requirement:* 1 The center shall monitor the locations of all transit vehicles within its network.
- Requirement:* 2 The center shall determine adherence of transit vehicles to their assigned schedule.
- Requirement:* 3 The center shall collect trip monitoring data from on-board systems including transit vehicle mileage, fuel usage, passenger loading, availability, etc.
- Requirement:* 4 The center shall provide transit operational data to traveler information service providers.
- Requirement:* 5 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for transit tracking and dispatch.

Functional Area: **Transit Center Fixed-Route Operations**

Planning and scheduling associated with fixed and flexible route transit services, automatically updates customer service operator systems, and provides current vehicle schedule adherence and optimum scenarios for schedule adjustment.

- Requirement:* 1 The center shall generate transit routes and schedules based on such factors as parameters input by the system operator, road network conditions, operational data on current routes and schedules, and digitized map data.
- Requirement:* 2 The center shall provide the interface to the system operator to control the generation of new routes and schedules (transit services) including the ability to review and update the parameters used by the routes and schedules generation processes and to initiate these processes
- Requirement:* 3 The center shall be able to generate special routes and schedules to support an incident, disaster, evacuation, or other emergency.
- Requirement:* 4 The center shall accept requests from traffic management to change routes and schedules as part of the implementation of demand management strategies.
- Requirement:* 5 The center shall collect transit operational data for use in the generation of routes and schedules.
- Requirement:* 6 The center shall assign transit vehicle operators based on factors such as eligibility, route preferences, seniority, and transit vehicle availability.
- Requirement:* 7 The center shall manage large deviations of individual transit vehicles, deviations in rural areas, and deviations of large numbers of vehicles.

Architecture

Northern New Jersey ITS Architecture

Element: **NJT Rail Operations Center Systems**

Entity: **Transit Management**

Functional Area: **Transit Center Fixed-Route Operations**

Planning and scheduling associated with fixed and flexible route transit services, automatically updates customer service operator systems, and provides current vehicle schedule adherence and optimum scenarios for schedule adjustment.

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- Requirement:* 8 The center shall generate the necessary corrective actions which may involve more than the vehicles concerned and more far reaching action, such as, the introduction of extra vehicles, wide area signal priority by traffic management, the premature termination of some services, etc.
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- Requirement:* 9 The center shall exchange information with Maintenance and Construction Operations concerning work zones, roadway conditions, asset restrictions, work plans, etc.
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- Requirement:* 10 The center shall disseminate up-to-date schedules and route information to other centers for fixed and flexible route services.
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Functional Area: **Transit Center Security**

Monitor transit vehicle operator or traveler activated alarms; authenticate transit vehicle operators; remotely disable a transit vehicle; alert operators, travelers, and police to potential incidents identified by these security features.

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- Requirement:* 1 The center shall monitor transit vehicle operational data to determine if the transit vehicle is off-route and assess whether a security incident is occurring.
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- Requirement:* 2 The center shall receive reports of emergencies on-board transit vehicles entered directly by the transit vehicle operator or from a traveler through interfaces such as panic buttons or alarm switches.
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- Requirement:* 3 The center shall support the back-office portion of functionality to authenticate transit vehicle operators.
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- Requirement:* 4 The center shall exchange transit incident information along with other service data with other transit agencies.
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- Requirement:* 5 The center shall receive information pertaining to a wide-area alert such as weather alerts, disaster situations, or child abductions. This information may come from Emergency Management or from other Alerting and Advisory Systems.
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- Requirement:* 6 The center shall send wide-area alert information to travelers (on-board transit vehicles or at stations/stops) and transit vehicle operators.
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- Requirement:* 7 The center shall coordinate the response to security incidents involving transit with other agencies including Emergency Management, other transit agencies, media, traffic management, and traveler information service providers.
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- Requirement:* 8 The center shall receive threat information and status on the integrity of the transit infrastructure.
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- Requirement:* 9 The center shall provide support to remotely disable (or reset the disabling of) a transit vehicle in service.
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Functional Area: **Transit Garage Operations**

Assignment of transit vehicles and operators to routes or service areas in a fair manner while minimizing labor and overtime services, considering operator preferences, qualifications, accumulated work hours, and other information about each operator.

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- Requirement:* 1 The center shall maintain records of a transit vehicle operator's performance. This may be done utilizing standardized performance evaluation criteria set forth by governmental regulations and transit operating company policies, assessing the transit vehicle operator's driving history, and assessing comments from the transit vehicle operator's supervisor(s) as well as noting any moving violations or accidents, supervisor comments, government regulations, and company policies.
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- Requirement:* 2 The center shall assess the transit vehicle operator's availability based on previous work assignments, accumulated hours, plus health and vacation commitments.
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Architecture

Northern New Jersey ITS Architecture

Element: **NJT Rail Operations Center Systems**

Entity: **Transit Management**

Functional Area: **Transit Garage Operations**

Assignment of transit vehicles and operators to routes or service areas in a fair manner while minimizing labor and overtime services, considering operator preferences, qualifications, accumulated work hours, and other information about each operator.

Requirement: 3 The center shall assign transit vehicle operators to transit schedules based on their eligibility, route preferences, seniority, and transit vehicle availability.

Requirement: 4 The center shall provide an interface through which the transit vehicle operator information can be maintained - either from the transit vehicle operator, a transit system operator (i.e. center personnel), or other functions.

Functional Area: **Transit Center Information Services**

Provide interactive traveler information to travelers (on-board transit vehicles, at stops/stations, using personal devices), traveler information service providers, media, and other transit organizations. Includes routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, yellow pages, and special events.

Requirement: 1 The center shall provide travelers using public transportation with traffic and advisory information upon request. Such information may include transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events.

Requirement: 2 The center shall provide transit information to the media including details of deviations from schedule of regular transit services.

Requirement: 3 The center shall exchange transit schedules, real-time arrival information, fare schedules, and general transit service information with other transit organizations to support transit traveler information systems.

Requirement: 4 The center shall provide transit service information to traveler information service providers including routes, schedules, schedule adherence, and fare information as well as transit service information during evacuation.

Requirement: 5 The center shall enable yellow pages (including non-motorized transportation) information to be output to the traveler.

Requirement: 6 The center shall broadcast transit advisory data, including alerts and advisories pertaining to major emergencies, or man made disasters.

Functional Area: **Transit Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and vehicle probes. The information is monitored and forwarded to other agencies to more effectively manage transit operations.

Requirement: 1 The center shall assimilate current and forecast road conditions and surface weather information to more effectively manage transit operations.

Requirement: 2 The center shall collect current and forecast road and weather information from weather service providers and vehicle probes.

Requirement: 3 The center shall receive road network probe information from its fleet of transit vehicles.

Requirement: 4 The center shall provide road network probe information from its fleet of transit vehicles to traffic management as well as maintenance and construction management.

Functional Area: **Transit Center Multi-Modal Coordination**

Generate requests for transit priority on routes and at certain intersections. Coordinate schedules with other agencies and modes, including transit transfer cluster and transfer point information.

Architecture**Northern New Jersey ITS Architecture***Element:***NJT Rail Operations Center Systems***Entity:***Transit Management***Functional Area:* **Transit Center Multi-Modal Coordination**

Generate requests for transit priority on routes and at certain intersections. Coordinate schedules with other agencies and modes, including transit transfer cluster and transfer point information.

- Requirement:* 1 The center shall analyze transit vehicle schedule performance to determine the need for priority along certain routes or at certain intersections.
- Requirement:* 2 The center shall send requests for priority along routes or at intersections to traffic management.
- Requirement:* 3 The center shall coordinate schedules and services between transit agencies, traffic management, maintenance and construction operations, parking management, and other surface or air transportation modes.
- Requirement:* 4 The center shall share transfer cluster and transfer point information with multimodal transportation service providers, other transit agencies, and traveler information service providers. A transfer cluster is a collection of stops, stations, or terminals where transfers can be made conveniently.

Functional Area: **Transit Evacuation Support**

Support evacuation and subsequent reentry of a population in the vicinity of a disaster or other emergency. Coordinate regional evacuation plans and resources including transit and school bus fleets.

- Requirement:* 1 The center shall manage the use of transit resources to support evacuation and subsequent reentry of a population in the vicinity of a disaster or other emergency.
- Requirement:* 2 The center shall coordinate regional evacuation plans with Emergency Management - identifying the transit role in an evacuation and the transit resources that would be used.
- Requirement:* 3 The center shall coordinate the use of transit and school bus fleets during an evacuation, supporting evacuation of those with special needs and the general population.
- Requirement:* 4 The center shall adjust and update transit service and fare schedules and provide that information to other agencies as they coordinate evacuations.

Functional Area: **Transit Data Collection**

Collection and storage of transit management data. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect transit management data such as transit fares and passenger use, transit services, paratransit operations, transit vehicle maintenance data, etc.
- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.
- Requirement:* 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the transit data or for the data itself.
- Requirement:* 4 The center shall be able to produce sample products of the data available.

*Element:***NJT Rail Trains***Entity:***Transit Vehicle Subsystem***Functional Area:* **On-board Transit Trip Monitoring**

Support fleet management with automatic vehicle location (AVL) and automated mileage and fuel reporting and auditing.

- Requirement:* 1 The transit vehicle shall compute the location of the transit vehicle based on inputs from a vehicle location determination function.
- Requirement:* 2 The transit vehicle shall support the computation of the location of a transit vehicle using on-board sensors to augment the location determination function. This may include proximity to the transit stops or other known reference points as well as recording trip length.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJT Rail Trains***Entity:* **Transit Vehicle Subsystem***Functional Area:* **On-board Transit Trip Monitoring**

Support fleet management with automatic vehicle location (AVL) and automated mileage and fuel reporting and auditing.

Requirement: 3 The transit vehicle shall record transit trip monitoring data including vehicle mileage and fuel usage.

Requirement: 4 The transit vehicle shall record transit trip monitoring data including operational status information such as doors open/closed, passenger loading, running times, etc.

Requirement: 5 The transit vehicle shall send the transit vehicle trip monitoring data to center-based trip monitoring functions.

Functional Area: **On-board Fixed Route Schedule Management**

Collecting of data for schedule generation and adjustment on-board a transit vehicle. Supports communication between the vehicle, operator, and center.

Requirement: 1 The transit vehicle shall receive transit route information for its assigned route including transit service instructions, traffic information, road conditions, and other information for the operator.

Requirement: 2 The transit vehicle shall use the route information and its current location to determine the deviation from the predetermined schedule.

Requirement: 3 The transit vehicle shall calculate the estimated times of arrival (ETA) at transit stops.

Requirement: 4 The transit vehicle shall determine scenarios to correct the schedule deviation.

Requirement: 5 The transit vehicle shall provide the schedule deviations and instructions for schedule corrections to the transit vehicle operator if the deviation is small, or the transit vehicle is operating in an urban area.

Requirement: 6 The transit vehicle shall send the schedule deviation and estimated arrival time information to the center.

Requirement: 7 The transit vehicle shall support the operations of a flexible route service. This may include requests for route deviations that would then lead to schedule corrective actions.

Functional Area: **On-board Transit Fare and Load Management**

On-board systems provide variable and flexible fare collection using a travelers fare medium (stored value cards or other payment instrument). Collect data required to determine accurate ridership levels and fare statistics.

Requirement: 1 The transit vehicle shall detect embarking travelers on-board a transit vehicle and read data from the traveler card / payment instrument that they are carrying.

Requirement: 2 The transit vehicle shall provide an image of all travelers which shall be used for violation processing of those who do not have a traveler card / payment instrument or whose transit fare transaction fails.

Requirement: 3 The transit vehicle shall determine the traveler's travel routing based on the transit vehicle's current location and the traveler's destination.

Requirement: 4 The transit vehicle shall calculate the traveler's fare based on the origin and destination provided by the traveler as well as factors such as the transit routing, transit fare category, traveler history, and route-specific information.

Requirement: 5 The transit vehicle shall have access to the complete range of transit services (routes and schedules) that are available to the traveler.

Requirement: 6 The transit vehicle shall provide a transit fare payment interface that is suitable for travelers with physical disabilities.

Requirement: 7 The transit vehicle shall include a database on-board the transit vehicle for use in fare processing from which the fares for all possible trips within the transit operational network can be determined.

Requirement: 8 The transit vehicle shall support an emergency fare structure overriding all other fares that can be activated during disasters, states of emergency or evacuations.

Architecture**Northern New Jersey ITS Architecture***Element:***NJT Rail Trains***Entity:***Transit Vehicle Subsystem***Functional Area:* **On-board Transit Fare and Load Management**

On-board systems provide variable and flexible fare collection using a travelers fare medium (stored value cards or other payment instrument). Collect data required to determine accurate ridership levels and fare statistics.

Requirement: 9 The transit vehicle shall support the support advanced payments for tolls, and/or parking lot charges, and/or transit fares via the traveler card / payment instrument.

Requirement: 10 The transit vehicle shall provide passenger loading and fare statistics data to the center.

Functional Area: **On-board Transit Information Services**

On-board systems to furnish next-stop annunciation as well as interactive travel-related information, including routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, non-motorized transportation services, and special events.

Requirement: 1 The transit vehicle shall enable traffic and travel advisory information to be requested and output to the traveler. Such information may include transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events.

Requirement: 2 The transit vehicle shall enable yellow pages (including non-motorized transportation) information to be requested and output to the traveler.

Requirement: 3 The transit vehicle shall broadcast advisories about the imminent arrival of the transit vehicle at the next stop via an on-board automated annunciation system.

Requirement: 4 The transit vehicle shall support input and output forms that are suitable for travelers with physical disabilities.

Requirement: 5 The transit vehicle shall gather transit advisory data, including alerts and advisories pertaining to major emergencies, or man made disasters.

Requirement: 6 The transit vehicle shall tailor the output of the request traveler information based on the current location of the transit vehicle.

*Element:***NJTA IVR***Entity:***Information Service Provider***Functional Area:* **Basic Information Broadcast**

Collection, processing, storage, and broadcast dissemination of traffic, transit, maintenance and construction, event, and weather information to traveler interface systems and vehicles.

Requirement: 1 The center shall collect, process, store, and disseminate traffic and highway condition information to travelers, including incident information, detours and road closures, event information, recommended routes, and current speeds on specific routes.

Requirement: 2 The center shall collect, process, store, and disseminate maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities.

Requirement: 3 The center shall collect, process, store, and disseminate transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers.

Requirement: 4 The center shall collect, process, store, and disseminate parking information to travelers, including location, availability, and fees.

Requirement: 5 The center shall collect, process, store, and disseminate toll fee information to travelers.

Requirement: 6 The center shall collect, process, store, and disseminate weather information to travelers.

Requirement: 7 The center shall collect, process, store, and disseminate event information to travelers.

Requirement: 8 The center shall collect, process, store, and disseminate air quality information to travelers.

Requirement: 9 The center shall provide the capability to support requests from the media for traffic and incident data.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA IVR***Entity:* **Information Service Provider***Functional Area:* **Basic Information Broadcast**

Collection, processing, storage, and broadcast dissemination of traffic, transit, maintenance and construction, event, and weather information to traveler interface systems and vehicles.

- Requirement:* 10 The center shall provide the capability for a system operator to control the type and update frequency of broadcast traveler information.

Functional Area: **Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

- Requirement:* 1 The center shall collect, process, store, and disseminate customized traffic and highway condition information to travelers, including incident information, detours and road closures, recommended routes, and current speeds on specific routes upon request.
- Requirement:* 2 The center shall collect, process, store, and disseminate customized maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities upon request.
- Requirement:* 3 The center shall collect, process, store, and disseminate customized transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers upon request.
- Requirement:* 4 The center shall collect, process, store, and disseminate customized parking information to travelers, including location, availability, and fees upon request.
- Requirement:* 5 The center shall collect, process, store, and disseminate customized toll fee information to travelers upon request.
- Requirement:* 6 The center shall collect, process, store, and disseminate customized weather information to travelers upon request.
- Requirement:* 7 The center shall collect, process, store, and disseminate customized multimodal transportation service information (for example, from ferry and airline operators), including transfer points and other information, to travelers upon request.
- Requirement:* 8 The center shall collect, process, store, and disseminate customized event information to travelers upon request.
- Requirement:* 9 The center shall collect, process, store, and disseminate customized air quality information to travelers upon request.
- Requirement:* 10 The center shall provide all traveler information based on the traveler's current location or a specific location identified by the traveler, and filter or customize the provided information accordingly.
- Requirement:* 11 The center shall accept traveler profiles for determining the type of personalized data to send to the traveler.
- Requirement:* 12 The center shall manage payment for services, such as tolls, transit fares, parking lot charges, map updates, and advanced payment for tolls, and provide transaction success or failure details.
- Requirement:* 13 The center shall support requests for traveler information and advanced payment for traveler services from commercial fleet operators.
- Requirement:* 14 The center shall provide the capability to exchange information with another traveler information service provider current or predicted data for road links that are outside the area served by the local supplier.
- Requirement:* 15 The center shall manage updates of digitized map data and provide updates to traveler interface systems upon request.
- Requirement:* 16 The center shall provide the capability to support requests from the media for traffic and incident data.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA IVR***Entity:* **Information Service Provider***Functional Area:* **Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

- Requirement:* 17 The center shall provide the capability for a system operator to control the type and update frequency of traveler information.

Functional Area: **Traveler Telephone Information**

Collection and distribution of traveler information and wide-area alerts to traveler telephone information systems such as 511, based on voice-based traveler requests.

- Requirement:* 1 The center shall provide the capability to process voice-formatted requests for traveler information from a traveler telephone information system, and return the information in the requested format.
- Requirement:* 2 The center shall provide the capability to process dual-tone multifrequency (DTMF)-based requests (touch-tone) for traveler information from a traveler telephone information system.
- Requirement:* 3 The center shall provide the capability to process traveler information requests from a traveler telephone information system.
- Requirement:* 4 The center shall collect and provide information on traffic conditions in the requested voice format and for the requested location.
- Requirement:* 5 The center shall collect and provide work zone and roadway maintenance information in the requested voice format and for the requested location.
- Requirement:* 6 The center shall collect and provide roadway environment conditions information in the requested voice format and for the requested location.
- Requirement:* 7 The center shall collect and provide weather and event information in the requested voice format and for the requested location.
- Requirement:* 8 The center shall collect and provide transit service information in the requested voice format and for the requested location.
- Requirement:* 9 The center shall collect and provide yellow pages services information in the requested voice format and for the requested location.
- Requirement:* 10 The center shall collect and provide current ferry and rail schedule and airport status information in the requested voice format and for the requested location.
- Requirement:* 11 The center shall provide the capability to support both specific caller requests as well as bulk upload of regional traveler information.
- Requirement:* 12 The center shall receive and forward region-specific wide-area alert and advisory information to the traveler telephone information system, including major emergencies such as a natural or man-made disaster, civil emergency, child abductions, severe weather watches and warnings, military activities, and law enforcement warnings.

Functional Area: **Infrastructure Provided Route Selection**

Generation of pre-trip and enroute trip plans for travelers (and vehicles) based on current traffic conditions, work zones, weather, and travelers constraints and preferences. Includes end-to-end trips using multiple modes, such as bicycle, transit, etc.

- Requirement:* 1 The center shall provide the capability to provide specific pre-trip and enroute directions to travelers (and drivers), including costs, arrival times, and transfer points.
- Requirement:* 2 The center shall include bicycle routes, walkways, skyways, and multi-use trails in the pre-trip and enroute directions it provides to travelers.
- Requirement:* 3 The center shall support on-line route guidance for travelers using personal devices (such as PDAs).
- Requirement:* 4 The center shall support on-line route guidance for drivers in vehicles.

Architecture**Northern New Jersey ITS Architecture***Element:***NJTA IVR***Entity:***Information Service Provider***Functional Area:* **Infrastructure Provided Route Selection**

Generation of pre-trip and enroute trip plans for travelers (and vehicles) based on current traffic conditions, work zones, weather, and travelers constraints and preferences. Includes end-to-end trips using multiple modes, such as bicycle, transit, etc.

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| <i>Requirement:</i> | 5 | The center shall support on-line route guidance for specialty vehicles, such as commercial vehicles. |
| <i>Requirement:</i> | 6 | The center shall generate route plans based on current and/or predicted conditions of the road network, scheduled maintenance and construction work activities, and work zone activities. |
| <i>Requirement:</i> | 7 | The center shall generate route plans based on transit services, including fares, schedules, and requirements for travelers with special needs. |
| <i>Requirement:</i> | 8 | The center shall generate route plans based on current asset restrictions, such as height and weight restrictions on tunnels or bridges. |
| <i>Requirement:</i> | 9 | The center shall generate route plans based on current or forecasted weather. |
| <i>Requirement:</i> | 10 | The center shall generate route plans based on ferry, rail, air, or other multimodal transportation data. |
| <i>Requirement:</i> | 11 | The center shall exchange route segment information with other centers outside the area served by the local center. |
| <i>Requirement:</i> | 12 | The center shall generate trips based on the use of more than one mode of transport. |
| <i>Requirement:</i> | 13 | The center shall use the preferences and constraints specified by the traveler in the trip request to select the most appropriate mode of transport. |
| <i>Requirement:</i> | 14 | The center shall provide the capability for the traveler to confirm the proposed trip plan. |
| <i>Requirement:</i> | 15 | The center shall log route plans, particularly for special vehicles such as those containing hazardous materials, over-sized vehicles, or motorcades, with a traffic center. |
| <i>Requirement:</i> | 16 | The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used to determine vehicle and non-vehicle routes, trip planning, and on-line vehicle guidance. |
| <i>Requirement:</i> | 17 | The center shall provide the capability for center personnel to control route calculation parameters. |

*Element:***NJTA Parkway Division Maintenance***Entity:***Maintenance and Construction Management***Functional Area:* **MCM Vehicle Tracking**

Remotely tracks the location of maintenance and construction vehicles and other equipment; presented to the center personnel.

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| <i>Requirement:</i> | 1 | The center shall monitor the locations of all maintenance and construction vehicles and other equipment under its jurisdiction. |
| <i>Requirement:</i> | 2 | The center shall present location data to center personnel for the fleet of maintenance and construction vehicles and other equipment. |
| <i>Requirement:</i> | 3 | The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for maintenance and construction vehicle tracking. |

Functional Area: **MCM Vehicle and Equipment Maintenance Management**

Monitors vehicle and equipment condition, tracks maintenance history, and schedules routine and corrective maintenance.

Architecture**Northern New Jersey ITS Architecture***Element:***NJTA Parkway Division Maintenance***Entity:***Maintenance and Construction Management***Functional Area:* **MCM Vehicle and Equipment Maintenance Management**

Monitors vehicle and equipment condition, tracks maintenance history, and schedules routine and corrective maintenance.

- Requirement:*
- 1 The center shall collect and analyze vehicle diagnostics information from maintenance and construction vehicles. The information includes engine temperature, mileage, tire wear, brake wear, belt wear, and any warnings or alarms concerning the operational condition of the vehicle and ancillary equipment.
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- Requirement:*
- 2 The center shall exchange information with equipment repair facilities including status and history of repairs concerning maintenance and construction vehicles. This information includes vehicle status and diagnostic information, vehicle utilization, and coordination of when vehicles will be available for preventative and corrective maintenance.
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- Requirement:*
- 3 The center shall schedule preventive and corrective vehicle maintenance with the equipment repair facility based on fleet health reports, maintenance records, vehicle utilization and vehicle availability schedules.

Functional Area: **MCM Environmental Information Collection**

Remotely controls environmental sensors and assimilates collected data with other current and forecast road conditions and surface weather information from weather service providers and transportation operations.

- Requirement:*
- 1 The center shall remotely control environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures.
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- Requirement:*
- 2 The center shall remotely control environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.
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- Requirement:*
- 3 The center shall remotely control environmental sensors on-board maintenance and construction vehicles that measure road and weather conditions including air and surface temperatures, wind speed, humidity, precipitation, visibility and other measures.
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- Requirement:*
- 4 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services), data from traffic, emergency, and transit management, traveler information providers, and environmental data collected from sensors deployed on and about the roadway as well as the fleet of maintenance and construction vehicles.
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- Requirement:*
- 5 The center shall provide weather and road condition information to weather service providers and center personnel.
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- Requirement:*
- 6 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.
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- Requirement:*
- 7 The center shall collect operational status for the roadside and vehicle-based environmental sensor equipment.
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- Requirement:*
- 8 The center shall collect fault data for the roadside and vehicle-based environmental sensor equipment for repair.

Functional Area: **MCM Environmental Information Processing**

Processes current and forecast weather data, road condition information, local environmental data, and uses internal models to develop specialized detailed forecasts of local weather and surface conditions. Disseminates road weather information to other agencies and centers.

- Requirement:*
- 1 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.
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- Requirement:*
- 2 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services) and local environmental sensor data.

Architecture**Northern New Jersey ITS Architecture****Element: NJTA Parkway Division Maintenance****Entity: Maintenance and Construction Management****Functional Area: MCM Environmental Information Processing**

Processes current and forecast weather data, road condition information, local environmental data, and uses internal models to develop specialized detailed forecasts of local weather and surface conditions. Disseminates road weather information to other agencies and centers.

- Requirement:* 3 The center shall use the various data inputs of environmental sensors and road weather data to develop a view of current and predicted road weather and road conditions.
- Requirement:* 4 The center shall disseminate current and forecasted road weather and road condition information to weather service providers (such as the National Weather Service and value-added sector specific meteorological services) as well as other agencies including traffic, emergency, and transit management, traveler information providers, rail operations centers, media, and other maintenance management centers.
- Requirement:* 5 The center shall provide value-added sector specific meteorological services with information on basic road facility and treatment information that supports forecasts for road conditions.

Functional Area: MCM Incident Management

Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.

- Requirement:* 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.
- Requirement:* 2 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, etc.
- Requirement:* 3 The center shall exchange incident and threat information with emergency management centers as well as traffic management centers; including notification of existence of incident and expected severity, location, time and nature of incident.
- Requirement:* 4 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.
- Requirement:* 5 The center shall respond to requests from emergency management to provide maintenance and construction resources to implement response plans, assist in clean up, verify an incident, etc. This may also involve coordination with traffic management centers and other maintenance centers.
- Requirement:* 6 The center shall exchange road network status assessment information with emergency management and traffic management centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.
- Requirement:* 7 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.
- Requirement:* 8 The center shall receive information indicating the damage sustained by transportation assets, derived from aerial surveillance, field reports, inspections, tests, and analyses to support incident management.

Functional Area: MCM Maintenance Decision Support

Maintenance Decision Support Systems recommend courses of action based on current and forecast environmental and road conditions (filtered and fused for specific time horizons) and additional application specific information. Recommendations and dispatch instructions are generated based on this integrated information.

Architecture**Northern New Jersey ITS Architecture****Element: NJTA Parkway Division Maintenance****Entity: Maintenance and Construction Management****Functional Area: MCM Maintenance Decision Support**

Maintenance Decision Support Systems recommend courses of action based on current and forecast environmental and road conditions (filtered and fused for specific time horizons) and additional application specific information. Recommendations and dispatch instructions are generated based on this integrated information.

- Requirement:* 1 The center shall provide the center personnel with tailored external information, including weather or road condition observations, forecasted weather information or road conditions, current usage of treatments and materials, available resources, equipment and vehicle availability, road network information, and source reliability information.
- Requirement:* 2 The center shall tailor the decision support information to include filtering (selection from a large amount of external information), error reduction ('smoothing' the information), fusion (combination of disparate information to match the decision needs), and analysis (creating the decision).
- Requirement:* 3 The center shall provide an interface to the center personnel to input control parameters for the decision support process and receive decisions or information presentation.
- Requirement:* 4 The center shall provide dispatch information to maintenance and construction vehicles based on the outputs of the decision support system, including recommended roadway treatment actions.

Functional Area: MCM Roadway Maintenance and Construction

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

- Requirement:* 1 The center shall maintain an interface with asset management systems to track the inventory, restrictions, repair needs and status updates of transportation assets (pavement, bridges, signs, etc.) including location, installation and materials information, vendor/contractor, current maintenance status, standard height, width, and weight restrictions.
- Requirement:* 2 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other roadway maintenance.
- Requirement:* 3 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
- Requirement:* 4 The center shall provide emergency management and traffic management centers with information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.
- Requirement:* 5 The center shall collect the status and fault data from roadside equipment, such as traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
- Requirement:* 6 The center shall collect the status and fault data from traffic management centers, including data for traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
- Requirement:* 7 The center shall remotely control and collect data from infrastructure monitoring sensors located along the roadway infrastructure or on maintenance and construction vehicles.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Parkway Division Maintenance***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

- Requirement:* 8 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of roadway maintenance and construction activities.
- Requirement:* 9 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of roadway maintenance and construction activities.
- Requirement:* 10 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
- Requirement:* 11 The center shall dispatch and route maintenance and construction vehicle drivers and support them with route- specific environmental, incident, advisory, threat, alert, and traffic congestion information.
- Requirement:* 12 The center shall manage an interface with center personnel to accept vehicle systems control information and remotely control maintenance and construction vehicle on-board equipment.
- Requirement:* 13 The center shall track the status of roadway maintenance and construction activities by monitoring collected data from the dispatched vehicles and equipment.

Functional Area: **MCM Work Zone Management**

Remotely monitors and supports work zone activities, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).

- Requirement:* 1 The center shall generate new work zone activity schedules for use by maintenance and construction vehicles, maintenance and construction operators, and for information coordination purposes.
- Requirement:* 2 The center shall control the collection of work zone status information including video images from cameras located in or near the work zone.
- Requirement:* 3 The center shall disseminate work zone information to other agencies and centers including traffic, transit, emergency management centers, other maintenance centers, traveler information providers, and the media.
- Requirement:* 4 The center shall control traffic in work zones by providing remote control of dynamic message signs and highway advisory radio systems located in or near the work zone.
- Requirement:* 5 The center shall exchange information with administrative systems to support the planning and scheduling of work zone activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.

Functional Area: **MCM Work Activity Coordination**

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

- Requirement:* 1 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

Architecture**Northern New Jersey ITS Architecture***Element:***NJTA Parkway Division Maintenance***Entity:***Maintenance and Construction Management***Functional Area:* **MCM Work Activity Coordination**

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

- Requirement:* 2 The center shall provide status information about scheduled maintenance and construction activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, multimodal transportation providers, rail operations, and the media.
- Requirement:* 3 The center shall collect and respond to feedback concerning scheduled maintenance and construction activities with other management centers such as traffic, emergency, transit, and rail operations.
- Requirement:* 4 The center shall collect and disseminate asset restriction information levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.
- Requirement:* 5 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance and construction activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
- Requirement:* 6 The center shall exchange rail schedules and work plans with rail operations centers.

*Element:***NJTA Parkway Division TOC***Entity:***Emergency Management***Functional Area:* **Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

- Requirement:* 1 The center shall support the interface to the Emergency Telecommunications System (e.g. 911 or 7-digit call routing) to receive emergency notification information and provide it to the emergency system operator.
- Requirement:* 2 The center shall receive emergency call information from 911 services and present the possible incident information to the emergency system operator.
- Requirement:* 3 The center shall receive emergency call information from motorist call-boxes and present the possible incident information to the emergency system operator.
- Requirement:* 4 The center shall receive emergency call information from mayday service providers and present the possible incident information to the emergency system operator.
- Requirement:* 5 The center shall receive emergency notification information from other public safety agencies and present the possible incident information to the emergency system operator.
- Requirement:* 6 The center shall receive emergency notification information from public transit systems and present the possible incident information to the emergency system operator.
- Requirement:* 7 The center shall receive emergency notification information from commercial vehicles, commercial vehicle check stations, or commercial fleet operators and present the possible incident information to the emergency system operator. This may include detection of non-permitted transport of security sensitive hazmat, hazardous cargo spills, etc.
- Requirement:* 8 The center shall receive details of the cargo being carried by commercial vehicles from their commercial fleet manager for incidents involving potential hazardous materials.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Parkway Division TOC***Entity:* **Emergency Management***Functional Area:* **Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

- Requirement:* 9 The center shall coordinate, correlate, and verify all emergency inputs, including those identified based on external calls and internal analysis of security sensor and surveillance data, and assign each a level of confidence.
- Requirement:* 10 The center shall send a request for remote control of CCTV systems from a traffic management center in order to verify the reported incident.
- Requirement:* 11 The center shall update the incident information log once the emergency system operator has verified the incident.
- Requirement:* 12 The center shall provide the capability for digitized map data to act as the background to the emergency information presented to the emergency system operator.
- Requirement:* 13 The center shall forward the verified emergency information to the responding agency based on the location and nature of the emergency.

Functional Area: **Emergency Dispatch**

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

- Requirement:* 1 The center shall dispatch emergency vehicles to respond to verified emergencies and provide suggested routing under center personnel control.
- Requirement:* 2 The center shall store the current status of all emergency vehicles available for dispatch and those that have been dispatched.
- Requirement:* 3 The center shall relay location and incident details to the responding vehicles.
- Requirement:* 4 The center shall provide the capability to request traffic control measures from traffic management centers such as signal preemption, traffic barriers and road closures.
- Requirement:* 5 The center shall track the location and status of emergency vehicles responding to an emergency and update the incident status based on information from the emergency vehicle.
- Requirement:* 6 The center shall receive status information from care facilities to determine the appropriate facility and its location.
- Requirement:* 7 The center shall store and maintain the emergency service responses in an action log.
- Requirement:* 8 The center shall receive asset restriction information from maintenance centers to support the dispatching of appropriate emergency resources.
- Requirement:* 9 The center shall receive traffic information, including closures, traffic conditions, etc. from traffic management centers.
- Requirement:* 10 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.
- Requirement:* 11 The center shall receive road network conditions and traffic images to support dispatch of emergency vehicles.
- Requirement:* 12 The center shall coordinate response to incidents with other Emergency Management centers to ensure appropriate resources are dispatched and utilized.

Functional Area: **Emergency Early Warning System**

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Parkway Division TOC***Entity:* **Emergency Management***Functional Area:* **Emergency Early Warning System**

Monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies in order to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to other ITS centers to notify the traveling public. Includes support for Child Abduction notices.

- Requirement:* 1 The center shall monitor information from Alerting and Advisory Systems such as the Information Sharing and Analysis Centers (ISACs), the National Infrastructure Protection Center (NIPC), the Homeland Security Advisory System (HSAS), etc. The information may include assessments (general incident and vulnerability awareness information), advisories (identification of threats or recommendations to increase preparedness levels), or alerts (information on imminent or in-progress emergencies).
- Requirement:* 2 The center shall provide the capability to correlate alerts and advisories, incident information, and security sensor and surveillance data.
- Requirement:* 3 The center shall broadcast wide-area alerts and advisories to traffic management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 4 The center shall broadcast wide-area alerts and advisories to transit management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 5 The center shall broadcast wide-area alerts and advisories to toll administration centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 6 The center shall broadcast wide-area alerts and advisories to traveler information service providers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 7 The center shall broadcast wide-area alerts and advisories to maintenance centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 8 The center shall broadcast wide-area alerts and advisories to other emergency management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 9 The center shall process status information from each of the centers that have been sent the wide-area alert.
- Requirement:* 10 The center shall coordinate the broadcast of wide-area alerts and advisories with other emergency management centers.
- Requirement:* 11 The center shall receive incident information from other transportation management centers to support the early warning system.
- Requirement:* 12 The center shall present the alert and advisory information and the status of the actions taken in response to the alert by the other centers to the emergency system operator as received from other system inputs.
- Requirement:* 13 The center shall support the entry of alert and advisory information directly from the emergency system operator.

Functional Area: **Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

- Requirement:* 1 The center shall provide strategic emergency response capabilities such as that of an Emergency Operations Center for large-scale incidents and disasters.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Parkway Division TOC***Entity:* **Emergency Management***Functional Area:* **Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

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| <i>Requirement:</i> | 2 | The center shall manage coordinated inter-agency responses to and recovery from large-scale emergencies. Such agencies include traffic management, transit, maintenance and construction management, rail operations, and other emergency management agencies. |
| <i>Requirement:</i> | 3 | The center shall provide the capability to implement response plans and track progress through the incident by exchanging incident information and distributing response status to allied agencies. |
| <i>Requirement:</i> | 4 | The center shall develop, coordinate with other agencies, and store emergency response plans. |
| <i>Requirement:</i> | 5 | The center shall track the availability of resources (including vehicles, roadway cleanup?, etc.), request additional resources from traffic, maintenance, or other emergency centers if needed. |
| <i>Requirement:</i> | 6 | The center shall allocate the appropriate emergency services, resources, and vehicle (s) to respond to incidents, and shall provide the capability to override the current allocation to suit the special needs of a current incident. |
| <i>Requirement:</i> | 7 | The center shall receive event scheduling information from Event Promoters. |
| <i>Requirement:</i> | 8 | The center shall receive hazardous materials incident information from commercial fleet operators. |
| <i>Requirement:</i> | 9 | The center shall provide the capability to request the safe disabling of a commercial vehicle during a hazardous materials incident. |
| <i>Requirement:</i> | 10 | The center shall provide the capability to request transit resource availability from transit centers for use during disaster and evacuation operations. |
| <i>Requirement:</i> | 11 | The center shall assimilate the status of the transit, traffic, rail, maintenance, and other emergency center services and systems to create an overall transportation system status, and disseminate to each of these centers and the traveling public via traveler information providers. |
| <i>Requirement:</i> | 12 | The center shall provide information to the media concerning the status of an emergency response. |
| <i>Requirement:</i> | 13 | The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator. |
| <i>Requirement:</i> | 14 | The center shall provide the capability for center personnel to provide inputs to the management of incidents, disasters and evacuations. |

Functional Area: **Incident Command**

Tactical decision support, resource coordination, and communications integration among emergency management agencies for Incident Commands that are established by first responders to support local management of an incident.

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| <i>Requirement:</i> | 1 | The center shall provide tactical decision support, resource coordination, and communications integration for Incident Commands that are established by first responders to support local management of an incident. |
| <i>Requirement:</i> | 2 | The center shall provide incident command communications with public safety, emergency management, transportation, and other allied response agency centers. |
| <i>Requirement:</i> | 3 | The center shall track and maintain resource information and action plans pertaining to the incident command. |
| <i>Requirement:</i> | 4 | The center shall share incident command information with other public safety agencies including resource deployment status, hazardous material information, rail incident information, evacuation advice as well as traffic, road, and weather conditions. |
| <i>Requirement:</i> | 5 | The center shall assess the status of responding emergency vehicles as part of an incident command. |

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Parkway Division TOC***Entity:* **Emergency Management***Functional Area:* **Emergency Evacuation Support**

Evacuation planning and coordination to manage evacuation and reentry of a population in the vicinity of a disaster or other emergency that poses a risk to public safety.

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| <i>Requirement:</i> | 1 The center shall manage inter-agency coordination of evacuation operations, from initial planning through the evacuation process and reentry. |
| <i>Requirement:</i> | 2 The center shall develop and exchange evacuation plans with allied agencies prior to the occurrence of a disaster. |
| <i>Requirement:</i> | 3 The center shall provide an interface to the emergency system operator to enter evacuation plans and procedures and present the operator with other agencies' plans. |
| <i>Requirement:</i> | 4 The center shall coordinate evacuation destinations and shelter needs with shelter providers (e.g., the American Red Cross) in the region. |
| <i>Requirement:</i> | 5 The center shall provide evacuation information to traffic, transit, maintenance and construction, rail operations, and other emergency management centers as needed. |
| <i>Requirement:</i> | 6 The center shall request resources from transit agencies as needed to support the evacuation. |
| <i>Requirement:</i> | 7 The center shall request traffic management agencies to implement special traffic control strategies and to control evacuation traffic, including traffic on local streets and arterials as well as the major evacuation routes. |
| <i>Requirement:</i> | 8 The center shall provide traveler information systems with evacuation guidance including basic information to assist potential evacuees in determining whether evacuation is necessary and when it is safe to return. |
| <i>Requirement:</i> | 9 The center shall monitor the progress or status of the evacuation once it begins and exchange tactical plans, prepared during the incident, with allied agencies. |
| <i>Requirement:</i> | 10 The center shall monitor the progress of the reentry process. |
| <i>Requirement:</i> | 11 The center shall submit evacuation information to toll administration centers along with requests for changes in the toll services or fee collection during an evacuation. |

Functional Area: **Emergency Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and emergency vehicles equipped with environmental sensors; used by the operator to more effectively manage incidents.

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| <i>Requirement:</i> | 1 The center shall collect current and forecast road and weather information from weather service providers (such as the National Weather Service and value-added sector specific meteorological services). |
| <i>Requirement:</i> | 2 The center shall receive environmental probe information from its fleet of emergency vehicles. |
| <i>Requirement:</i> | 3 The center shall collect current road and weather information from roadway maintenance operations. |
| <i>Requirement:</i> | 4 The center shall assimilate current and forecast road conditions and surface weather information to support incident management. |
| <i>Requirement:</i> | 5 The center shall present the current and forecast road and weather information to the emergency system operator. |
| <i>Requirement:</i> | 6 The center shall provide aggregated or processed environmental probe information from its fleet of emergency vehicles to traffic management and maintenance centers. |

Functional Area: **Center Secure Area Surveillance**

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Parkway Division TOC***Entity:* **Emergency Management***Functional Area:* **Center Secure Area Surveillance**

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 1 The center shall remotely monitor video images and audio surveillance data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The data may be raw or pre-processed in the field.
- Requirement:* 2 The center shall remotely monitor video images and audio surveillance data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The data may be raw or pre-processed in the field.
- Requirement:* 3 The center shall remotely monitor video images and audio surveillance data collected on-board transit vehicles. The data may be raw or pre-processed in the field.
- Requirement:* 4 The center shall exchange surveillance data with other emergency centers.
- Requirement:* 5 The center shall identify potential security threats based on collected security surveillance data.
- Requirement:* 6 The center shall verify potential security threats by correlating security surveillance data from multiple sources.
- Requirement:* 7 The center shall remotely control security surveillance devices in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways).
- Requirement:* 8 The center shall remotely control security surveillance devices in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers).
- Requirement:* 9 The center shall remotely control security surveillance devices on-board transit vehicles.
- Requirement:* 10 The center shall match traveler video images against a database from the Alerting and Advisory Systems of known images that may represent criminals and terrorists.
- Requirement:* 11 The center shall exchange traveler images with other emergency management centers to support traveler image matching.
- Requirement:* 12 The center shall respond to control data from center personnel regarding security surveillance data collection, processing, threat detection, and image matching.

Functional Area: **Center Secure Area Sensor Management**

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 1 The center shall remotely monitor and control security sensor data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), infrastructure condition and integrity, intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Parkway Division TOC***Entity:* **Emergency Management***Functional Area:* **Center Secure Area Sensor Management**

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 2 The center shall remotely monitor and control security sensor data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 3 The center shall remotely monitor and control security sensor data collected on-board transit vehicles. The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors) and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 4 The center shall exchange security sensor data with other emergency centers.
- Requirement:* 5 The center shall identify potential security threats based on collected security sensor data.
- Requirement:* 6 The center shall verify potential security threats by correlating security sensor data from multiple sources.
- Requirement:* 7 The center shall perform threat analysis based on correlations of security sensor and surveillance data.
- Requirement:* 8 The center shall exchange threat analysis data with Alerting and Advisory Systems and use that data in local threat analysis processing.
- Requirement:* 9 The center shall disseminate threat information to other agencies, including traffic, transit, maintenance, rail operations, and other emergency management centers.
- Requirement:* 10 The center shall respond to control data from center personnel regarding security sensor data collection, processing, threat detection, and threat analysis.

Functional Area: **Service Patrol Management**

Dispatch and communication with roadway service patrol vehicles that monitor roads to aid motorists, offering rapid response to minor incidents.

- Requirement:* 1 The center shall dispatch roadway service patrol vehicles to identified incident locations.
- Requirement:* 2 The center shall store the current status of all service patrol vehicles available for dispatch and those that have been dispatched.
- Requirement:* 3 The center shall share incident information collected by the service patrol with traffic, maintenance and construction, and traveler information centers for incident management, incident notification to travelers, and incident cleanup.
- Requirement:* 4 The center shall track the location and status of service patrol vehicles.

Functional Area: **Emergency Data Collection**

Collection and storage of information related to Emergency Management. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect emergency service data, emergency vehicle management data, emergency vehicle data, sensor and surveillance data, threat data, and incident data.
- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Parkway Division TOC***Entity:* **Emergency Management***Functional Area:* **Emergency Data Collection**

Collection and storage of information related to Emergency Management. For use by operations personnel or data archives in the region.

Requirement: 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the emergency management data or for the data itself.

Requirement: 4 The center shall be able to produce sample products of the data available.

Entity: **Maintenance and Construction Management***Functional Area:* **MCM Environmental Information Collection**

Remotely controls environmental sensors and assimilates collected data with other current and forecast road conditions and surface weather information from weather service providers and transportation operations.

Requirement: 1 The center shall remotely control environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures.

Requirement: 2 The center shall remotely control environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.

Requirement: 3 The center shall remotely control environmental sensors on-board maintenance and construction vehicles that measure road and weather conditions including air and surface temperatures, wind speed, humidity, precipitation, visibility and other measures.

Requirement: 4 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services), data from traffic, emergency, and transit management, traveler information providers, and environmental data collected from sensors deployed on and about the roadway as well as the fleet of maintenance and construction vehicles.

Requirement: 5 The center shall provide weather and road condition information to weather service providers and center personnel.

Requirement: 6 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.

Requirement: 7 The center shall collect operational status for the roadside and vehicle-based environmental sensor equipment.

Requirement: 8 The center shall collect fault data for the roadside and vehicle-based environmental sensor equipment for repair.

Functional Area: **MCM Environmental Information Processing**

Processes current and forecast weather data, road condition information, local environmental data, and uses internal models to develop specialized detailed forecasts of local weather and surface conditions. Disseminates road weather information to other agencies and centers.

Requirement: 1 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.

Requirement: 2 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services) and local environmental sensor data.

Requirement: 3 The center shall use the various data inputs of environmental sensors and road weather data to develop a view of current and predicted road weather and road conditions.

Architecture

Northern New Jersey ITS Architecture

Element: **NJTA Parkway Division TOC**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Environmental Information Processing**

Processes current and forecast weather data, road condition information, local environmental data, and uses internal models to develop specialized detailed forecasts of local weather and surface conditions. Disseminates road weather information to other agencies and centers.

Requirement: 4 The center shall disseminate current and forecasted road weather and road condition information to weather service providers (such as the National Weather Service and value-added sector specific meteorological services) as well as other agencies including traffic, emergency, and transit management, traveler information providers, rail operations centers, media, and other maintenance management centers.

Requirement: 5 The center shall provide value-added sector specific meteorological services with information on basic road facility and treatment information that supports forecasts for road conditions.

Functional Area: **MCM Incident Management**

Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.

Requirement: 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.

Requirement: 2 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, etc.

Requirement: 3 The center shall exchange incident and threat information with emergency management centers as well as traffic management centers; including notification of existence of incident and expected severity, location, time and nature of incident.

Requirement: 4 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.

Requirement: 5 The center shall respond to requests from emergency management to provide maintenance and construction resources to implement response plans, assist in clean up, verify an incident, etc. This may also involve coordination with traffic management centers and other maintenance centers.

Requirement: 6 The center shall exchange road network status assessment information with emergency management and traffic management centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.

Requirement: 7 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

Requirement: 8 The center shall receive information indicating the damage sustained by transportation assets, derived from aerial surveillance, field reports, inspections, tests, and analyses to support incident management.

Functional Area: **MCM Maintenance Decision Support**

Maintenance Decision Support Systems recommend courses of action based on current and forecast environmental and road conditions (filtered and fused for specific time horizons) and additional application specific information. Recommendations and dispatch instructions are generated based on this integrated information.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Parkway Division TOC***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Maintenance Decision Support**

Maintenance Decision Support Systems recommend courses of action based on current and forecast environmental and road conditions (filtered and fused for specific time horizons) and additional application specific information. Recommendations and dispatch instructions are generated based on this integrated information.

- Requirement:* 1 The center shall provide the center personnel with tailored external information, including weather or road condition observations, forecasted weather information or road conditions, current usage of treatments and materials, available resources, equipment and vehicle availability, road network information, and source reliability information.
- Requirement:* 2 The center shall tailor the decision support information to include filtering (selection from a large amount of external information), error reduction ('smoothing' the information), fusion (combination of disparate information to match the decision needs), and analysis (creating the decision).
- Requirement:* 3 The center shall provide an interface to the center personnel to input control parameters for the decision support process and receive decisions or information presentation.
- Requirement:* 4 The center shall provide dispatch information to maintenance and construction vehicles based on the outputs of the decision support system, including recommended roadway treatment actions.

Functional Area: **MCM Winter Maintenance Management**

Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.

- Requirement:* 1 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other winter roadway maintenance.
- Requirement:* 2 The center shall exchange information with administrative systems to support the planning and scheduling of winter maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
- Requirement:* 3 The center shall provide status information about scheduled winter maintenance activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, and the media.
- Requirement:* 4 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of winter maintenance activities.
- Requirement:* 5 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of winter maintenance activities.
- Requirement:* 6 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
- Requirement:* 7 The center shall dispatch and route winter maintenance vehicle drivers and support them with route-specific environmental, incident, advisory, threat, alert, and traffic congestion information.
- Requirement:* 8 The center shall determine the need for roadway treatment based on current and forecasted weather information, current usage of treatments and materials, available resources, requests for action from other agencies, and recommendations from the Maintenance Decision Support system, specifically under winter conditions. This supports winter maintenance such as plowing, treating, anti-icing, etc.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Parkway Division TOC***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Winter Maintenance Management**

Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.

- Requirement:* 9 The center shall provide dispatch instructions for vehicle operators based on input parameters from center personnel, specifically for winter conditions. This could include a treatment route, treatment application rates, start and end times, and other treatment instructions.
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- Requirement:* 10 The center shall support remote control of on-board maintenance and construction vehicle systems and field equipment that is remotely controlled by the vehicle such as adjusting material application rates and spread patterns.
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- Requirement:* 11 The center shall assess the current status of all winter maintenance activities, including actual work activities performed, current locations and operational conditions of vehicles, materials and equipment inventories, field equipment status, environmental information, etc.

Functional Area: **MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

- Requirement:* 1 The center shall maintain an interface with asset management systems to track the inventory, restrictions, repair needs and status updates of transportation assets (pavement, bridges, signs, etc.) including location, installation and materials information, vendor/contractor, current maintenance status, standard height, width, and weight restrictions.
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- Requirement:* 2 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other roadway maintenance.
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- Requirement:* 3 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
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- Requirement:* 4 The center shall provide emergency management and traffic management centers with information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.
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- Requirement:* 5 The center shall collect the status and fault data from roadside equipment, such as traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
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- Requirement:* 6 The center shall collect the status and fault data from traffic management centers, including data for traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
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- Requirement:* 7 The center shall remotely control and collect data from infrastructure monitoring sensors located along the roadway infrastructure or on maintenance and construction vehicles.
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- Requirement:* 8 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of roadway maintenance and construction activities.
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- Requirement:* 9 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of roadway maintenance and construction activities.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Parkway Division TOC***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

- Requirement:* 10 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
- Requirement:* 11 The center shall dispatch and route maintenance and construction vehicle drivers and support them with route- specific environmental, incident, advisory, threat, alert, and traffic congestion information.
- Requirement:* 12 The center shall manage an interface with center personnel to accept vehicle systems control information and remotely control maintenance and construction vehicle on-board equipment.
- Requirement:* 13 The center shall track the status of roadway maintenance and construction activities by monitoring collected data from the dispatched vehicles and equipment.

Functional Area: **MCM Work Zone Management**

Remotely monitors and supports work zone activities, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).

- Requirement:* 1 The center shall generate new work zone activity schedules for use by maintenance and construction vehicles, maintenance and construction operators, and for information coordination purposes.
- Requirement:* 2 The center shall control the collection of work zone status information including video images from cameras located in or near the work zone.
- Requirement:* 3 The center shall disseminate work zone information to other agencies and centers including traffic, transit, emergency management centers, other maintenance centers, traveler information providers, and the media.
- Requirement:* 4 The center shall control traffic in work zones by providing remote control of dynamic message signs and highway advisory radio systems located in or near the work zone.
- Requirement:* 5 The center shall exchange information with administrative systems to support the planning and scheduling of work zone activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.

Functional Area: **MCM Work Activity Coordination**

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

- Requirement:* 1 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.
- Requirement:* 2 The center shall provide status information about scheduled maintenance and construction activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, multimodal transportation providers, rail operations, and the media.
- Requirement:* 3 The center shall collect and respond to feedback concerning scheduled maintenance and construction activities with other management centers such as traffic, emergency, transit, and rail operations.

Architecture

Northern New Jersey ITS Architecture

Element: **NJTA Parkway Division TOC**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Work Activity Coordination**

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

Requirement: 4 The center shall collect and disseminate asset restriction information levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.

Requirement: 5 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance and construction activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.

Requirement: 6 The center shall exchange rail schedules and work plans with rail operations centers.

Functional Area: **MCM Data Collection**

Collection and storage of maintenance and construction information. For use by operations personnel or data archives in the region.

Requirement: 1 The center shall collect maintenance and construction data (such as field equipment status, infrastructure status, maintenance and construction activity data) gathered from roadway, traffic, and other maintenance and construction sources.

Requirement: 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

Requirement: 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the maintenance and construction data or for the data itself.

Requirement: 4 The center shall be able to produce sample products of the data available.

Requirement: 5 The center shall provide data to Asset Management to be used in updating the status of assets in the inventory.

Entity: **Traffic Management**

Functional Area: **Collect Traffic Surveillance**

Management of traffic sensors and surveillance (CCTV) equipment, and distribution of the collected information to other centers and operators.

Requirement: 1 The center shall monitor, analyze, and store traffic sensor data (speed, volume, occupancy) collected from field elements under remote control of the center.

Requirement: 2 The center shall monitor, analyze, and distribute traffic images from CCTV systems under remote control of the center.

Requirement: 3 The center shall monitor, analyze, and store pedestrian sensor data collected from field elements under remote control of the center.

Requirement: 4 The center shall monitor, analyze, and distribute pedestrian images from CCTV systems under remote control of the center.

Requirement: 5 The center shall monitor, analyze, and store multimodal crossing and high occupancy vehicle (HOV) lane sensor data under remote control of the center.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Parkway Division TOC***Entity:* **Traffic Management***Functional Area:* **Collect Traffic Surveillance**

Management of traffic sensors and surveillance (CCTV) equipment, and distribution of the collected information to other centers and operators.

- Requirement:* 6 The center shall maintain a database of surveillance and sensors and the freeways, surface street and rural roadways, e.g. where they are located, to which part(s) of the network their data applies, the type of data, and the ownership of each link (that is, the agency or entity responsible for collecting and storing surveillance of the link) in the network.
- Requirement:* 7 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic data.
- Requirement:* 8 The center shall distribute road network conditions data (raw or processed) based on collected and analyzed traffic sensor and surveillance data to other centers.
- Requirement:* 9 The center shall respond to control data from center personnel regarding sensor and surveillance data collection, analysis, storage, and distribution.

Functional Area: **TMC Probe Information Collection**

Collects, assimilates, and disseminates vehicle probe data collected from roadside beacons and centers controlling transit vehicles, emergency vehicles, toll collection points, and route-guided vehicles.

- Requirement:* 1 The center shall collect probe data including traffic and road conditions from vehicles via roadside beacon field elements; the data may be aggregated and initial link time calculations performed in the field.
- Requirement:* 2 The center shall collect road condition data from probe-equipped transit vehicles via transit management centers; the data may be aggregated and preliminarily processed at the sending center.
- Requirement:* 3 The center shall collect traffic data from probe-equipped emergency vehicles via emergency management centers; the data may be aggregated and initial link time calculations performed at the sending center.
- Requirement:* 4 The center shall collect traffic data from traveler information centers based on data from their subscriber vehicles; the data may be aggregated and initial link time calculations performed at the sending center.
- Requirement:* 5 The center shall collect traffic data from toll administrative centers containing journey times between toll collection points for those vehicles equipped for electronic toll collection; the data may be aggregated and processed at the sending center.
- Requirement:* 6 The center shall assimilate current and forecast traffic and road conditions based on collected probe data and distribute to other centers for dissemination to travelers.
- Requirement:* 7 The center shall collect operational status for the roadside probe data collection equipment.
- Requirement:* 8 The center shall collect fault data for the roadside probe data collection equipment for repair.

Functional Area: **TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

- Requirement:* 1 The center shall remotely control traffic signal controllers.
- Requirement:* 2 The center shall accept notifications of right-of-way requests from pedestrians.
- Requirement:* 3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center.
- Requirement:* 4 The center shall collect traffic signal controller fault data from the field.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Parkway Division TOC***Entity:* **Traffic Management***Functional Area:* **TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

- Requirement:* 5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.

Functional Area: **TMC Freeway Management**

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

- Requirement:* 1 The center shall remotely control systems to manage use of the freeways, including ramp meters, mainline metering, and lane controls.

- Requirement:* 2 The center shall collect operational status from ramp meters, mainline metering, and lane controls and compare against the control information sent by the center.

- Requirement:* 3 The center shall collect fault data from ramp meters, mainline metering, and lane controls.

- Requirement:* 4 The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, mainline metering, and lane controls), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the ramps themselves.

Functional Area: **TMC HOV Lane Management**

Remotely controls high-occupancy vehicle (HOV) lane sensors, driver information systems, and ramp meters to manage use of HOV or High Occupancy Toll (HOT) lanes; also detects HOV violators and notifies enforcement agencies.

- Requirement:* 1 The center shall remotely control sensors to detect high-occupancy vehicle (HOV) lane usage.

- Requirement:* 2 The center shall remotely control driver information systems to notify users of lane status for lanes that become HOV or High Occupancy Toll (HOT) lanes during certain times of the day on freeways.

- Requirement:* 3 The center shall remotely control freeway control devices, such as ramp signals and mainline metering and other systems associated with freeway operations that control use of HOV lanes.

- Requirement:* 4 The center shall collect traffic flow measures and information regarding vehicle occupancy (i.e., lane usage) in HOV lanes.

- Requirement:* 5 The center shall monitor the use of HOV lanes and detect vehicles that do not have the required number of occupants.

- Requirement:* 6 The center shall collect operational status for the freeway control devices associated with HOV lane control.

- Requirement:* 7 The center shall collect fault data for the freeway control devices associated with HOV lane control for repair.

- Requirement:* 8 The center shall store violation parameters, detect HOV lane violators, obtain the vehicle registration data from the appropriate State Department of Motor Vehicles (DMV) office, and then provide the capability to send violation information to a law enforcement agency.

Functional Area: **TMC Traffic Information Dissemination**

Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.

- Requirement:* 1 The center shall remotely control dynamic messages signs for dissemination of traffic and other information to drivers.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Parkway Division TOC***Entity:* **Traffic Management***Functional Area:* **TMC Traffic Information Dissemination**

Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.

- Requirement:* 2 The center shall remotely control driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers.
- Requirement:* 3 The center shall collect operational status for the driver information systems equipment (DMS, HAR, etc.).
- Requirement:* 4 The center shall collect fault data for the driver information systems equipment (DMS, HAR, etc.) for repair.
- Requirement:* 5 The center shall retrieve locally stored traffic information, including current and forecasted traffic information, road and weather conditions, traffic incident information, information on diversions and alternate routes, closures, and special traffic restrictions (lane/shoulder use, weight restrictions, width restrictions, HOV requirements), etc.
- Requirement:* 6 The center shall distribute traffic data to maintenance and construction centers, transit centers, emergency management centers, and traveler information providers.
- Requirement:* 7 The center shall distribute traffic data to the media upon request; the capability to provide the information in both data stream and graphical display shall be supported.
- Requirement:* 8 The center shall provide the capability for center personnel to control the nature of the data that is available to non-traffic operations centers and the media.

Functional Area: **TMC Regional Traffic Control**

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

- Requirement:* 1 The center shall exchange traffic information with other traffic management centers, includes incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.
- Requirement:* 2 The center shall exchange traffic control information with other traffic management centers, includes remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).

Functional Area: **TMC Incident Detection**

Remotely controls traffic and video sensors to support incident detection and verification; exchange information with other agencies including emergency management, maintenance and construction, alerting and advisory systems, event promoters, intermodal freight depots, and traveler information systems.

- Requirement:* 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.
- Requirement:* 2 The center shall collect and store traffic flow and image data from the field equipment to detect and verify incidents.
- Requirement:* 3 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, and intermodal freight depots.
- Requirement:* 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Parkway Division TOC***Entity:* **Traffic Management***Functional Area:* **TMC Incident Detection**

Remotely controls traffic and video sensors to support incident detection and verification; exchange information with other agencies including emergency management, maintenance and construction, alerting and advisory systems, event promoters, intermodal freight depots, and traveler information systems.

Requirement: 5 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field.

Requirement: 6 The center shall provide road network conditions and traffic images to emergency management centers to support the detection, verification, and classification of incidents.

Requirement: 7 The center shall provide video and traffic sensor control commands to the field equipment to detect and verify incidents.

Functional Area: **TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

Requirement: 1 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction for distribution to the public. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, and information and instructions necessary for the public to respond to the alert. This may also identify specific information that should not be released to the public.

Requirement: 2 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.

Requirement: 3 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field, provide special routing for emergency vehicles, and to provide responding emergency vehicles with signal preemption.

Requirement: 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.

Requirement: 5 The center shall respond to requests from emergency management to provide traffic management resources to implement special traffic control measures, assist in clean up, verify an incident, etc. This may also involve coordination with maintenance centers.

Requirement: 6 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, media, and rail operations centers.

Requirement: 7 The center shall provide road network conditions and traffic images to emergency management centers, maintenance and construction centers, and traveler information service providers.

Requirement: 8 The center shall exchange road network status assessment information with emergency management and maintenance centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.

Requirement: 9 The center shall coordinate information and controls with other traffic management centers.

Requirement: 10 The center shall receive inputs from emergency management and transit management centers to develop an overall status of the transportation system including emergency transit schedules in effect and current status and condition of the transportation infrastructure.

Architecture

Northern New Jersey ITS Architecture

Element: **NJTA Parkway Division TOC**

Entity: **Traffic Management**

Functional Area: **TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

- Requirement:* 11 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic incident management.
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Functional Area: **TMC Evacuation Support**

Development, coordination, and execution of special traffic management strategies during evacuation and subsequent reentry of a population in the vicinity of a disaster or major emergency. Interfaces with emergency management and other traffic management centers.

- Requirement:* 1 The center shall coordinate planning for evacuation with emergency management centers - including pre-planning activities such as establishing routes, areas to be evacuated, timing, etc.
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- Requirement:* 2 The center shall support requests from emergency management centers to preempt the current traffic control strategy, activate traffic control and closure systems such as gates and barriers, activate safeguard systems, or use driver information systems to support evacuation traffic control plans.
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- Requirement:* 3 The center shall coordinate information and controls with other traffic management centers.
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- Requirement:* 4 The center shall coordinate execution of evacuation strategies with emergency management centers - including activities such as setting closures and detours, establishing routes, updating areas to be evacuated, timing the process, etc.
-

Functional Area: **TMC Environmental Monitoring**

Management of environmental sensors and assimilation of collected data with other current and forecast road conditions and surface weather information from weather service providers and roadway maintenance operations.

- Requirement:* 1 The center shall remotely control environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures.
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- Requirement:* 2 The center shall remotely control environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.
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- Requirement:* 3 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services), data from roadway maintenance operations, and environmental data collected from sensors deployed on and about the roadway.
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- Requirement:* 4 The center shall provide weather and road condition information to weather service providers and center personnel.
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- Requirement:* 5 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.
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Functional Area: **Barrier System Management**

Remotely controls barrier systems such as gates and other systems that manage entry to roadways, transportation facilities and infrastructure.

- Requirement:* 1 The center shall remotely control barrier systems for transportation facilities and infrastructure. Barrier systems include automated or remotely controlled gates, barriers and other systems that manage entry to roadways.
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- Requirement:* 2 The center shall collect barrier system operational status.
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- Requirement:* 3 The center shall collect barrier system fault data and send to the maintenance center for repair.
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Architecture

Northern New Jersey ITS Architecture

Element: **NJTA Parkway Division TOC**

Entity: **Traffic Management**

Functional Area: **Barrier System Management**

Remotely controls barrier systems such as gates and other systems that manage entry to roadways, transportation facilities and infrastructure.

- Requirement:* 4 The center shall accept requests for barrier system activation from other centers and from center personnel to support emergency response and detours.
-

Functional Area: **Safeguard System Management**

Remotely controls safeguard systems such as blast shields and tunnel exhaust systems that are used to mitigate the impact of incidents on transportation infrastructure.

- Requirement:* 1 The center shall remotely control safeguard systems, equipment used to mitigate the impact of incidents on transportation infrastructure (e.g., blast shields, tunnel exhaust systems, etc.)
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- Requirement:* 2 The center shall collect safeguard system operational status.
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- Requirement:* 3 The center shall collect safeguard system fault data and send to the maintenance center for repair.
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- Requirement:* 4 The center shall accept requests for safeguard system activation from other centers and from center personnel to support emergency response.
-

Functional Area: **Traffic Maintenance**

Monitoring and remote diagnostics of field equipment - detect failures, issue problem reports, and track the repair or replacement of the failed equipment.

- Requirement:* 1 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) operational status.
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- Requirement:* 2 The center shall collect and store CCTV surveillance system (traffic, pedestrian) operational status.
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- Requirement:* 3 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) fault data and send to the maintenance center for repair.
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- Requirement:* 4 The center shall collect and store CCTV surveillance system (traffic, pedestrian) fault data send to the maintenance center for repair.
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- Requirement:* 5 The center shall collect environmental sensor operational status.
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- Requirement:* 6 The center shall collect environmental sensor equipment fault data and send to the maintenance center for repair.
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- Requirement:* 7 The center shall exchange data with maintenance centers concerning the reporting of faulty equipment and the schedule/status of their repair. Information exchanged includes details of new equipment faults, and clearances when the faults are cleared.
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- Requirement:* 8 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic maintenance data.
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Functional Area: **TMC Work Zone Traffic Management**

Coordination with maintenance systems using work zone images and traveler information systems (such as DMS), and distribution of work plans so that work zones are established that have minimum traffic impact.

- Requirement:* 1 The center shall receive work zone images from a maintenance center.
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- Requirement:* 2 The center shall analyze work zone images for indications of a possible incident.
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- Requirement:* 3 The center shall remotely control driver information systems (such as dynamic messages signs, highway advisory radios) to advise drivers of activity around a work zone.
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- Requirement:* 4 The center shall collect operational status for the driver information systems equipment in work zones.
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- Requirement:* 5 The center shall collect fault data for the driver information systems equipment in work zones for repair.
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Architecture

Northern New Jersey ITS Architecture

Element: **NJTA Parkway Division TOC**

Entity: **Traffic Management**

Functional Area: **TMC Work Zone Traffic Management**

Coordination with maintenance systems using work zone images and traveler information systems (such as DMS), and distribution of work plans so that work zones are established that have minimum traffic impact.

- Requirement:* 6 The center shall receive proposed maintenance and construction work plans, analyze the activity as a possible incident, and provide work plan feedback to the sending center.
-

Functional Area: **TMC Input to In-Vehicle Signing**

Formats and outputs information to field equipment that supports in-vehicle signage equipment communications.

- Requirement:* 1 The center shall format and output road condition and environmental information to field equipment that supports in-vehicle signage communications.
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- Requirement:* 2 The center shall format and output advisory information, such as evacuation information, wide-area alerts, incident information, work zone intrusion information, and other special information to field equipment that supports in-vehicle signage communications.
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- Requirement:* 3 The center shall format and output indicator and fixed sign information, such as actual intersection traffic signal states, stop, or yield signs to field equipment that supports in-vehicle signage communications.
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- Requirement:* 4 The center shall receive system operational status from field equipment that supports in-vehicle signage communications.
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- Requirement:* 5 The center shall receive system fault data from field equipment that supports in-vehicle signage communications.
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Functional Area: **Traffic Data Collection**

Collection and storage of traffic management data. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect traffic management data such as operational data, event logs, etc.
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- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.
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- Requirement:* 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the traffic data or for the data itself.
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- Requirement:* 4 The center shall be able to produce sample products of the data available.
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Element: **NJTA Turnpike Central System**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Environmental Information Processing**

Processes current and forecast weather data, road condition information, local environmental data, and uses internal models to develop specialized detailed forecasts of local weather and surface conditions. Disseminates road weather information to other agencies and centers.

- Requirement:* 1 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.
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- Requirement:* 2 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services) and local environmental sensor data.
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- Requirement:* 3 The center shall use the various data inputs of environmental sensors and road weather data to develop a view of current and predicted road weather and road conditions.
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Architecture

Northern New Jersey ITS Architecture

Element: **NJTA Turnpike Central System**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Environmental Information Processing**

Processes current and forecast weather data, road condition information, local environmental data, and uses internal models to develop specialized detailed forecasts of local weather and surface conditions. Disseminates road weather information to other agencies and centers.

Requirement: 4 The center shall disseminate current and forecasted road weather and road condition information to weather service providers (such as the National Weather Service and value-added sector specific meteorological services) as well as other agencies including traffic, emergency, and transit management, traveler information providers, rail operations centers, media, and other maintenance management centers.

Requirement: 5 The center shall provide value-added sector specific meteorological services with information on basic road facility and treatment information that supports forecasts for road conditions.

Element: **NJTA Turnpike Maintenance**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Vehicle Tracking**

Remotely tracks the location of maintenance and construction vehicles and other equipment; presented to the center personnel.

Requirement: 1 The center shall monitor the locations of all maintenance and construction vehicles and other equipment under its jurisdiction.

Requirement: 2 The center shall present location data to center personnel for the fleet of maintenance and construction vehicles and other equipment.

Requirement: 3 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for maintenance and construction vehicle tracking.

Functional Area: **MCM Vehicle and Equipment Maintenance Management**

Monitors vehicle and equipment condition, tracks maintenance history, and schedules routine and corrective maintenance.

Requirement: 1 The center shall collect and analyze vehicle diagnostics information from maintenance and construction vehicles. The information includes engine temperature, mileage, tire wear, brake wear, belt wear, and any warnings or alarms concerning the operational condition of the vehicle and ancillary equipment.

Requirement: 2 The center shall exchange information with equipment repair facilities including status and history of repairs concerning maintenance and construction vehicles. This information includes vehicle status and diagnostic information, vehicle utilization, and coordination of when vehicles will be available for preventative and corrective maintenance.

Requirement: 3 The center shall schedule preventive and corrective vehicle maintenance with the equipment repair facility based on fleet health reports, maintenance records, vehicle utilization and vehicle availability schedules.

Functional Area: **MCM Environmental Information Collection**

Remotely controls environmental sensors and assimilates collected data with other current and forecast road conditions and surface weather information from weather service providers and transportation operations.

Requirement: 1 The center shall remotely control environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures.

Requirement: 2 The center shall remotely control environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.

Architecture**Northern New Jersey ITS Architecture***Element:***NJTA Turnpike Maintenance***Entity:***Maintenance and Construction Management***Functional Area:* **MCM Environmental Information Collection**

Remotely controls environmental sensors and assimilates collected data with other current and forecast road conditions and surface weather information from weather service providers and transportation operations.

- Requirement:* 3 The center shall remotely control environmental sensors on-board maintenance and construction vehicles that measure road and weather conditions including air and surface temperatures, wind speed, humidity, precipitation, visibility and other measures.
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- Requirement:* 4 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services), data from traffic, emergency, and transit management, traveler information providers, and environmental data collected from sensors deployed on and about the roadway as well as the fleet of maintenance and construction vehicles.
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- Requirement:* 5 The center shall provide weather and road condition information to weather service providers and center personnel.
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- Requirement:* 6 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.
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- Requirement:* 7 The center shall collect operational status for the roadside and vehicle-based environmental sensor equipment.
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- Requirement:* 8 The center shall collect fault data for the roadside and vehicle-based environmental sensor equipment for repair.

Functional Area: **MCM Environmental Information Processing**

Processes current and forecast weather data, road condition information, local environmental data, and uses internal models to develop specialized detailed forecasts of local weather and surface conditions. Disseminates road weather information to other agencies and centers.

- Requirement:* 1 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.
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- Requirement:* 2 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services) and local environmental sensor data.
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- Requirement:* 3 The center shall use the various data inputs of environmental sensors and road weather data to develop a view of current and predicted road weather and road conditions.
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- Requirement:* 4 The center shall disseminate current and forecasted road weather and road condition information to weather service providers (such as the National Weather Service and value-added sector specific meteorological services) as well as other agencies including traffic, emergency, and transit management, traveler information providers, rail operations centers, media, and other maintenance management centers.
-
- Requirement:* 5 The center shall provide value-added sector specific meteorological services with information on basic road facility and treatment information that supports forecasts for road conditions.

Functional Area: **MCM Incident Management**

Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.

- Requirement:* 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Turnpike Maintenance***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Incident Management**

Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.

- Requirement:* 2 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, etc.
- Requirement:* 3 The center shall exchange incident and threat information with emergency management centers as well as traffic management centers; including notification of existence of incident and expected severity, location, time and nature of incident.
- Requirement:* 4 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.
- Requirement:* 5 The center shall respond to requests from emergency management to provide maintenance and construction resources to implement response plans, assist in clean up, verify an incident, etc. This may also involve coordination with traffic management centers and other maintenance centers.
- Requirement:* 6 The center shall exchange road network status assessment information with emergency management and traffic management centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.
- Requirement:* 7 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.
- Requirement:* 8 The center shall receive information indicating the damage sustained by transportation assets, derived from aerial surveillance, field reports, inspections, tests, and analyses to support incident management.

Functional Area: **MCM Maintenance Decision Support**

Maintenance Decision Support Systems recommend courses of action based on current and forecast environmental and road conditions (filtered and fused for specific time horizons) and additional application specific information. Recommendations and dispatch instructions are generated based on this integrated information.

- Requirement:* 1 The center shall provide the center personnel with tailored external information, including weather or road condition observations, forecasted weather information or road conditions, current usage of treatments and materials, available resources, equipment and vehicle availability, road network information, and source reliability information.
- Requirement:* 2 The center shall tailor the decision support information to include filtering (selection from a large amount of external information), error reduction ('smoothing' the information), fusion (combination of disparate information to match the decision needs), and analysis (creating the decision).
- Requirement:* 3 The center shall provide an interface to the center personnel to input control parameters for the decision support process and receive decisions or information presentation.
- Requirement:* 4 The center shall provide dispatch information to maintenance and construction vehicles based on the outputs of the decision support system, including recommended roadway treatment actions.

Functional Area: **MCM Winter Maintenance Management**

Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.

- Requirement:* 1 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other winter roadway maintenance.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Turnpike Maintenance***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Winter Maintenance Management**

Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.

- Requirement:* 2 The center shall exchange information with administrative systems to support the planning and scheduling of winter maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
- Requirement:* 3 The center shall provide status information about scheduled winter maintenance activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, and the media.
- Requirement:* 4 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of winter maintenance activities.
- Requirement:* 5 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of winter maintenance activities.
- Requirement:* 6 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
- Requirement:* 7 The center shall dispatch and route winter maintenance vehicle drivers and support them with route-specific environmental, incident, advisory, threat, alert, and traffic congestion information.
- Requirement:* 8 The center shall determine the need for roadway treatment based on current and forecasted weather information, current usage of treatments and materials, available resources, requests for action from other agencies, and recommendations from the Maintenance Decision Support system, specifically under winter conditions. This supports winter maintenance such as plowing, treating, anti-icing, etc.
- Requirement:* 9 The center shall provide dispatch instructions for vehicle operators based on input parameters from center personnel, specifically for winter conditions. This could include a treatment route, treatment application rates, start and end times, and other treatment instructions.
- Requirement:* 10 The center shall support remote control of on-board maintenance and construction vehicle systems and field equipment that is remotely controlled by the vehicle such as adjusting material application rates and spread patterns.
- Requirement:* 11 The center shall assess the current status of all winter maintenance activities, including actual work activities performed, current locations and operational conditions of vehicles, materials and equipment inventories, field equipment status, environmental information, etc.

Functional Area: **MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

- Requirement:* 1 The center shall maintain an interface with asset management systems to track the inventory, restrictions, repair needs and status updates of transportation assets (pavement, bridges, signs, etc.) including location, installation and materials information, vendor/contractor, current maintenance status, standard height, width, and weight restrictions.
- Requirement:* 2 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other roadway maintenance.

Architecture

Northern New Jersey ITS Architecture

Element: **NJTA Turnpike Maintenance**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

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| <i>Requirement:</i> | 3 | The center shall exchange information with administrative systems to support the planning and scheduling of maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration. |
| <i>Requirement:</i> | 4 | The center shall provide emergency management and traffic management centers with information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. |
| <i>Requirement:</i> | 5 | The center shall collect the status and fault data from roadside equipment, such as traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs. |
| <i>Requirement:</i> | 6 | The center shall collect the status and fault data from traffic management centers, including data for traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs. |
| <i>Requirement:</i> | 7 | The center shall remotely control and collect data from infrastructure monitoring sensors located along the roadway infrastructure or on maintenance and construction vehicles. |
| <i>Requirement:</i> | 8 | The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of roadway maintenance and construction activities. |
| <i>Requirement:</i> | 9 | The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of roadway maintenance and construction activities. |
| <i>Requirement:</i> | 10 | The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services). |
| <i>Requirement:</i> | 11 | The center shall dispatch and route maintenance and construction vehicle drivers and support them with route- specific environmental, incident, advisory, threat, alert, and traffic congestion information. |
| <i>Requirement:</i> | 12 | The center shall manage an interface with center personnel to accept vehicle systems control information and remotely control maintenance and construction vehicle on-board equipment. |
| <i>Requirement:</i> | 13 | The center shall track the status of roadway maintenance and construction activities by monitoring collected data from the dispatched vehicles and equipment. |

Functional Area: **MCM Work Zone Management**

Remotely monitors and supports work zone activities, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).

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| <i>Requirement:</i> | 1 | The center shall generate new work zone activity schedules for use by maintenance and construction vehicles, maintenance and construction operators, and for information coordination purposes. |
| <i>Requirement:</i> | 2 | The center shall control the collection of work zone status information including video images from cameras located in or near the work zone. |

Architecture

Northern New Jersey ITS Architecture

Element: **NJTA Turnpike Maintenance**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Work Zone Management**

Remotely monitors and supports work zone activities, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).

Requirement: 3 The center shall disseminate work zone information to other agencies and centers including traffic, transit, emergency management centers, other maintenance centers, traveler information providers, and the media.

Requirement: 4 The center shall control traffic in work zones by providing remote control of dynamic message signs and highway advisory radio systems located in or near the work zone.

Requirement: 5 The center shall exchange information with administrative systems to support the planning and scheduling of work zone activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.

Functional Area: **MCM Work Activity Coordination**

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

Requirement: 1 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

Requirement: 2 The center shall provide status information about scheduled maintenance and construction activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, multimodal transportation providers, rail operations, and the media.

Requirement: 3 The center shall collect and respond to feedback concerning scheduled maintenance and construction activities with other management centers such as traffic, emergency, transit, and rail operations.

Requirement: 4 The center shall collect and disseminate asset restriction information levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.

Requirement: 5 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance and construction activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.

Requirement: 6 The center shall exchange rail schedules and work plans with rail operations centers.

Element: **NJTA Turnpike Maintenance Vehicles**

Entity: **Maintenance and Construction Vehicle**

Functional Area: **MCV Vehicle Location Tracking**

On-board systems to track vehicle location and reports the position and timestamp information to the dispatch center.

Requirement: 1 The maintenance and construction vehicle shall compute the location of the vehicle based on inputs from a vehicle location determination function.

Architecture**Northern New Jersey ITS Architecture****Element: NJTA Turnpike Maintenance Vehicles****Entity: Maintenance and Construction Vehicle****Functional Area: MCV Vehicle Location Tracking**

On-board systems to track vehicle location and reports the position and timestamp information to the dispatch center.

- Requirement:* 2 The maintenance and construction vehicle shall send the timestamped vehicle location to the controlling center.

Functional Area: MCV Vehicle System Monitoring and Diagnostics

On-board sensors capable of monitoring the condition of each of the vehicle systems and diagnostics that can be used to support vehicle maintenance.

- Requirement:* 1 The maintenance and construction vehicle shall collect vehicle diagnostics and operating status data from the maintenance vehicle platform including engine temperature, mileage, tire wear, brake wear, belt wear, and other operational status measures as well as the status of maintenance and construction-specific systems on the vehicle.

- Requirement:* 2 The maintenance and construction vehicle shall use the diagnostic and status information to support scheduling vehicle maintenance, monitoring safety status, and informing the vehicle operator of the conditions.

- Requirement:* 3 The maintenance and construction vehicle shall the vehicle diagnostic and safety information to an equipment repair facility.

- Requirement:* 4 The maintenance and construction vehicle shall send the vehicle diagnostic and safety information to the controlling maintenance center.

Functional Area: MCV Winter Maintenance

On-board systems that support snow plow operations and other roadway treatments (e.g., salt spraying and other material applications). Supports platooning of snow plows.

- Requirement:* 1 The maintenance and construction vehicle shall track the location and status of safety systems on-board the vehicle.

- Requirement:* 2 The maintenance and construction vehicle shall respond to control information from the center to allow remote operation of the on-board vehicle systems. These systems include winter maintenance equipment for plowing, treating, and anti-icing.

- Requirement:* 3 The maintenance and construction vehicle shall monitor materials information including remaining quantity and current application rate of materials on the vehicle.

- Requirement:* 4 The maintenance and construction vehicle shall respond to dispatch information from the center, presented to the vehicle operator for acknowledgement and returning status.

- Requirement:* 5 The maintenance and construction vehicle shall send operational data to the center including the operational state of the maintenance equipment (e.g., blade up/down, spreader pattern), types and quantities of materials used for construction and maintenance activities, and a record of the actual work performed.

- Requirement:* 6 The maintenance and construction vehicle shall exchange operational and environmental data with other maintenance and construction vehicles. Operational data includes operational state of the maintenance equipment (e.g., blade up/down, spreader pattern, equipment configuration) and a record of the actual work performed while the environmental data includes environmental sensor data collected on-board a maintenance and construction vehicle, either raw or processed data.

Functional Area: MCV Infrastructure Monitoring

On-board systems to monitor the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts). Includes vehicle-based sensors and communications with roadway-based infrastructure monitoring sensors.

Architecture

Northern New Jersey ITS Architecture

Element: **NJTA Turnpike Maintenance Vehicles**

Entity: **Maintenance and Construction Vehicle**

Functional Area: **MCV Infrastructure Monitoring**

On-board systems to monitor the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts). Includes vehicle-based sensors and communications with roadway-based infrastructure monitoring sensors.

- Requirement:*
- 1 The maintenance and construction vehicle shall collect infrastructure data from on-board sensors relating to the physical characteristics of the roadway infrastructure, including pavement, bridges, culverts, signs, etc.
-

Functional Area: **MCV Roadway Maintenance and Construction**

On-board systems that support routine non-winter maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of equipment on the roadway.

- Requirement:*
- 1 The maintenance and construction vehicle shall track the location and status of safety systems on-board the vehicle.
-

Functional Area: **MCV Infrastructure Monitoring**

On-board systems to monitor the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts). Includes vehicle-based sensors and communications with roadway-based infrastructure monitoring sensors.

- Requirement:*
- 2 The maintenance and construction vehicle shall collect infrastructure data from sensors located along the roadway relating to the physical characteristics of the roadway infrastructure, including pavement, bridges, culverts, signs, etc.
-

Functional Area: **MCV Roadway Maintenance and Construction**

On-board systems that support routine non-winter maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of equipment on the roadway.

- Requirement:*
- 2 The maintenance and construction vehicle shall respond to control information from the center to allow remote operation of the on-board vehicle systems. These systems include routine maintenance equipment for cutting, repairs, hazard removal, etc.
-

Functional Area: **MCV Infrastructure Monitoring**

On-board systems to monitor the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts). Includes vehicle-based sensors and communications with roadway-based infrastructure monitoring sensors.

- Requirement:*
- 3 The maintenance and construction vehicle shall provide control signals to infrastructure monitoring sensors located at the roadway.
-

Functional Area: **MCV Roadway Maintenance and Construction**

On-board systems that support routine non-winter maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of equipment on the roadway.

- Requirement:*
- 3 The maintenance and construction vehicle shall monitor materials information including remaining quantity and current application rate of materials on the vehicle.
-

Functional Area: **MCV Infrastructure Monitoring**

On-board systems to monitor the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts). Includes vehicle-based sensors and communications with roadway-based infrastructure monitoring sensors.

Architecture

Northern New Jersey ITS Architecture

Element: **NJTA Turnpike Maintenance Vehicles**

Entity: **Maintenance and Construction Vehicle**

Functional Area: **MCV Infrastructure Monitoring**

On-board systems to monitor the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts). Includes vehicle-based sensors and communications with roadway-based infrastructure monitoring sensors.

- Requirement:* 4 The maintenance and construction vehicle shall send current condition of pavement, bridges, culverts, signs, and other roadway infrastructure as measured by on-board sensors or read from infrastructure-based sensors to the center. The data may include raw data or images (e.g., photo logs) that indicate the current status of the infrastructure.
-

Functional Area: **MCV Roadway Maintenance and Construction**

On-board systems that support routine non-winter maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of equipment on the roadway.

- Requirement:* 4 The maintenance and construction vehicle shall respond to dispatch information from the center, presented to the vehicle operator for acknowledgement and returning status.
-
- Requirement:* 5 The maintenance and construction vehicle shall send operational data to the center including the operational state of the maintenance equipment (e.g., blade up/down, spreader pattern), types and quantities of materials used for construction and maintenance activities, and a record of the actual work performed.
-

Functional Area: **MCV Infrastructure Monitoring**

On-board systems to monitor the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts). Includes vehicle-based sensors and communications with roadway-based infrastructure monitoring sensors.

- Requirement:* 5 The maintenance and construction vehicle shall provide infrastructure sensor equipment operational status to the center.
-

Element: **NJTA Turnpike TOC**

Entity: **Emergency Management**

Functional Area: **Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

- Requirement:* 1 The center shall support the interface to the Emergency Telecommunications System (e.g. 911 or 7-digit call routing) to receive emergency notification information and provide it to the emergency system operator.
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- Requirement:* 2 The center shall receive emergency call information from 911 services and present the possible incident information to the emergency system operator.
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- Requirement:* 3 The center shall receive emergency call information from motorist call-boxes and present the possible incident information to the emergency system operator.
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- Requirement:* 4 The center shall receive emergency call information from mayday service providers and present the possible incident information to the emergency system operator.
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- Requirement:* 5 The center shall receive emergency notification information from other public safety agencies and present the possible incident information to the emergency system operator.
-
- Requirement:* 6 The center shall receive emergency notification information from public transit systems and present the possible incident information to the emergency system operator.
-

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Turnpike TOC***Entity:* **Emergency Management***Functional Area:* **Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

- Requirement:* 7 The center shall receive emergency notification information from commercial vehicles, commercial vehicle check stations, or commercial fleet operators and present the possible incident information to the emergency system operator. This may include detection of non-permitted transport of security sensitive hazmat, hazardous cargo spills, etc.
- Requirement:* 8 The center shall receive details of the cargo being carried by commercial vehicles from their commercial fleet manager for incidents involving potential hazardous materials.
- Requirement:* 9 The center shall coordinate, correlate, and verify all emergency inputs, including those identified based on external calls and internal analysis of security sensor and surveillance data, and assign each a level of confidence.
- Requirement:* 10 The center shall send a request for remote control of CCTV systems from a traffic management center in order to verify the reported incident.
- Requirement:* 11 The center shall update the incident information log once the emergency system operator has verified the incident.
- Requirement:* 12 The center shall provide the capability for digitized map data to act as the background to the emergency information presented to the emergency system operator.
- Requirement:* 13 The center shall forward the verified emergency information to the responding agency based on the location and nature of the emergency.

Functional Area: **Emergency Dispatch**

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

- Requirement:* 1 The center shall dispatch emergency vehicles to respond to verified emergencies and provide suggested routing under center personnel control.
- Requirement:* 2 The center shall store the current status of all emergency vehicles available for dispatch and those that have been dispatched.
- Requirement:* 3 The center shall relay location and incident details to the responding vehicles.
- Requirement:* 4 The center shall provide the capability to request traffic control measures from traffic management centers such as signal preemption, traffic barriers and road closures.
- Requirement:* 5 The center shall track the location and status of emergency vehicles responding to an emergency and update the incident status based on information from the emergency vehicle.
- Requirement:* 6 The center shall receive status information from care facilities to determine the appropriate facility and its location.
- Requirement:* 7 The center shall store and maintain the emergency service responses in an action log.
- Requirement:* 8 The center shall receive asset restriction information from maintenance centers to support the dispatching of appropriate emergency resources.
- Requirement:* 9 The center shall receive traffic information, including closures, traffic conditions, etc. from traffic management centers.
- Requirement:* 10 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Turnpike TOC***Entity:* **Emergency Management***Functional Area:* **Emergency Dispatch**

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

Requirement: 11 The center shall receive road network conditions and traffic images to support dispatch of emergency vehicles.

Requirement: 12 The center shall coordinate response to incidents with other Emergency Management centers to ensure appropriate resources are dispatched and utilized.

Functional Area: **Emergency Early Warning System**

Monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies in order to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to other ITS centers to notify the traveling public. Includes support for Child Abduction notices.

Requirement: 1 The center shall monitor information from Alerting and Advisory Systems such as the Information Sharing and Analysis Centers (ISACs), the National Infrastructure Protection Center (NIPC), the Homeland Security Advisory System (HSAS), etc. The information may include assessments (general incident and vulnerability awareness information), advisories (identification of threats or recommendations to increase preparedness levels), or alerts (information on imminent or in-progress emergencies).

Requirement: 2 The center shall provide the capability to correlate alerts and advisories, incident information, and security sensor and surveillance data.

Requirement: 3 The center shall broadcast wide-area alerts and advisories to traffic management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.

Requirement: 4 The center shall broadcast wide-area alerts and advisories to transit management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.

Requirement: 5 The center shall broadcast wide-area alerts and advisories to toll administration centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.

Requirement: 6 The center shall broadcast wide-area alerts and advisories to traveler information service providers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.

Requirement: 7 The center shall broadcast wide-area alerts and advisories to maintenance centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.

Requirement: 8 The center shall broadcast wide-area alerts and advisories to other emergency management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.

Requirement: 9 The center shall process status information from each of the centers that have been sent the wide-area alert.

Requirement: 10 The center shall coordinate the broadcast of wide-area alerts and advisories with other emergency management centers.

Requirement: 11 The center shall receive incident information from other transportation management centers to support the early warning system.

Requirement: 12 The center shall present the alert and advisory information and the status of the actions taken in response to the alert by the other centers to the emergency system operator as received from other system inputs.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Turnpike TOC***Entity:* **Emergency Management***Functional Area:* **Emergency Early Warning System**

Monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies in order to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to other ITS centers to notify the traveling public. Includes support for Child Abduction notices.

- Requirement:* 13 The center shall support the entry of alert and advisory information directly from the emergency system operator.

Functional Area: **Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

- Requirement:* 1 The center shall provide strategic emergency response capabilities such as that of an Emergency Operations Center for large-scale incidents and disasters.
- Requirement:* 2 The center shall manage coordinated inter-agency responses to and recovery from large-scale emergencies. Such agencies include traffic management, transit, maintenance and construction management, rail operations, and other emergency management agencies.
- Requirement:* 3 The center shall provide the capability to implement response plans and track progress through the incident by exchanging incident information and distributing response status to allied agencies.
- Requirement:* 4 The center shall develop, coordinate with other agencies, and store emergency response plans.
- Requirement:* 5 The center shall track the availability of resources (including vehicles, roadway cleanup?, etc.), request additional resources from traffic, maintenance, or other emergency centers if needed.
- Requirement:* 6 The center shall allocate the appropriate emergency services, resources, and vehicle (s) to respond to incidents, and shall provide the capability to override the current allocation to suit the special needs of a current incident.
- Requirement:* 7 The center shall receive event scheduling information from Event Promoters.
- Requirement:* 8 The center shall receive hazardous materials incident information from commercial fleet operators.
- Requirement:* 9 The center shall provide the capability to request the safe disabling of a commercial vehicle during a hazardous materials incident.
- Requirement:* 10 The center shall provide the capability to request transit resource availability from transit centers for use during disaster and evacuation operations.
- Requirement:* 11 The center shall assimilate the status of the transit, traffic, rail, maintenance, and other emergency center services and systems to create an overall transportation system status, and disseminate to each of these centers and the traveling public via traveler information providers.
- Requirement:* 12 The center shall provide information to the media concerning the status of an emergency response.
- Requirement:* 13 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.
- Requirement:* 14 The center shall provide the capability for center personnel to provide inputs to the management of incidents, disasters and evacuations.

Functional Area: **Incident Command**

Tactical decision support, resource coordination, and communications integration among emergency management agencies for Incident Commands that are established by first responders to support local management of an incident.

- Requirement:* 1 The center shall provide tactical decision support, resource coordination, and communications integration for Incident Commands that are established by first responders to support local management of an incident.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Turnpike TOC***Entity:* **Emergency Management***Functional Area:* **Incident Command**

Tactical decision support, resource coordination, and communications integration among emergency management agencies for Incident Commands that are established by first responders to support local management of an incident.

- Requirement:* 2 The center shall provide incident command communications with public safety, emergency management, transportation, and other allied response agency centers.
- Requirement:* 3 The center shall track and maintain resource information and action plans pertaining to the incident command.
- Requirement:* 4 The center shall share incident command information with other public safety agencies including resource deployment status, hazardous material information, rail incident information, evacuation advice as well as traffic, road, and weather conditions.
- Requirement:* 5 The center shall assess the status of responding emergency vehicles as part of an incident command.

Functional Area: **Emergency Evacuation Support**

Evacuation planning and coordination to manage evacuation and reentry of a population in the vicinity of a disaster or other emergency that poses a risk to public safety.

- Requirement:* 1 The center shall manage inter-agency coordination of evacuation operations, from initial planning through the evacuation process and reentry.
- Requirement:* 2 The center shall develop and exchange evacuation plans with allied agencies prior to the occurrence of a disaster.
- Requirement:* 3 The center shall provide an interface to the emergency system operator to enter evacuation plans and procedures and present the operator with other agencies' plans.
- Requirement:* 4 The center shall coordinate evacuation destinations and shelter needs with shelter providers (e.g., the American Red Cross) in the region.
- Requirement:* 5 The center shall provide evacuation information to traffic, transit, maintenance and construction, rail operations, and other emergency management centers as needed.
- Requirement:* 6 The center shall request resources from transit agencies as needed to support the evacuation.
- Requirement:* 7 The center shall request traffic management agencies to implement special traffic control strategies and to control evacuation traffic, including traffic on local streets and arterials as well as the major evacuation routes.
- Requirement:* 8 The center shall provide traveler information systems with evacuation guidance including basic information to assist potential evacuees in determining whether evacuation is necessary and when it is safe to return.
- Requirement:* 9 The center shall monitor the progress or status of the evacuation once it begins and exchange tactical plans, prepared during the incident, with allied agencies.
- Requirement:* 10 The center shall monitor the progress of the reentry process.
- Requirement:* 11 The center shall submit evacuation information to toll administration centers along with requests for changes in the toll services or fee collection during an evacuation.

Functional Area: **Emergency Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and emergency vehicles equipped with environmental sensors; used by the operator to more effectively manage incidents.

- Requirement:* 1 The center shall collect current and forecast road and weather information from weather service providers (such as the National Weather Service and value-added sector specific meteorological services).

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Turnpike TOC***Entity:* **Emergency Management***Functional Area:* **Emergency Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and emergency vehicles equipped with environmental sensors; used by the operator to more effectively manage incidents.

- Requirement:* 2 The center shall receive environmental probe information from its fleet of emergency vehicles.
- Requirement:* 3 The center shall collect current road and weather information from roadway maintenance operations.
- Requirement:* 4 The center shall assimilate current and forecast road conditions and surface weather information to support incident management.
- Requirement:* 5 The center shall present the current and forecast road and weather information to the emergency system operator.
- Requirement:* 6 The center shall provide aggregated or processed environmental probe information from its fleet of emergency vehicles to traffic management and maintenance centers.

Functional Area: **Center Secure Area Surveillance**

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 1 The center shall remotely monitor video images and audio surveillance data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The data may be raw or pre-processed in the field.
- Requirement:* 2 The center shall remotely monitor video images and audio surveillance data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The data may be raw or pre-processed in the field.
- Requirement:* 3 The center shall remotely monitor video images and audio surveillance data collected on-board transit vehicles. The data may be raw or pre-processed in the field.
- Requirement:* 4 The center shall exchange surveillance data with other emergency centers.
- Requirement:* 5 The center shall identify potential security threats based on collected security surveillance data.
- Requirement:* 6 The center shall verify potential security threats by correlating security surveillance data from multiple sources.
- Requirement:* 7 The center shall remotely control security surveillance devices in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways).
- Requirement:* 8 The center shall remotely control security surveillance devices in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers).
- Requirement:* 9 The center shall remotely control security surveillance devices on-board transit vehicles.
- Requirement:* 10 The center shall match traveler video images against a database from the Alerting and Advisory Systems of known images that may represent criminals and terrorists.
- Requirement:* 11 The center shall exchange traveler images with other emergency management centers to support traveler image matching.
- Requirement:* 12 The center shall respond to control data from center personnel regarding security surveillance data collection, processing, threat detection, and image matching.

Functional Area: **Center Secure Area Sensor Management**

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Turnpike TOC***Entity:* **Emergency Management***Functional Area:* **Center Secure Area Sensor Management**

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 1 The center shall remotely monitor and control security sensor data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), infrastructure condition and integrity, intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 2 The center shall remotely monitor and control security sensor data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 3 The center shall remotely monitor and control security sensor data collected on-board transit vehicles. The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors) and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 4 The center shall exchange security sensor data with other emergency centers.
- Requirement:* 5 The center shall identify potential security threats based on collected security sensor data.
- Requirement:* 6 The center shall verify potential security threats by correlating security sensor data from multiple sources.
- Requirement:* 7 The center shall perform threat analysis based on correlations of security sensor and surveillance data.
- Requirement:* 8 The center shall exchange threat analysis data with Alerting and Advisory Systems and use that data in local threat analysis processing.
- Requirement:* 9 The center shall disseminate threat information to other agencies, including traffic, transit, maintenance, rail operations, and other emergency management centers.
- Requirement:* 10 The center shall respond to control data from center personnel regarding security sensor data collection, processing, threat detection, and threat analysis.

Functional Area: **Service Patrol Management**

Dispatch and communication with roadway service patrol vehicles that monitor roads to aid motorists, offering rapid response to minor incidents.

- Requirement:* 1 The center shall dispatch roadway service patrol vehicles to identified incident locations.
- Requirement:* 2 The center shall store the current status of all service patrol vehicles available for dispatch and those that have been dispatched.
- Requirement:* 3 The center shall share incident information collected by the service patrol with traffic, maintenance and construction, and traveler information centers for incident management, incident notification to travelers, and incident cleanup.
- Requirement:* 4 The center shall track the location and status of service patrol vehicles.

Functional Area: **Emergency Data Collection**

Collection and storage of information related to Emergency Management. For use by operations personnel or data archives in the region.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Turnpike TOC***Entity:* **Emergency Management***Functional Area:* **Emergency Data Collection**

Collection and storage of information related to Emergency Management. For use by operations personnel or data archives in the region.

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| <i>Requirement:</i> | 1 The center shall collect emergency service data, emergency vehicle management data, emergency vehicle data, sensor and surveillance data, threat data, and incident data. |
| <i>Requirement:</i> | 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data. |
| <i>Requirement:</i> | 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the emergency management data or for the data itself. |
| <i>Requirement:</i> | 4 The center shall be able to produce sample products of the data available. |

Entity: **Maintenance and Construction Management***Functional Area:* **MCM Environmental Information Collection**

Remotely controls environmental sensors and assimilates collected data with other current and forecast road conditions and surface weather information from weather service providers and transportation operations.

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| <i>Requirement:</i> | 1 The center shall remotely control environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures. |
| <i>Requirement:</i> | 2 The center shall remotely control environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility. |
| <i>Requirement:</i> | 3 The center shall remotely control environmental sensors on-board maintenance and construction vehicles that measure road and weather conditions including air and surface temperatures, wind speed, humidity, precipitation, visibility and other measures. |
| <i>Requirement:</i> | 4 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services), data from traffic, emergency, and transit management, traveler information providers, and environmental data collected from sensors deployed on and about the roadway as well as the fleet of maintenance and construction vehicles. |
| <i>Requirement:</i> | 5 The center shall provide weather and road condition information to weather service providers and center personnel. |
| <i>Requirement:</i> | 6 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing. |
| <i>Requirement:</i> | 7 The center shall collect operational status for the roadside and vehicle-based environmental sensor equipment. |
| <i>Requirement:</i> | 8 The center shall collect fault data for the roadside and vehicle-based environmental sensor equipment for repair. |

Functional Area: **MCM Environmental Information Processing**

Processes current and forecast weather data, road condition information, local environmental data, and uses internal models to develop specialized detailed forecasts of local weather and surface conditions. Disseminates road weather information to other agencies and centers.

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| <i>Requirement:</i> | 1 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing. |
| <i>Requirement:</i> | 2 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services) and local environmental sensor data. |

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Turnpike TOC***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Environmental Information Processing**

Processes current and forecast weather data, road condition information, local environmental data, and uses internal models to develop specialized detailed forecasts of local weather and surface conditions. Disseminates road weather information to other agencies and centers.

Requirement: 3 The center shall use the various data inputs of environmental sensors and road weather data to develop a view of current and predicted road weather and road conditions.

Requirement: 4 The center shall disseminate current and forecasted road weather and road condition information to weather service providers (such as the National Weather Service and value-added sector specific meteorological services) as well as other agencies including traffic, emergency, and transit management, traveler information providers, rail operations centers, media, and other maintenance management centers.

Requirement: 5 The center shall provide value-added sector specific meteorological services with information on basic road facility and treatment information that supports forecasts for road conditions.

Functional Area: **MCM Incident Management**

Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.

Requirement: 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.

Requirement: 2 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, etc.

Requirement: 3 The center shall exchange incident and threat information with emergency management centers as well as traffic management centers; including notification of existence of incident and expected severity, location, time and nature of incident.

Requirement: 4 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.

Requirement: 5 The center shall respond to requests from emergency management to provide maintenance and construction resources to implement response plans, assist in clean up, verify an incident, etc. This may also involve coordination with traffic management centers and other maintenance centers.

Requirement: 6 The center shall exchange road network status assessment information with emergency management and traffic management centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.

Requirement: 7 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

Requirement: 8 The center shall receive information indicating the damage sustained by transportation assets, derived from aerial surveillance, field reports, inspections, tests, and analyses to support incident management.

Functional Area: **MCM Maintenance Decision Support**

Maintenance Decision Support Systems recommend courses of action based on current and forecast environmental and road conditions (filtered and fused for specific time horizons) and additional application specific information. Recommendations and dispatch instructions are generated based on this integrated information.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Turnpike TOC***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Maintenance Decision Support**

Maintenance Decision Support Systems recommend courses of action based on current and forecast environmental and road conditions (filtered and fused for specific time horizons) and additional application specific information. Recommendations and dispatch instructions are generated based on this integrated information.

- Requirement:* 1 The center shall provide the center personnel with tailored external information, including weather or road condition observations, forecasted weather information or road conditions, current usage of treatments and materials, available resources, equipment and vehicle availability, road network information, and source reliability information.
- Requirement:* 2 The center shall tailor the decision support information to include filtering (selection from a large amount of external information), error reduction ('smoothing' the information), fusion (combination of disparate information to match the decision needs), and analysis (creating the decision).
- Requirement:* 3 The center shall provide an interface to the center personnel to input control parameters for the decision support process and receive decisions or information presentation.
- Requirement:* 4 The center shall provide dispatch information to maintenance and construction vehicles based on the outputs of the decision support system, including recommended roadway treatment actions.

Functional Area: **MCM Winter Maintenance Management**

Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.

- Requirement:* 1 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other winter roadway maintenance.
- Requirement:* 2 The center shall exchange information with administrative systems to support the planning and scheduling of winter maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
- Requirement:* 3 The center shall provide status information about scheduled winter maintenance activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, and the media.
- Requirement:* 4 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of winter maintenance activities.
- Requirement:* 5 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of winter maintenance activities.
- Requirement:* 6 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
- Requirement:* 7 The center shall dispatch and route winter maintenance vehicle drivers and support them with route-specific environmental, incident, advisory, threat, alert, and traffic congestion information.
- Requirement:* 8 The center shall determine the need for roadway treatment based on current and forecasted weather information, current usage of treatments and materials, available resources, requests for action from other agencies, and recommendations from the Maintenance Decision Support system, specifically under winter conditions. This supports winter maintenance such as plowing, treating, anti-icing, etc.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Turnpike TOC***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Winter Maintenance Management**

Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.

- Requirement:* 9 The center shall provide dispatch instructions for vehicle operators based on input parameters from center personnel, specifically for winter conditions. This could include a treatment route, treatment application rates, start and end times, and other treatment instructions.
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- Requirement:* 10 The center shall support remote control of on-board maintenance and construction vehicle systems and field equipment that is remotely controlled by the vehicle such as adjusting material application rates and spread patterns.
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- Requirement:* 11 The center shall assess the current status of all winter maintenance activities, including actual work activities performed, current locations and operational conditions of vehicles, materials and equipment inventories, field equipment status, environmental information, etc.

Functional Area: **MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

- Requirement:* 1 The center shall maintain an interface with asset management systems to track the inventory, restrictions, repair needs and status updates of transportation assets (pavement, bridges, signs, etc.) including location, installation and materials information, vendor/contractor, current maintenance status, standard height, width, and weight restrictions.
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- Requirement:* 2 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other roadway maintenance.
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- Requirement:* 3 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
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- Requirement:* 4 The center shall provide emergency management and traffic management centers with information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.
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- Requirement:* 5 The center shall collect the status and fault data from roadside equipment, such as traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
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- Requirement:* 6 The center shall collect the status and fault data from traffic management centers, including data for traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
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- Requirement:* 7 The center shall remotely control and collect data from infrastructure monitoring sensors located along the roadway infrastructure or on maintenance and construction vehicles.
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- Requirement:* 8 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of roadway maintenance and construction activities.
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- Requirement:* 9 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of roadway maintenance and construction activities.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Turnpike TOC***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

- Requirement:* 10 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
- Requirement:* 11 The center shall dispatch and route maintenance and construction vehicle drivers and support them with route- specific environmental, incident, advisory, threat, alert, and traffic congestion information.
- Requirement:* 12 The center shall manage an interface with center personnel to accept vehicle systems control information and remotely control maintenance and construction vehicle on-board equipment.
- Requirement:* 13 The center shall track the status of roadway maintenance and construction activities by monitoring collected data from the dispatched vehicles and equipment.

Functional Area: **MCM Work Zone Management**

Remotely monitors and supports work zone activities, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).

- Requirement:* 1 The center shall generate new work zone activity schedules for use by maintenance and construction vehicles, maintenance and construction operators, and for information coordination purposes.
- Requirement:* 2 The center shall control the collection of work zone status information including video images from cameras located in or near the work zone.
- Requirement:* 3 The center shall disseminate work zone information to other agencies and centers including traffic, transit, emergency management centers, other maintenance centers, traveler information providers, and the media.
- Requirement:* 4 The center shall control traffic in work zones by providing remote control of dynamic message signs and highway advisory radio systems located in or near the work zone.
- Requirement:* 5 The center shall exchange information with administrative systems to support the planning and scheduling of work zone activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.

Functional Area: **MCM Work Activity Coordination**

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

- Requirement:* 1 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.
- Requirement:* 2 The center shall provide status information about scheduled maintenance and construction activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, multimodal transportation providers, rail operations, and the media.
- Requirement:* 3 The center shall collect and respond to feedback concerning scheduled maintenance and construction activities with other management centers such as traffic, emergency, transit, and rail operations.

Architecture

Northern New Jersey ITS Architecture

Element: **NJTA Turnpike TOC**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Work Activity Coordination**

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

Requirement: 4 The center shall collect and disseminate asset restriction information levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.

Requirement: 5 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance and construction activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.

Requirement: 6 The center shall exchange rail schedules and work plans with rail operations centers.

Functional Area: **MCM Data Collection**

Collection and storage of maintenance and construction information. For use by operations personnel or data archives in the region.

Requirement: 1 The center shall collect maintenance and construction data (such as field equipment status, infrastructure status, maintenance and construction activity data) gathered from roadway, traffic, and other maintenance and construction sources.

Requirement: 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

Requirement: 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the maintenance and construction data or for the data itself.

Requirement: 4 The center shall be able to produce sample products of the data available.

Requirement: 5 The center shall provide data to Asset Management to be used in updating the status of assets in the inventory.

Entity: **Traffic Management**

Functional Area: **Collect Traffic Surveillance**

Management of traffic sensors and surveillance (CCTV) equipment, and distribution of the collected information to other centers and operators.

Requirement: 1 The center shall monitor, analyze, and store traffic sensor data (speed, volume, occupancy) collected from field elements under remote control of the center.

Requirement: 2 The center shall monitor, analyze, and distribute traffic images from CCTV systems under remote control of the center.

Requirement: 3 The center shall monitor, analyze, and store pedestrian sensor data collected from field elements under remote control of the center.

Requirement: 4 The center shall monitor, analyze, and distribute pedestrian images from CCTV systems under remote control of the center.

Requirement: 5 The center shall monitor, analyze, and store multimodal crossing and high occupancy vehicle (HOV) lane sensor data under remote control of the center.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Turnpike TOC***Entity:* **Traffic Management***Functional Area:* **Collect Traffic Surveillance**

Management of traffic sensors and surveillance (CCTV) equipment, and distribution of the collected information to other centers and operators.

- Requirement:* 6 The center shall maintain a database of surveillance and sensors and the freeways, surface street and rural roadways, e.g. where they are located, to which part(s) of the network their data applies, the type of data, and the ownership of each link (that is, the agency or entity responsible for collecting and storing surveillance of the link) in the network.
- Requirement:* 7 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic data.
- Requirement:* 8 The center shall distribute road network conditions data (raw or processed) based on collected and analyzed traffic sensor and surveillance data to other centers.
- Requirement:* 9 The center shall respond to control data from center personnel regarding sensor and surveillance data collection, analysis, storage, and distribution.

Functional Area: **TMC Probe Information Collection**

Collects, assimilates, and disseminates vehicle probe data collected from roadside beacons and centers controlling transit vehicles, emergency vehicles, toll collection points, and route-guided vehicles.

- Requirement:* 1 The center shall collect probe data including traffic and road conditions from vehicles via roadside beacon field elements; the data may be aggregated and initial link time calculations performed in the field.
- Requirement:* 2 The center shall collect road condition data from probe-equipped transit vehicles via transit management centers; the data may be aggregated and preliminarily processed at the sending center.
- Requirement:* 3 The center shall collect traffic data from probe-equipped emergency vehicles via emergency management centers; the data may be aggregated and initial link time calculations performed at the sending center.
- Requirement:* 4 The center shall collect traffic data from traveler information centers based on data from their subscriber vehicles; the data may be aggregated and initial link time calculations performed at the sending center.
- Requirement:* 5 The center shall collect traffic data from toll administrative centers containing journey times between toll collection points for those vehicles equipped for electronic toll collection; the data may be aggregated and processed at the sending center.
- Requirement:* 6 The center shall assimilate current and forecast traffic and road conditions based on collected probe data and distribute to other centers for dissemination to travelers.
- Requirement:* 7 The center shall collect operational status for the roadside probe data collection equipment.
- Requirement:* 8 The center shall collect fault data for the roadside probe data collection equipment for repair.

Functional Area: **TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

- Requirement:* 1 The center shall remotely control traffic signal controllers.
- Requirement:* 2 The center shall accept notifications of right-of-way requests from pedestrians.
- Requirement:* 3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center.
- Requirement:* 4 The center shall collect traffic signal controller fault data from the field.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Turnpike TOC***Entity:* **Traffic Management***Functional Area:* **TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

- Requirement:* 5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.

Functional Area: **TMC Freeway Management**

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

- Requirement:* 1 The center shall remotely control systems to manage use of the freeways, including ramp meters, mainline metering, and lane controls.

- Requirement:* 2 The center shall collect operational status from ramp meters, mainline metering, and lane controls and compare against the control information sent by the center.

- Requirement:* 3 The center shall collect fault data from ramp meters, mainline metering, and lane controls.

- Requirement:* 4 The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, mainline metering, and lane controls), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the ramps themselves.

Functional Area: **TMC HOV Lane Management**

Remotely controls high-occupancy vehicle (HOV) lane sensors, driver information systems, and ramp meters to manage use of HOV or High Occupancy Toll (HOT) lanes; also detects HOV violators and notifies enforcement agencies.

- Requirement:* 1 The center shall remotely control sensors to detect high-occupancy vehicle (HOV) lane usage.

- Requirement:* 2 The center shall remotely control driver information systems to notify users of lane status for lanes that become HOV or High Occupancy Toll (HOT) lanes during certain times of the day on freeways.

- Requirement:* 3 The center shall remotely control freeway control devices, such as ramp signals and mainline metering and other systems associated with freeway operations that control use of HOV lanes.

- Requirement:* 4 The center shall collect traffic flow measures and information regarding vehicle occupancy (i.e., lane usage) in HOV lanes.

- Requirement:* 5 The center shall monitor the use of HOV lanes and detect vehicles that do not have the required number of occupants.

- Requirement:* 6 The center shall collect operational status for the freeway control devices associated with HOV lane control.

- Requirement:* 7 The center shall collect fault data for the freeway control devices associated with HOV lane control for repair.

- Requirement:* 8 The center shall store violation parameters, detect HOV lane violators, obtain the vehicle registration data from the appropriate State Department of Motor Vehicles (DMV) office, and then provide the capability to send violation information to a law enforcement agency.

Functional Area: **TMC Traffic Information Dissemination**

Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.

- Requirement:* 1 The center shall remotely control dynamic messages signs for dissemination of traffic and other information to drivers.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Turnpike TOC***Entity:* **Traffic Management***Functional Area:* **TMC Traffic Information Dissemination**

Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.

- Requirement:* 2 The center shall remotely control driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers.
- Requirement:* 3 The center shall collect operational status for the driver information systems equipment (DMS, HAR, etc.).
- Requirement:* 4 The center shall collect fault data for the driver information systems equipment (DMS, HAR, etc.) for repair.
- Requirement:* 5 The center shall retrieve locally stored traffic information, including current and forecasted traffic information, road and weather conditions, traffic incident information, information on diversions and alternate routes, closures, and special traffic restrictions (lane/shoulder use, weight restrictions, width restrictions, HOV requirements), etc.
- Requirement:* 6 The center shall distribute traffic data to maintenance and construction centers, transit centers, emergency management centers, and traveler information providers.
- Requirement:* 7 The center shall distribute traffic data to the media upon request; the capability to provide the information in both data stream and graphical display shall be supported.
- Requirement:* 8 The center shall provide the capability for center personnel to control the nature of the data that is available to non-traffic operations centers and the media.

Functional Area: **TMC Regional Traffic Control**

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

- Requirement:* 1 The center shall exchange traffic information with other traffic management centers, includes incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.
- Requirement:* 2 The center shall exchange traffic control information with other traffic management centers, includes remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).

Functional Area: **TMC Incident Detection**

Remotely controls traffic and video sensors to support incident detection and verification; exchange information with other agencies including emergency management, maintenance and construction, alerting and advisory systems, event promoters, intermodal freight depots, and traveler information systems.

- Requirement:* 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.
- Requirement:* 2 The center shall collect and store traffic flow and image data from the field equipment to detect and verify incidents.
- Requirement:* 3 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, and intermodal freight depots.
- Requirement:* 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Turnpike TOC***Entity:* **Traffic Management***Functional Area:* **TMC Incident Detection**

Remotely controls traffic and video sensors to support incident detection and verification; exchange information with other agencies including emergency management, maintenance and construction, alerting and advisory systems, event promoters, intermodal freight depots, and traveler information systems.

Requirement: 5 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field.

Requirement: 6 The center shall provide road network conditions and traffic images to emergency management centers to support the detection, verification, and classification of incidents.

Requirement: 7 The center shall provide video and traffic sensor control commands to the field equipment to detect and verify incidents.

Functional Area: **TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

Requirement: 1 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction for distribution to the public. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, and information and instructions necessary for the public to respond to the alert. This may also identify specific information that should not be released to the public.

Requirement: 2 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.

Requirement: 3 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field, provide special routing for emergency vehicles, and to provide responding emergency vehicles with signal preemption.

Requirement: 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.

Requirement: 5 The center shall respond to requests from emergency management to provide traffic management resources to implement special traffic control measures, assist in clean up, verify an incident, etc. This may also involve coordination with maintenance centers.

Requirement: 6 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, media, and rail operations centers.

Requirement: 7 The center shall provide road network conditions and traffic images to emergency management centers, maintenance and construction centers, and traveler information service providers.

Requirement: 8 The center shall exchange road network status assessment information with emergency management and maintenance centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.

Requirement: 9 The center shall coordinate information and controls with other traffic management centers.

Requirement: 10 The center shall receive inputs from emergency management and transit management centers to develop an overall status of the transportation system including emergency transit schedules in effect and current status and condition of the transportation infrastructure.

Architecture

Northern New Jersey ITS Architecture

Element: **NJTA Turnpike TOC**

Entity: **Traffic Management**

Functional Area: **TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

- Requirement:* 11 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic incident management.
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Functional Area: **TMC Evacuation Support**

Development, coordination, and execution of special traffic management strategies during evacuation and subsequent reentry of a population in the vicinity of a disaster or major emergency. Interfaces with emergency management and other traffic management centers.

- Requirement:* 1 The center shall coordinate planning for evacuation with emergency management centers - including pre-planning activities such as establishing routes, areas to be evacuated, timing, etc.
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- Requirement:* 2 The center shall support requests from emergency management centers to preempt the current traffic control strategy, activate traffic control and closure systems such as gates and barriers, activate safeguard systems, or use driver information systems to support evacuation traffic control plans.
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- Requirement:* 3 The center shall coordinate information and controls with other traffic management centers.
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- Requirement:* 4 The center shall coordinate execution of evacuation strategies with emergency management centers - including activities such as setting closures and detours, establishing routes, updating areas to be evacuated, timing the process, etc.
-

Functional Area: **TMC Environmental Monitoring**

Management of environmental sensors and assimilation of collected data with other current and forecast road conditions and surface weather information from weather service providers and roadway maintenance operations.

- Requirement:* 1 The center shall remotely control environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures.
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- Requirement:* 2 The center shall remotely control environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.
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- Requirement:* 3 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services), data from roadway maintenance operations, and environmental data collected from sensors deployed on and about the roadway.
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- Requirement:* 4 The center shall provide weather and road condition information to weather service providers and center personnel.
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- Requirement:* 5 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.
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Functional Area: **Barrier System Management**

Remotely controls barrier systems such as gates and other systems that manage entry to roadways, transportation facilities and infrastructure.

- Requirement:* 1 The center shall remotely control barrier systems for transportation facilities and infrastructure. Barrier systems include automated or remotely controlled gates, barriers and other systems that manage entry to roadways.
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- Requirement:* 2 The center shall collect barrier system operational status.
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- Requirement:* 3 The center shall collect barrier system fault data and send to the maintenance center for repair.
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Architecture

Northern New Jersey ITS Architecture

Element: **NJTA Turnpike TOC**

Entity: **Traffic Management**

Functional Area: **Barrier System Management**

Remotely controls barrier systems such as gates and other systems that manage entry to roadways, transportation facilities and infrastructure.

- Requirement:* 4 The center shall accept requests for barrier system activation from other centers and from center personnel to support emergency response and detours.
-

Functional Area: **Safeguard System Management**

Remotely controls safeguard systems such as blast shields and tunnel exhaust systems that are used to mitigate the impact of incidents on transportation infrastructure.

- Requirement:* 1 The center shall remotely control safeguard systems, equipment used to mitigate the impact of incidents on transportation infrastructure (e.g., blast shields, tunnel exhaust systems, etc.)
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- Requirement:* 2 The center shall collect safeguard system operational status.
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- Requirement:* 3 The center shall collect safeguard system fault data and send to the maintenance center for repair.
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- Requirement:* 4 The center shall accept requests for safeguard system activation from other centers and from center personnel to support emergency response.
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Functional Area: **Traffic Maintenance**

Monitoring and remote diagnostics of field equipment - detect failures, issue problem reports, and track the repair or replacement of the failed equipment.

- Requirement:* 1 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) operational status.
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- Requirement:* 2 The center shall collect and store CCTV surveillance system (traffic, pedestrian) operational status.
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- Requirement:* 3 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) fault data and send to the maintenance center for repair.
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- Requirement:* 4 The center shall collect and store CCTV surveillance system (traffic, pedestrian) fault data send to the maintenance center for repair.
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- Requirement:* 5 The center shall collect environmental sensor operational status.
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- Requirement:* 6 The center shall collect environmental sensor equipment fault data and send to the maintenance center for repair.
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- Requirement:* 7 The center shall exchange data with maintenance centers concerning the reporting of faulty equipment and the schedule/status of their repair. Information exchanged includes details of new equipment faults, and clearances when the faults are cleared.
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- Requirement:* 8 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic maintenance data.
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Functional Area: **TMC Work Zone Traffic Management**

Coordination with maintenance systems using work zone images and traveler information systems (such as DMS), and distribution of work plans so that work zones are established that have minimum traffic impact.

- Requirement:* 1 The center shall receive work zone images from a maintenance center.
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- Requirement:* 2 The center shall analyze work zone images for indications of a possible incident.
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- Requirement:* 3 The center shall remotely control driver information systems (such as dynamic messages signs, highway advisory radios) to advise drivers of activity around a work zone.
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- Requirement:* 4 The center shall collect operational status for the driver information systems equipment in work zones.
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- Requirement:* 5 The center shall collect fault data for the driver information systems equipment in work zones for repair.
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Architecture**Northern New Jersey ITS Architecture***Element:***NJTA Turnpike TOC***Entity:***Traffic Management***Functional Area:* **TMC Work Zone Traffic Management**

Coordination with maintenance systems using work zone images and traveler information systems (such as DMS), and distribution of work plans so that work zones are established that have minimum traffic impact.

- Requirement:* 6 The center shall receive proposed maintenance and construction work plans, analyze the activity as a possible incident, and provide work plan feedback to the sending center.

Functional Area: **TMC Input to In-Vehicle Signing**

Formats and outputs information to field equipment that supports in-vehicle signage equipment communications.

- Requirement:* 1 The center shall format and output road condition and environmental information to field equipment that supports in-vehicle signage communications.

- Requirement:* 2 The center shall format and output advisory information, such as evacuation information, wide-area alerts, incident information, work zone intrusion information, and other special information to field equipment that supports in-vehicle signage communications.

- Requirement:* 3 The center shall format and output indicator and fixed sign information, such as actual intersection traffic signal states, stop, or yield signs to field equipment that supports in-vehicle signage communications.

- Requirement:* 4 The center shall receive system operational status from field equipment that supports in-vehicle signage communications.

- Requirement:* 5 The center shall receive system fault data from field equipment that supports in-vehicle signage communications.

Functional Area: **Traffic Data Collection**

Collection and storage of traffic management data. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect traffic management data such as operational data, event logs, etc.

- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

- Requirement:* 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the traffic data or for the data itself.

- Requirement:* 4 The center shall be able to produce sample products of the data available.

*Element:***NJTA Weather System***Entity:***Maintenance and Construction Management***Functional Area:* **MCM Environmental Information Collection**

Remotely controls environmental sensors and assimilates collected data with other current and forecast road conditions and surface weather information from weather service providers and transportation operations.

- Requirement:* 1 The center shall remotely control environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures.

- Requirement:* 2 The center shall remotely control environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.

- Requirement:* 3 The center shall remotely control environmental sensors on-board maintenance and construction vehicles that measure road and weather conditions including air and surface temperatures, wind speed, humidity, precipitation, visibility and other measures.

Architecture**Northern New Jersey ITS Architecture***Element:***NJTA Weather System***Entity:***Maintenance and Construction Management***Functional Area:* **MCM Environmental Information Collection**

Remotely controls environmental sensors and assimilates collected data with other current and forecast road conditions and surface weather information from weather service providers and transportation operations.

- Requirement:* 4 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services), data from traffic, emergency, and transit management, traveler information providers, and environmental data collected from sensors deployed on and about the roadway as well as the fleet of maintenance and construction vehicles.
- Requirement:* 5 The center shall provide weather and road condition information to weather service providers and center personnel.
- Requirement:* 6 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.
- Requirement:* 7 The center shall collect operational status for the roadside and vehicle-based environmental sensor equipment.
- Requirement:* 8 The center shall collect fault data for the roadside and vehicle-based environmental sensor equipment for repair.

*Element:***NJTA Website***Entity:***Information Service Provider***Functional Area:* **Basic Information Broadcast**

Collection, processing, storage, and broadcast dissemination of traffic, transit, maintenance and construction, event, and weather information to traveler interface systems and vehicles.

- Requirement:* 1 The center shall collect, process, store, and disseminate traffic and highway condition information to travelers, including incident information, detours and road closures, event information, recommended routes, and current speeds on specific routes.
- Requirement:* 2 The center shall collect, process, store, and disseminate maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities.
- Requirement:* 3 The center shall collect, process, store, and disseminate transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers.
- Requirement:* 4 The center shall collect, process, store, and disseminate parking information to travelers, including location, availability, and fees.
- Requirement:* 5 The center shall collect, process, store, and disseminate toll fee information to travelers.
- Requirement:* 6 The center shall collect, process, store, and disseminate weather information to travelers.
- Requirement:* 7 The center shall collect, process, store, and disseminate event information to travelers.
- Requirement:* 8 The center shall collect, process, store, and disseminate air quality information to travelers.
- Requirement:* 9 The center shall provide the capability to support requests from the media for traffic and incident data.
- Requirement:* 10 The center shall provide the capability for a system operator to control the type and update frequency of broadcast traveler information.

Functional Area: **Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

- Requirement:* 1 The center shall collect, process, store, and disseminate customized traffic and highway condition information to travelers, including incident information, detours and road closures, recommended routes, and current speeds on specific routes upon request.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Website***Entity:* **Information Service Provider***Functional Area:* **Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

- Requirement:* 2 The center shall collect, process, store, and disseminate customized maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities upon request.
- Requirement:* 3 The center shall collect, process, store, and disseminate customized transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers upon request.
- Requirement:* 4 The center shall collect, process, store, and disseminate customized parking information to travelers, including location, availability, and fees upon request.
- Requirement:* 5 The center shall collect, process, store, and disseminate customized toll fee information to travelers upon request.
- Requirement:* 6 The center shall collect, process, store, and disseminate customized weather information to travelers upon request.
- Requirement:* 7 The center shall collect, process, store, and disseminate customized multimodal transportation service information (for example, from ferry and airline operators), including transfer points and other information, to travelers upon request.
- Requirement:* 8 The center shall collect, process, store, and disseminate customized event information to travelers upon request.
- Requirement:* 9 The center shall collect, process, store, and disseminate customized air quality information to travelers upon request.
- Requirement:* 10 The center shall provide all traveler information based on the traveler's current location or a specific location identified by the traveler, and filter or customize the provided information accordingly.
- Requirement:* 11 The center shall accept traveler profiles for determining the type of personalized data to send to the traveler.
- Requirement:* 12 The center shall manage payment for services, such as tolls, transit fares, parking lot charges, map updates, and advanced payment for tolls, and provide transaction success or failure details.
- Requirement:* 13 The center shall support requests for traveler information and advanced payment for traveler services from commercial fleet operators.
- Requirement:* 14 The center shall provide the capability to exchange information with another traveler information service provider current or predicted data for road links that are outside the area served by the local supplier.
- Requirement:* 15 The center shall manage updates of digitized map data and provide updates to traveler interface systems upon request.
- Requirement:* 16 The center shall provide the capability to support requests from the media for traffic and incident data.
- Requirement:* 17 The center shall provide the capability for a system operator to control the type and update frequency of traveler information.

Functional Area: **Traveler Telephone Information**

Collection and distribution of traveler information and wide-area alerts to traveler telephone information systems such as 511, based on voice-based traveler requests.

- Requirement:* 1 The center shall provide the capability to process voice-formatted requests for traveler information from a traveler telephone information system, and return the information in the requested format.
- Requirement:* 2 The center shall provide the capability to process dual-tone multifrequency (DTMF)-based requests (touch-tone) for traveler information from a traveler telephone information system.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTA Website***Entity:* **Information Service Provider***Functional Area:* **Traveler Telephone Information**

Collection and distribution of traveler information and wide-area alerts to traveler telephone information systems such as 511, based on voice-based traveler requests.

- Requirement:* 3 The center shall provide the capability to process traveler information requests from a traveler telephone information system.
- Requirement:* 4 The center shall collect and provide information on traffic conditions in the requested voice format and for the requested location.
- Requirement:* 5 The center shall collect and provide work zone and roadway maintenance information in the requested voice format and for the requested location.
- Requirement:* 6 The center shall collect and provide roadway environment conditions information in the requested voice format and for the requested location.
- Requirement:* 7 The center shall collect and provide weather and event information in the requested voice format and for the requested location.
- Requirement:* 8 The center shall collect and provide transit service information in the requested voice format and for the requested location.
- Requirement:* 9 The center shall collect and provide yellow pages services information in the requested voice format and for the requested location.
- Requirement:* 10 The center shall collect and provide current ferry and rail schedule and airport status information in the requested voice format and for the requested location.
- Requirement:* 11 The center shall provide the capability to support both specific caller requests as well as bulk upload of regional traveler information.
- Requirement:* 12 The center shall receive and forward region-specific wide-area alert and advisory information to the traveler telephone information system, including major emergencies such as a natural or man-made disaster, civil emergency, child abductions, severe weather watches and warnings, military activities, and law enforcement warnings.

Functional Area: **Infrastructure Provided Route Selection**

Generation of pre-trip and enroute trip plans for travelers (and vehicles) based on current traffic conditions, work zones, weather, and travelers constraints and preferences. Includes end-to-end trips using multiple modes, such as bicycle, transit, etc.

- Requirement:* 1 The center shall provide the capability to provide specific pre-trip and enroute directions to travelers (and drivers), including costs, arrival times, and transfer points.
- Requirement:* 2 The center shall include bicycle routes, walkways, skyways, and multi-use trails in the pre-trip and enroute directions it provides to travelers.
- Requirement:* 3 The center shall support on-line route guidance for travelers using personal devices (such as PDAs).
- Requirement:* 4 The center shall support on-line route guidance for drivers in vehicles.
- Requirement:* 5 The center shall support on-line route guidance for specialty vehicles, such as commercial vehicles.
- Requirement:* 6 The center shall generate route plans based on current and/or predicted conditions of the road network, scheduled maintenance and construction work activities, and work zone activities.
- Requirement:* 7 The center shall generate route plans based on transit services, including fares, schedules, and requirements for travelers with special needs.
- Requirement:* 8 The center shall generate route plans based on current asset restrictions, such as height and weight restrictions on tunnels or bridges.
- Requirement:* 9 The center shall generate route plans based on current or forecasted weather.

Architecture**Northern New Jersey ITS Architecture***Element:***NJTA Website***Entity:***Information Service Provider***Functional Area:* **Infrastructure Provided Route Selection**

Generation of pre-trip and enroute trip plans for travelers (and vehicles) based on current traffic conditions, work zones, weather, and travelers constraints and preferences. Includes end-to-end trips using multiple modes, such as bicycle, transit, etc.

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| <i>Requirement:</i> | 10 | The center shall generate route plans based on ferry, rail, air, or other multimodal transportation data. |
| <i>Requirement:</i> | 11 | The center shall exchange route segment information with other centers outside the area served by the local center. |
| <i>Requirement:</i> | 12 | The center shall generate trips based on the use of more than one mode of transport. |
| <i>Requirement:</i> | 13 | The center shall use the preferences and constraints specified by the traveler in the trip request to select the most appropriate mode of transport. |
| <i>Requirement:</i> | 14 | The center shall provide the capability for the traveler to confirm the proposed trip plan. |
| <i>Requirement:</i> | 15 | The center shall log route plans, particularly for special vehicles such as those containing hazardous materials, over-sized vehicles, or motorcades, with a traffic center. |
| <i>Requirement:</i> | 16 | The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used to determine vehicle and non-vehicle routes, trip planning, and on-line vehicle guidance. |
| <i>Requirement:</i> | 17 | The center shall provide the capability for center personnel to control route calculation parameters. |

*Element:***NJTPA Counties EOCs***Entity:***Emergency Management***Functional Area:* **Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

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| <i>Requirement:</i> | 1 | The center shall support the interface to the Emergency Telecommunications System (e.g. 911 or 7-digit call routing) to receive emergency notification information and provide it to the emergency system operator. |
| <i>Requirement:</i> | 2 | The center shall receive emergency call information from 911 services and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 3 | The center shall receive emergency call information from motorist call-boxes and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 4 | The center shall receive emergency call information from mayday service providers and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 5 | The center shall receive emergency notification information from other public safety agencies and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 6 | The center shall receive emergency notification information from public transit systems and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 7 | The center shall receive emergency notification information from commercial vehicles, commercial vehicle check stations, or commercial fleet operators and present the possible incident information to the emergency system operator. This may include detection of non-permitted transport of security sensitive hazmat, hazardous cargo spills, etc. |
| <i>Requirement:</i> | 8 | The center shall receive details of the cargo being carried by commercial vehicles from their commercial fleet manager for incidents involving potential hazardous materials. |

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Counties EOCs***Entity:* **Emergency Management***Functional Area:* **Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

- Requirement:* 9 The center shall coordinate, correlate, and verify all emergency inputs, including those identified based on external calls and internal analysis of security sensor and surveillance data, and assign each a level of confidence.
- Requirement:* 10 The center shall send a request for remote control of CCTV systems from a traffic management center in order to verify the reported incident.
- Requirement:* 11 The center shall update the incident information log once the emergency system operator has verified the incident.
- Requirement:* 12 The center shall provide the capability for digitized map data to act as the background to the emergency information presented to the emergency system operator.
- Requirement:* 13 The center shall forward the verified emergency information to the responding agency based on the location and nature of the emergency.

Functional Area: **Emergency Dispatch**

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

- Requirement:* 1 The center shall dispatch emergency vehicles to respond to verified emergencies and provide suggested routing under center personnel control.
- Requirement:* 2 The center shall store the current status of all emergency vehicles available for dispatch and those that have been dispatched.
- Requirement:* 3 The center shall relay location and incident details to the responding vehicles.
- Requirement:* 4 The center shall provide the capability to request traffic control measures from traffic management centers such as signal preemption, traffic barriers and road closures.
- Requirement:* 5 The center shall track the location and status of emergency vehicles responding to an emergency and update the incident status based on information from the emergency vehicle.
- Requirement:* 6 The center shall receive status information from care facilities to determine the appropriate facility and its location.
- Requirement:* 7 The center shall store and maintain the emergency service responses in an action log.
- Requirement:* 8 The center shall receive asset restriction information from maintenance centers to support the dispatching of appropriate emergency resources.
- Requirement:* 9 The center shall receive traffic information, including closures, traffic conditions, etc. from traffic management centers.
- Requirement:* 10 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.
- Requirement:* 11 The center shall receive road network conditions and traffic images to support dispatch of emergency vehicles.
- Requirement:* 12 The center shall coordinate response to incidents with other Emergency Management centers to ensure appropriate resources are dispatched and utilized.

Functional Area: **Emergency Early Warning System**

Architecture**Northern New Jersey ITS Architecture***Element:* NJTPA Counties EOCs*Entity:* Emergency Management*Functional Area:* **Emergency Early Warning System**

Monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies in order to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to other ITS centers to notify the traveling public. Includes support for Child Abduction notices.

- Requirement:* 1 The center shall monitor information from Alerting and Advisory Systems such as the Information Sharing and Analysis Centers (ISACs), the National Infrastructure Protection Center (NIPC), the Homeland Security Advisory System (HSAS), etc. The information may include assessments (general incident and vulnerability awareness information), advisories (identification of threats or recommendations to increase preparedness levels), or alerts (information on imminent or in-progress emergencies).
- Requirement:* 2 The center shall provide the capability to correlate alerts and advisories, incident information, and security sensor and surveillance data.
- Requirement:* 3 The center shall broadcast wide-area alerts and advisories to traffic management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 4 The center shall broadcast wide-area alerts and advisories to transit management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 5 The center shall broadcast wide-area alerts and advisories to toll administration centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 6 The center shall broadcast wide-area alerts and advisories to traveler information service providers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 7 The center shall broadcast wide-area alerts and advisories to maintenance centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 8 The center shall broadcast wide-area alerts and advisories to other emergency management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 9 The center shall process status information from each of the centers that have been sent the wide-area alert.
- Requirement:* 10 The center shall coordinate the broadcast of wide-area alerts and advisories with other emergency management centers.
- Requirement:* 11 The center shall receive incident information from other transportation management centers to support the early warning system.
- Requirement:* 12 The center shall present the alert and advisory information and the status of the actions taken in response to the alert by the other centers to the emergency system operator as received from other system inputs.
- Requirement:* 13 The center shall support the entry of alert and advisory information directly from the emergency system operator.

Functional Area: **Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

- Requirement:* 1 The center shall provide strategic emergency response capabilities such as that of an Emergency Operations Center for large-scale incidents and disasters.

Architecture

Northern New Jersey ITS Architecture

Element: **NJTPA Counties EOCs**

Entity: **Emergency Management**

Functional Area: **Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

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| <i>Requirement:</i> | 2 The center shall manage coordinated inter-agency responses to and recovery from large-scale emergencies. Such agencies include traffic management, transit, maintenance and construction management, rail operations, and other emergency management agencies. |
| <i>Requirement:</i> | 3 The center shall provide the capability to implement response plans and track progress through the incident by exchanging incident information and distributing response status to allied agencies. |
| <i>Requirement:</i> | 4 The center shall develop, coordinate with other agencies, and store emergency response plans. |
| <i>Requirement:</i> | 5 The center shall track the availability of resources (including vehicles, roadway cleanup?, etc.), request additional resources from traffic, maintenance, or other emergency centers if needed. |
| <i>Requirement:</i> | 6 The center shall allocate the appropriate emergency services, resources, and vehicle (s) to respond to incidents, and shall provide the capability to override the current allocation to suit the special needs of a current incident. |
| <i>Requirement:</i> | 7 The center shall receive event scheduling information from Event Promoters. |
| <i>Requirement:</i> | 8 The center shall receive hazardous materials incident information from commercial fleet operators. |
| <i>Requirement:</i> | 9 The center shall provide the capability to request the safe disabling of a commercial vehicle during a hazardous materials incident. |
| <i>Requirement:</i> | 10 The center shall provide the capability to request transit resource availability from transit centers for use during disaster and evacuation operations. |
| <i>Requirement:</i> | 11 The center shall assimilate the status of the transit, traffic, rail, maintenance, and other emergency center services and systems to create an overall transportation system status, and disseminate to each of these centers and the traveling public via traveler information providers. |
| <i>Requirement:</i> | 12 The center shall provide information to the media concerning the status of an emergency response. |
| <i>Requirement:</i> | 13 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator. |
| <i>Requirement:</i> | 14 The center shall provide the capability for center personnel to provide inputs to the management of incidents, disasters and evacuations. |
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Functional Area: **Incident Command**

Tactical decision support, resource coordination, and communications integration among emergency management agencies for Incident Commands that are established by first responders to support local management of an incident.

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| <i>Requirement:</i> | 1 The center shall provide tactical decision support, resource coordination, and communications integration for Incident Commands that are established by first responders to support local management of an incident. |
| <i>Requirement:</i> | 2 The center shall provide incident command communications with public safety, emergency management, transportation, and other allied response agency centers. |
| <i>Requirement:</i> | 3 The center shall track and maintain resource information and action plans pertaining to the incident command. |
| <i>Requirement:</i> | 4 The center shall share incident command information with other public safety agencies including resource deployment status, hazardous material information, rail incident information, evacuation advice as well as traffic, road, and weather conditions. |
| <i>Requirement:</i> | 5 The center shall assess the status of responding emergency vehicles as part of an incident command. |
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Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Counties EOCs***Entity:* **Emergency Management***Functional Area:* **Emergency Evacuation Support**

Evacuation planning and coordination to manage evacuation and reentry of a population in the vicinity of a disaster or other emergency that poses a risk to public safety.

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| <i>Requirement:</i> | 1 The center shall manage inter-agency coordination of evacuation operations, from initial planning through the evacuation process and reentry. |
| <i>Requirement:</i> | 2 The center shall develop and exchange evacuation plans with allied agencies prior to the occurrence of a disaster. |
| <i>Requirement:</i> | 3 The center shall provide an interface to the emergency system operator to enter evacuation plans and procedures and present the operator with other agencies' plans. |
| <i>Requirement:</i> | 4 The center shall coordinate evacuation destinations and shelter needs with shelter providers (e.g., the American Red Cross) in the region. |
| <i>Requirement:</i> | 5 The center shall provide evacuation information to traffic, transit, maintenance and construction, rail operations, and other emergency management centers as needed. |
| <i>Requirement:</i> | 6 The center shall request resources from transit agencies as needed to support the evacuation. |
| <i>Requirement:</i> | 7 The center shall request traffic management agencies to implement special traffic control strategies and to control evacuation traffic, including traffic on local streets and arterials as well as the major evacuation routes. |
| <i>Requirement:</i> | 8 The center shall provide traveler information systems with evacuation guidance including basic information to assist potential evacuees in determining whether evacuation is necessary and when it is safe to return. |
| <i>Requirement:</i> | 9 The center shall monitor the progress or status of the evacuation once it begins and exchange tactical plans, prepared during the incident, with allied agencies. |
| <i>Requirement:</i> | 10 The center shall monitor the progress of the reentry process. |
| <i>Requirement:</i> | 11 The center shall submit evacuation information to toll administration centers along with requests for changes in the toll services or fee collection during an evacuation. |

Functional Area: **Emergency Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and emergency vehicles equipped with environmental sensors; used by the operator to more effectively manage incidents.

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| <i>Requirement:</i> | 1 The center shall collect current and forecast road and weather information from weather service providers (such as the National Weather Service and value-added sector specific meteorological services). |
| <i>Requirement:</i> | 2 The center shall receive environmental probe information from its fleet of emergency vehicles. |
| <i>Requirement:</i> | 3 The center shall collect current road and weather information from roadway maintenance operations. |
| <i>Requirement:</i> | 4 The center shall assimilate current and forecast road conditions and surface weather information to support incident management. |
| <i>Requirement:</i> | 5 The center shall present the current and forecast road and weather information to the emergency system operator. |
| <i>Requirement:</i> | 6 The center shall provide aggregated or processed environmental probe information from its fleet of emergency vehicles to traffic management and maintenance centers. |

Functional Area: **Center Secure Area Surveillance**

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Counties EOCs***Entity:* **Emergency Management***Functional Area:* **Center Secure Area Surveillance**

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 1 The center shall remotely monitor video images and audio surveillance data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The data may be raw or pre-processed in the field.
- Requirement:* 2 The center shall remotely monitor video images and audio surveillance data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The data may be raw or pre-processed in the field.
- Requirement:* 3 The center shall remotely monitor video images and audio surveillance data collected on-board transit vehicles. The data may be raw or pre-processed in the field.
- Requirement:* 4 The center shall exchange surveillance data with other emergency centers.
- Requirement:* 5 The center shall identify potential security threats based on collected security surveillance data.
- Requirement:* 6 The center shall verify potential security threats by correlating security surveillance data from multiple sources.
- Requirement:* 7 The center shall remotely control security surveillance devices in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways).
- Requirement:* 8 The center shall remotely control security surveillance devices in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers).
- Requirement:* 9 The center shall remotely control security surveillance devices on-board transit vehicles.
- Requirement:* 10 The center shall match traveler video images against a database from the Alerting and Advisory Systems of known images that may represent criminals and terrorists.
- Requirement:* 11 The center shall exchange traveler images with other emergency management centers to support traveler image matching.
- Requirement:* 12 The center shall respond to control data from center personnel regarding security surveillance data collection, processing, threat detection, and image matching.

Functional Area: **Center Secure Area Sensor Management**

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 1 The center shall remotely monitor and control security sensor data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), infrastructure condition and integrity, intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.

Architecture**Northern New Jersey ITS Architecture***Element:***NJTPA Counties EOCs***Entity:***Emergency Management***Functional Area:* **Center Secure Area Sensor Management**

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 2 The center shall remotely monitor and control security sensor data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 3 The center shall remotely monitor and control security sensor data collected on-board transit vehicles. The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors) and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 4 The center shall exchange security sensor data with other emergency centers.
- Requirement:* 5 The center shall identify potential security threats based on collected security sensor data.
- Requirement:* 6 The center shall verify potential security threats by correlating security sensor data from multiple sources.
- Requirement:* 7 The center shall perform threat analysis based on correlations of security sensor and surveillance data.
- Requirement:* 8 The center shall exchange threat analysis data with Alerting and Advisory Systems and use that data in local threat analysis processing.
- Requirement:* 9 The center shall disseminate threat information to other agencies, including traffic, transit, maintenance, rail operations, and other emergency management centers.
- Requirement:* 10 The center shall respond to control data from center personnel regarding security sensor data collection, processing, threat detection, and threat analysis.

*Element:***NJTPA Counties ITS Field Equipment***Entity:***Roadway Subsystem***Functional Area:* **Roadway Basic Surveillance**

Field elements that monitor traffic conditions using loop detectors and CCTV cameras.

- Requirement:* 1 The field element shall collect, process, digitize, and send traffic sensor data (speed, volume, and occupancy) to the center for further analysis and storage, under center control.
- Requirement:* 2 The field element shall collect, process, and send traffic images to the center for further analysis and distribution.
- Requirement:* 3 The field element shall collect, digitize, and send pedestrian sensor data to the center for further analysis and storage.
- Requirement:* 4 The field element shall collect, process, and send pedestrian images to the center for further analysis and distribution.
- Requirement:* 5 The field element shall collect, digitize, and send multimodal crossing and high occupancy vehicle (HOV) lane sensor data to the center for further analysis and storage.
- Requirement:* 6 The field element shall return sensor and CCTV system operational status to the controlling center.
- Requirement:* 7 The field element shall return sensor and CCTV system fault data to the controlling center for repair.

Functional Area: **Roadway Probe Beacons**

Architecture**Northern New Jersey ITS Architecture****Element: NJTPA Counties ITS Field Equipment****Entity: Roadway Subsystem****Functional Area: Roadway Probe Beacons**

Field elements to collect traffic and road conditions from passing vehicles; both anonymous toll/parking tag readings for link time calculations and smart probe data supported.

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| <i>Requirement:</i> | 1 The field element shall use toll and parking tags on passing vehicles for traffic data link time calculations and send to the controlling center; tag identities will be removed to ensure anonymity. |
| <i>Requirement:</i> | 2 The field element shall include equipment that monitors traffic conditions (e.g., average speed) by communicating with passing vehicles equipped with a transponder or other short range communications device; also called smart probes. |
| <i>Requirement:</i> | 3 The field element shall include equipment that monitors road conditions by communicating with passing vehicles equipped with a transponder or other short range communications device; also called smart probes. |
| <i>Requirement:</i> | 4 The field element shall aggregate, format, and store collected vehicle smart probe data (traffic and road conditions data), calculate link travel times and processed road condition data, and send to future passing vehicles. |
| <i>Requirement:</i> | 5 The field element shall provide roadside beacon equipment operational status to the center. |
| <i>Requirement:</i> | 6 The field element shall provide roadside beacon equipment fault indication to the center for repair. |

Functional Area: Roadway Signal Controls

Field elements including traffic signal controllers for use at major intersections and on main highways for urban areas; also supports pedestrian crossings.

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| <i>Requirement:</i> | 1 The field element shall control traffic signals at intersections and on main highways for urban and rural areas, under center control. |
| <i>Requirement:</i> | 2 The field element shall collect pedestrian images and pedestrian sensor data, and respond to pedestrian crossing requests via display, audio signal, or other manner. |
| <i>Requirement:</i> | 3 The field element shall provide the capability to notify the traffic management center that a pedestrian has requested right-of-way and when the request was or will be granted (request for right-of-way). |
| <i>Requirement:</i> | 4 The field element shall monitor operation of traffic signal controllers and report to the center any instances in which the indicator response does not match that expected from the indicator control information. |
| <i>Requirement:</i> | 5 The field element shall monitor operation of traffic signal controllers and report to the center any instances in which the indicator response does not match that expected from known indicator preemptions. |
| <i>Requirement:</i> | 6 The field element shall return traffic signal controller operational status to the controlling center. |
| <i>Requirement:</i> | 7 The field element shall return traffic signal controller fault data to the maintenance center for repair. |

Functional Area: Roadway Signal Priority

Field elements that provide the capability to receive vehicle signal priority requests and control traffic signals accordingly.

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| <i>Requirement:</i> | 1 The field element shall respond to requests for indicator (e.g., signal) preemption requests from emergency vehicles at intersections, pedestrian crossings, and multimodal crossings. |
| <i>Requirement:</i> | 2 The field element shall respond to requests for indicator (e.g., signal) priority requests from transit vehicles at intersections, pedestrian crossings, and multimodal crossings. |
| <i>Requirement:</i> | 3 The field element shall notify controlling traffic management center and maintenance center that the signal timing has changed based on a signal preemption/priority request to help those centers determine whether a fault detected at the signal is a true malfunction or due to a signal override. |

Architecture**Northern New Jersey ITS Architecture****Element: NJTPA Counties ITS Field Equipment****Entity: Roadway Subsystem****Functional Area: Roadway Traffic Information Dissemination**

Driver information systems, such as dynamic message signs and Highway Advisory Radio (HAR).

- Requirement:* 1 The field element shall include dynamic messages signs for dissemination of traffic and other information to drivers, under center control; the DMS may be either those that display variable text messages, or those that have fixed format display(s) (e.g. vehicle restrictions, or lane open/close).
- Requirement:* 2 The field element shall include driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers, under center control.
- Requirement:* 3 The field element shall include pedestrian information systems under center control (e.g. warning pedestrians of a potential hazard, or providing mandatory instructions as to the availability of pedestrian access).
- Requirement:* 4 The field element shall provide operational status for the driver information systems equipment (DMS, HAR, etc.) to the center.
- Requirement:* 5 The field element shall provide fault data for the driver information systems equipment (DMS, HAR, etc.) to the center for repair.

Functional Area: Standard Rail Crossing

Field elements at highway-rail intersections (HRIs) where operational requirements do not dictate advanced features (e.g., where rail operational speeds are less than 80 miles per hour). Includes traditional HRI warning systems augmented with other standard traffic management devices.

- Requirement:* 1 The field element shall collect and process, traffic sensor data in the vicinity of a highway-rail intersection (HRI).
- Requirement:* 2 The field element shall monitor the status of the highway-rail intersection (HRI) equipment, including both the current state and mode of operation and the current equipment condition, to be forwarded on to the traffic management center.
- Requirement:* 3 The field element shall monitor the status of the highway-rail intersection (HRI) equipment, including both the current state and mode of operation and the current equipment condition, to be forwarded on to the rail wayside equipment.
- Requirement:* 4 The field element shall receive track status from the rail wayside equipment that can be passed on to the traffic management center. This may include the current status of the tracks and whether a train is approaching.
- Requirement:* 5 The field element shall collect pedestrian images and pedestrian sensor data, and respond to pedestrian crossing requests via display, audio signal, or other manner.
- Requirement:* 6 The field element shall control the dynamic message signs (DMS) in the vicinity of a highway-rail intersection (HRI) to advise drivers, cyclists, and pedestrians of approaching trains.
- Requirement:* 7 The field element shall close the highway-rail intersection (HRI) when a train is approaching using gates, lights/signs, barriers, and traffic control signals.
- Requirement:* 8 The field element shall support the integrated control of adjacent traffic signals to clear an area in advance of an approaching train and to manage traffic around the intersection.
- Requirement:* 9 The field element shall forward rail traffic advisories received from the Wayside Equipment to the traffic management center.

Functional Area: Advanced Rail Crossing

Field elements at highway-rail intersections (HRIs) where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). Capabilities from the Standard Rail Crossing plus systems which preclude entrance into the intersection when the barriers are activated, additional arriving train information, and detection of blocked intersections.

Architecture**Northern New Jersey ITS Architecture****Element: NJTPA Counties ITS Field Equipment****Entity: Roadway Subsystem****Functional Area: Advanced Rail Crossing**

Field elements at highway-rail intersections (HRIs) where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). Capabilities from the Standard Rail Crossing plus systems which preclude entrance into the intersection when the barriers are activated, additional arriving train information, and detection of blocked intersections.

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| <i>Requirement:</i> | 1 The field element shall collect and process, traffic sensor data in the vicinity of a highway-rail intersection (HRI). |
| <i>Requirement:</i> | 2 The field element shall determine whether the highway-rail intersection (HRI) is blocked by traffic in the roadway or some other obstruction. |
| <i>Requirement:</i> | 3 The field element shall notify the traffic management center and the rail wayside equipment of any intersection blockages, including trapped vehicles or other obstructions. |
| <i>Requirement:</i> | 4 The field element shall monitor the status of the highway-rail intersection (HRI) equipment, including both the current state and mode of operation and the current equipment condition, to be forwarded on to the traffic management center. |
| <i>Requirement:</i> | 5 The field element shall monitor the status of the highway-rail intersection (HRI) equipment, including both the current state and mode of operation and the current equipment condition, to be forwarded on to the rail wayside equipment. |
| <i>Requirement:</i> | 6 The field element shall receive track status and arriving train information from the rail wayside equipment that can be passed on to the traffic management center. This may include the current status of the tracks and when a train is expected and/or how long the crossing will be closed. |
| <i>Requirement:</i> | 7 The field element shall collect pedestrian images and pedestrian sensor data, and respond to pedestrian crossing requests via display, audio signal, or other manner. |
| <i>Requirement:</i> | 8 The field element shall control the dynamic message signs (DMS) in the vicinity of a highway-rail intersection (HRI) to advise drivers, cyclists, and pedestrians of approaching trains. |
| <i>Requirement:</i> | 9 The field element shall close the highway-rail intersection (HRI) when a train is approaching with enough time for traffic to safely clear the crossing using gates, lights/signs, barriers, and traffic control signals. |
| <i>Requirement:</i> | 10 The field element shall support the integrated control of adjacent traffic signals to clear an area in advance of an approaching train and to manage traffic around the intersection. |
| <i>Requirement:</i> | 11 The field element shall forward rail traffic advisories received from the Wayside Equipment to the traffic management center. |

Functional Area: Roadway Equipment Coordination

Field elements that control and send data to other field elements (such as environmental sensors that send data to a DMS or coordination between traffic controllers on adjacent intersections), without center control.

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| <i>Requirement:</i> | 1 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that provide data and status information to other field element devices (such as dynamic message signs, ramp meters, traffic signals, work zone intrusion alert systems), without center control. |
| <i>Requirement:</i> | 2 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that receive control information from other field element devices, without center control. |
| <i>Requirement:</i> | 3 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that provide data and status information to other field element devices (such as dynamic message signs, traffic controllers on adjacent intersections), without center control. |

Architecture**Northern New Jersey ITS Architecture****Element: NJTPA Counties ITS Field Equipment****Entity: Roadway Subsystem****Functional Area: Roadway Equipment Coordination**

Field elements that control and send data to other field elements (such as environmental sensors that send data to a DMS or coordination between traffic controllers on adjacent intersections), without center control.

- Requirement:* 4 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that receive control information from other field element devices, without center control.

Functional Area: Roadway Environmental Monitoring

Environmental sensors, surface and sub-surface, that collect weather and road surface information. Weather conditions measured include temperature, wind, humidity, precipitation, and visibility. Sensors measure road surface temperature, moisture, icing, salinity, etc.

- Requirement:* 1 The field element shall include surface and sub-surface environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures.
- Requirement:* 2 The field element shall include environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.
- Requirement:* 3 The field element's environmental sensors shall be remotely controlled by a maintenance center.
- Requirement:* 4 The field element's environmental sensors shall be remotely controlled by a traffic management center.
- Requirement:* 5 The field element's environmental sensors shall be remotely controlled by weather service providers such as the National Weather Service or value-added sector specific meteorological services.
- Requirement:* 6 The field element's environmental sensors shall be remotely controlled by a maintenance and construction vehicle.
- Requirement:* 7 The field element shall provide environmental sensor equipment operational status to the controlling center or maintenance vehicle.
- Requirement:* 8 The field element shall provide environmental sensor equipment fault indication to the controlling center or maintenance vehicle.
- Requirement:* 9 The field element shall remotely aggregate environmental sensor data with environmental data collected from maintenance and construction vehicles.
- Requirement:* 10 The field element shall provide weather and road surface condition data to centers.
- Requirement:* 11 The field element shall provide weather and road surface condition data to maintenance and construction vehicles.

Functional Area: Multimodal Crossing Control

Field elements to monitor and control traffic at multimodal crossings, such as draw bridges and other crossings between highway traffic and other modes; does not include highway-rail intersection.

- Requirement:* 1 The field element shall include sensors to monitor requests from non-highway traffic to cross at multimodal crossings for specified durations (such as draw bridges and miscellaneous other interference crossings between highway traffic and other modes such as river traffic, aircraft, etc.); the sensors are under center control.
- Requirement:* 2 The field element shall include signals to control traffic at multimodal crossings on surface streets, under center control.
- Requirement:* 3 The field element shall include driver information systems (such as dynamic messages signs, highway advisory radios (HAR), and equipment that controls warning lights and gates) that advise drivers at multimodal crossings, under center control.
- Requirement:* 4 The field element shall provide operational status for the sensors, signals, and driver information systems equipment at multimodal crossings to the center.

Architecture

Northern New Jersey ITS Architecture

Element: **NJTPA Counties ITS Field Equipment**

Entity: **Roadway Subsystem**

Functional Area: **Multimodal Crossing Control**

Field elements to monitor and control traffic at multimodal crossings, such as draw bridges and other crossings between highway traffic and other modes; does not include highway-rail intersection.

Requirement: 5 The field element shall provide fault data for the sensors, signals, and driver information systems equipment at multimodal crossings to the center for repair.

Requirement: 6 The field element shall forward all requests for right-of-way at multimodal crossings to the controlling center.

Element: **NJTPA Counties PWD Operations**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Vehicle Tracking**

Remotely tracks the location of maintenance and construction vehicles and other equipment; presented to the center personnel.

Requirement: 1 The center shall monitor the locations of all maintenance and construction vehicles and other equipment under its jurisdiction.

Requirement: 2 The center shall present location data to center personnel for the fleet of maintenance and construction vehicles and other equipment.

Requirement: 3 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for maintenance and construction vehicle tracking.

Functional Area: **MCM Vehicle and Equipment Maintenance Management**

Monitors vehicle and equipment condition, tracks maintenance history, and schedules routine and corrective maintenance.

Requirement: 1 The center shall collect and analyze vehicle diagnostics information from maintenance and construction vehicles. The information includes engine temperature, mileage, tire wear, brake wear, belt wear, and any warnings or alarms concerning the operational condition of the vehicle and ancillary equipment.

Requirement: 2 The center shall exchange information with equipment repair facilities including status and history of repairs concerning maintenance and construction vehicles. This information includes vehicle status and diagnostic information, vehicle utilization, and coordination of when vehicles will be available for preventative and corrective maintenance.

Requirement: 3 The center shall schedule preventive and corrective vehicle maintenance with the equipment repair facility based on fleet health reports, maintenance records, vehicle utilization and vehicle availability schedules.

Functional Area: **MCM Environmental Information Collection**

Remotely controls environmental sensors and assimilates collected data with other current and forecast road conditions and surface weather information from weather service providers and transportation operations.

Requirement: 1 The center shall remotely control environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures.

Requirement: 2 The center shall remotely control environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.

Requirement: 3 The center shall remotely control environmental sensors on-board maintenance and construction vehicles that measure road and weather conditions including air and surface temperatures, wind speed, humidity, precipitation, visibility and other measures.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Counties PWD Operations***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Environmental Information Collection**

Remotely controls environmental sensors and assimilates collected data with other current and forecast road conditions and surface weather information from weather service providers and transportation operations.

- Requirement:* 4 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services), data from traffic, emergency, and transit management, traveler information providers, and environmental data collected from sensors deployed on and about the roadway as well as the fleet of maintenance and construction vehicles.
- Requirement:* 5 The center shall provide weather and road condition information to weather service providers and center personnel.
- Requirement:* 6 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.
- Requirement:* 7 The center shall collect operational status for the roadside and vehicle-based environmental sensor equipment.
- Requirement:* 8 The center shall collect fault data for the roadside and vehicle-based environmental sensor equipment for repair.

Functional Area: **MCM Environmental Information Processing**

Processes current and forecast weather data, road condition information, local environmental data, and uses internal models to develop specialized detailed forecasts of local weather and surface conditions. Disseminates road weather information to other agencies and centers.

- Requirement:* 1 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.
- Requirement:* 2 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services) and local environmental sensor data.
- Requirement:* 3 The center shall use the various data inputs of environmental sensors and road weather data to develop a view of current and predicted road weather and road conditions.
- Requirement:* 4 The center shall disseminate current and forecasted road weather and road condition information to weather service providers (such as the National Weather Service and value-added sector specific meteorological services) as well as other agencies including traffic, emergency, and transit management, traveler information providers, rail operations centers, media, and other maintenance management centers.
- Requirement:* 5 The center shall provide value-added sector specific meteorological services with information on basic road facility and treatment information that supports forecasts for road conditions.

Functional Area: **MCM Incident Management**

Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.

- Requirement:* 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.
- Requirement:* 2 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, etc.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Counties PWD Operations***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Incident Management**

Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.

- Requirement:* 3 The center shall exchange incident and threat information with emergency management centers as well as traffic management centers; including notification of existence of incident and expected severity, location, time and nature of incident.
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- Requirement:* 4 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.
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- Requirement:* 5 The center shall respond to requests from emergency management to provide maintenance and construction resources to implement response plans, assist in clean up, verify an incident, etc. This may also involve coordination with traffic management centers and other maintenance centers.
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- Requirement:* 6 The center shall exchange road network status assessment information with emergency management and traffic management centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.
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- Requirement:* 7 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.
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- Requirement:* 8 The center shall receive information indicating the damage sustained by transportation assets, derived from aerial surveillance, field reports, inspections, tests, and analyses to support incident management.

Functional Area: **MCM Maintenance Decision Support**

Maintenance Decision Support Systems recommend courses of action based on current and forecast environmental and road conditions (filtered and fused for specific time horizons) and additional application specific information. Recommendations and dispatch instructions are generated based on this integrated information.

- Requirement:* 1 The center shall provide the center personnel with tailored external information, including weather or road condition observations, forecasted weather information or road conditions, current usage of treatments and materials, available resources, equipment and vehicle availability, road network information, and source reliability information.
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- Requirement:* 2 The center shall tailor the decision support information to include filtering (selection from a large amount of external information), error reduction ('smoothing' the information), fusion (combination of disparate information to match the decision needs), and analysis (creating the decision).
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- Requirement:* 3 The center shall provide an interface to the center personnel to input control parameters for the decision support process and receive decisions or information presentation.
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- Requirement:* 4 The center shall provide dispatch information to maintenance and construction vehicles based on the outputs of the decision support system, including recommended roadway treatment actions.

Functional Area: **MCM Winter Maintenance Management**

Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.

- Requirement:* 1 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other winter roadway maintenance.

Architecture

Northern New Jersey ITS Architecture

Element: **NJTPA Counties PWD Operations**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Winter Maintenance Management**

Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.

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| <i>Requirement:</i> | 2 The center shall exchange information with administrative systems to support the planning and scheduling of winter maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration. |
| <i>Requirement:</i> | 3 The center shall provide status information about scheduled winter maintenance activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, and the media. |
| <i>Requirement:</i> | 4 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of winter maintenance activities. |
| <i>Requirement:</i> | 5 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of winter maintenance activities. |
| <i>Requirement:</i> | 6 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services). |
| <i>Requirement:</i> | 7 The center shall dispatch and route winter maintenance vehicle drivers and support them with route-specific environmental, incident, advisory, threat, alert, and traffic congestion information. |
| <i>Requirement:</i> | 8 The center shall determine the need for roadway treatment based on current and forecasted weather information, current usage of treatments and materials, available resources, requests for action from other agencies, and recommendations from the Maintenance Decision Support system, specifically under winter conditions. This supports winter maintenance such as plowing, treating, anti-icing, etc. |
| <i>Requirement:</i> | 9 The center shall provide dispatch instructions for vehicle operators based on input parameters from center personnel, specifically for winter conditions. This could include a treatment route, treatment application rates, start and end times, and other treatment instructions. |
| <i>Requirement:</i> | 10 The center shall support remote control of on-board maintenance and construction vehicle systems and field equipment that is remotely controlled by the vehicle such as adjusting material application rates and spread patterns. |
| <i>Requirement:</i> | 11 The center shall assess the current status of all winter maintenance activities, including actual work activities performed, current locations and operational conditions of vehicles, materials and equipment inventories, field equipment status, environmental information, etc. |
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Functional Area: **MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

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| <i>Requirement:</i> | 1 The center shall maintain an interface with asset management systems to track the inventory, restrictions, repair needs and status updates of transportation assets (pavement, bridges, signs, etc.) including location, installation and materials information, vendor/contractor, current maintenance status, standard height, width, and weight restrictions. |
| <i>Requirement:</i> | 2 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other roadway maintenance. |
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Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Counties PWD Operations***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

- Requirement:* 3 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
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- Requirement:* 4 The center shall provide emergency management and traffic management centers with information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.
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- Requirement:* 5 The center shall collect the status and fault data from roadside equipment, such as traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
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- Requirement:* 6 The center shall collect the status and fault data from traffic management centers, including data for traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
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- Requirement:* 7 The center shall remotely control and collect data from infrastructure monitoring sensors located along the roadway infrastructure or on maintenance and construction vehicles.
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- Requirement:* 8 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of roadway maintenance and construction activities.
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- Requirement:* 9 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of roadway maintenance and construction activities.
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- Requirement:* 10 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
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- Requirement:* 11 The center shall dispatch and route maintenance and construction vehicle drivers and support them with route- specific environmental, incident, advisory, threat, alert, and traffic congestion information.
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- Requirement:* 12 The center shall manage an interface with center personnel to accept vehicle systems control information and remotely control maintenance and construction vehicle on-board equipment.
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- Requirement:* 13 The center shall track the status of roadway maintenance and construction activities by monitoring collected data from the dispatched vehicles and equipment.

Functional Area: **MCM Work Zone Management**

Remotely monitors and supports work zone activities, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).

- Requirement:* 1 The center shall generate new work zone activity schedules for use by maintenance and construction vehicles, maintenance and construction operators, and for information coordination purposes.
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- Requirement:* 2 The center shall control the collection of work zone status information including video images from cameras located in or near the work zone.

Architecture

Northern New Jersey ITS Architecture

Element: **NJTPA Counties PWD Operations**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Work Zone Management**

Remotely monitors and supports work zone activities, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).

Requirement: 3 The center shall disseminate work zone information to other agencies and centers including traffic, transit, emergency management centers, other maintenance centers, traveler information providers, and the media.

Requirement: 4 The center shall control traffic in work zones by providing remote control of dynamic message signs and highway advisory radio systems located in or near the work zone.

Requirement: 5 The center shall exchange information with administrative systems to support the planning and scheduling of work zone activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.

Functional Area: **MCM Work Activity Coordination**

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

Requirement: 1 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

Requirement: 2 The center shall provide status information about scheduled maintenance and construction activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, multimodal transportation providers, rail operations, and the media.

Requirement: 3 The center shall collect and respond to feedback concerning scheduled maintenance and construction activities with other management centers such as traffic, emergency, transit, and rail operations.

Requirement: 4 The center shall collect and disseminate asset restriction information levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.

Requirement: 5 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance and construction activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.

Requirement: 6 The center shall exchange rail schedules and work plans with rail operations centers.

Element: **NJTPA Counties PWD Vehicles**

Entity: **Maintenance and Construction Vehicle**

Functional Area: **MCV Vehicle Location Tracking**

On-board systems to track vehicle location and reports the position and timestamp information to the dispatch center.

Requirement: 1 The maintenance and construction vehicle shall compute the location of the vehicle based on inputs from a vehicle location determination function.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Counties PWD Vehicles***Entity:* **Maintenance and Construction Vehicle***Functional Area:* **MCV Vehicle Location Tracking**

On-board systems to track vehicle location and reports the position and timestamp information to the dispatch center.

- Requirement:* 2 The maintenance and construction vehicle shall send the timestamped vehicle location to the controlling center.

Functional Area: **MCV Vehicle System Monitoring and Diagnostics**

On-board sensors capable of monitoring the condition of each of the vehicle systems and diagnostics that can be used to support vehicle maintenance.

- Requirement:* 1 The maintenance and construction vehicle shall collect vehicle diagnostics and operating status data from the maintenance vehicle platform including engine temperature, mileage, tire wear, brake wear, belt wear, and other operational status measures as well as the status of maintenance and construction-specific systems on the vehicle.

- Requirement:* 2 The maintenance and construction vehicle shall use the diagnostic and status information to support scheduling vehicle maintenance, monitoring safety status, and informing the vehicle operator of the conditions.

- Requirement:* 3 The maintenance and construction vehicle shall the vehicle diagnostic and safety information to an equipment repair facility.

- Requirement:* 4 The maintenance and construction vehicle shall send the vehicle diagnostic and safety information to the controlling maintenance center.

Functional Area: **MCV Winter Maintenance**

On-board systems that support snow plow operations and other roadway treatments (e.g., salt spraying and other material applications). Supports platooning of snow plows.

- Requirement:* 1 The maintenance and construction vehicle shall track the location and status of safety systems on-board the vehicle.

- Requirement:* 2 The maintenance and construction vehicle shall respond to control information from the center to allow remote operation of the on-board vehicle systems. These systems include winter maintenance equipment for plowing, treating, and anti-icing.

- Requirement:* 3 The maintenance and construction vehicle shall monitor materials information including remaining quantity and current application rate of materials on the vehicle.

- Requirement:* 4 The maintenance and construction vehicle shall respond to dispatch information from the center, presented to the vehicle operator for acknowledgement and returning status.

- Requirement:* 5 The maintenance and construction vehicle shall send operational data to the center including the operational state of the maintenance equipment (e.g., blade up/down, spreader pattern), types and quantities of materials used for construction and maintenance activities, and a record of the actual work performed.

- Requirement:* 6 The maintenance and construction vehicle shall exchange operational and environmental data with other maintenance and construction vehicles. Operational data includes operational state of the maintenance equipment (e.g., blade up/down, spreader pattern, equipment configuration) and a record of the actual work performed while the environmental data includes environmental sensor data collected on-board a maintenance and construction vehicle, either raw or processed data.

Functional Area: **MCV Roadway Maintenance and Construction**

On-board systems that support routine non-winter maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of equipment on the roadway.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Counties PWD Vehicles***Entity:* **Maintenance and Construction Vehicle***Functional Area:* **MCV Roadway Maintenance and Construction**

On-board systems that support routine non-winter maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of equipment on the roadway.

- Requirement:*
- 1 The maintenance and construction vehicle shall track the location and status of safety systems on-board the vehicle.

Functional Area: **MCV Infrastructure Monitoring**

On-board systems to monitor the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts). Includes vehicle-based sensors and communications with roadway-based infrastructure monitoring sensors.

- Requirement:*
- 1 The maintenance and construction vehicle shall collect infrastructure data from on-board sensors relating to the physical characteristics of the roadway infrastructure, including pavement, bridges, culverts, signs, etc.

- Requirement:*
- 2 The maintenance and construction vehicle shall collect infrastructure data from sensors located along the roadway relating to the physical characteristics of the roadway infrastructure, including pavement, bridges, culverts, signs, etc.

Functional Area: **MCV Roadway Maintenance and Construction**

On-board systems that support routine non-winter maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of equipment on the roadway.

- Requirement:*
- 2 The maintenance and construction vehicle shall respond to control information from the center to allow remote operation of the on-board vehicle systems. These systems include routine maintenance equipment for cutting, repairs, hazard removal, etc.

Functional Area: **MCV Infrastructure Monitoring**

On-board systems to monitor the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts). Includes vehicle-based sensors and communications with roadway-based infrastructure monitoring sensors.

- Requirement:*
- 3 The maintenance and construction vehicle shall provide control signals to infrastructure monitoring sensors located at the roadway.

Functional Area: **MCV Roadway Maintenance and Construction**

On-board systems that support routine non-winter maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of equipment on the roadway.

- Requirement:*
- 3 The maintenance and construction vehicle shall monitor materials information including remaining quantity and current application rate of materials on the vehicle.

Functional Area: **MCV Infrastructure Monitoring**

On-board systems to monitor the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts). Includes vehicle-based sensors and communications with roadway-based infrastructure monitoring sensors.

- Requirement:*
- 4 The maintenance and construction vehicle shall send current condition of pavement, bridges, culverts, signs, and other roadway infrastructure as measured by on-board sensors or read from infrastructure-based sensors to the center. The data may include raw data or images (e.g., photo logs) that indicate the current status of the infrastructure.

Functional Area: **MCV Roadway Maintenance and Construction**

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Counties PWD Vehicles***Entity:* **Maintenance and Construction Vehicle***Functional Area:* **MCV Roadway Maintenance and Construction**

On-board systems that support routine non-winter maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of equipment on the roadway.

- Requirement:* 4 The maintenance and construction vehicle shall respond to dispatch information from the center, presented to the vehicle operator for acknowledgement and returning status.

Functional Area: **MCV Infrastructure Monitoring**

On-board systems to monitor the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts). Includes vehicle-based sensors and communications with roadway-based infrastructure monitoring sensors.

- Requirement:* 5 The maintenance and construction vehicle shall provide infrastructure sensor equipment operational status to the center.

Functional Area: **MCV Roadway Maintenance and Construction**

On-board systems that support routine non-winter maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of equipment on the roadway.

- Requirement:* 5 The maintenance and construction vehicle shall send operational data to the center including the operational state of the maintenance equipment (e.g., blade up/down, spreader pattern), types and quantities of materials used for construction and maintenance activities, and a record of the actual work performed.

Element: **NJTPA Counties TOCs***Entity:* **Traffic Management***Functional Area:* **Collect Traffic Surveillance**

Management of traffic sensors and surveillance (CCTV) equipment, and distribution of the collected information to other centers and operators.

- Requirement:* 1 The center shall monitor, analyze, and store traffic sensor data (speed, volume, occupancy) collected from field elements under remote control of the center.
- Requirement:* 2 The center shall monitor, analyze, and distribute traffic images from CCTV systems under remote control of the center.
- Requirement:* 3 The center shall monitor, analyze, and store pedestrian sensor data collected from field elements under remote control of the center.
- Requirement:* 4 The center shall monitor, analyze, and distribute pedestrian images from CCTV systems under remote control of the center.
- Requirement:* 5 The center shall monitor, analyze, and store multimodal crossing and high occupancy vehicle (HOV) lane sensor data under remote control of the center.
- Requirement:* 6 The center shall maintain a database of surveillance and sensors and the freeways, surface street and rural roadways, e.g. where they are located, to which part(s) of the network their data applies, the type of data, and the ownership of each link (that is, the agency or entity responsible for collecting and storing surveillance of the link) in the network.
- Requirement:* 7 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic data.
- Requirement:* 8 The center shall distribute road network conditions data (raw or processed) based on collected and analyzed traffic sensor and surveillance data to other centers.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Counties TOCs***Entity:* **Traffic Management***Functional Area:* **Collect Traffic Surveillance**

Management of traffic sensors and surveillance (CCTV) equipment, and distribution of the collected information to other centers and operators.

- Requirement:* 9 The center shall respond to control data from center personnel regarding sensor and surveillance data collection, analysis, storage, and distribution.

Functional Area: **TMC Probe Information Collection**

Collects, assimilates, and disseminates vehicle probe data collected from roadside beacons and centers controlling transit vehicles, emergency vehicles, toll collection points, and route-guided vehicles.

- Requirement:* 1 The center shall collect probe data including traffic and road conditions from vehicles via roadside beacon field elements; the data may be aggregated and initial link time calculations performed in the field.

- Requirement:* 2 The center shall collect road condition data from probe-equipped transit vehicles via transit management centers; the data may be aggregated and preliminarily processed at the sending center.

- Requirement:* 3 The center shall collect traffic data from probe-equipped emergency vehicles via emergency management centers; the data may be aggregated and initial link time calculations performed at the sending center.

- Requirement:* 4 The center shall collect traffic data from traveler information centers based on data from their subscriber vehicles; the data may be aggregated and initial link time calculations performed at the sending center.

- Requirement:* 5 The center shall collect traffic data from toll administrative centers containing journey times between toll collection points for those vehicles equipped for electronic toll collection; the data may be aggregated and processed at the sending center.

- Requirement:* 6 The center shall assimilate current and forecast traffic and road conditions based on collected probe data and distribute to other centers for dissemination to travelers.

- Requirement:* 7 The center shall collect operational status for the roadside probe data collection equipment.

- Requirement:* 8 The center shall collect fault data for the roadside probe data collection equipment for repair.

Functional Area: **TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

- Requirement:* 1 The center shall remotely control traffic signal controllers.

- Requirement:* 2 The center shall accept notifications of right-of-way requests from pedestrians.

- Requirement:* 3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center.

- Requirement:* 4 The center shall collect traffic signal controller fault data from the field.

- Requirement:* 5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.

Functional Area: **TMC Freeway Management**

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

- Requirement:* 1 The center shall remotely control systems to manage use of the freeways, including ramp meters, mainline metering, and lane controls.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Counties TOCs***Entity:* **Traffic Management***Functional Area:* **TMC Freeway Management**

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

Requirement: 2 The center shall collect operational status from ramp meters, mainline metering, and lane controls and compare against the control information sent by the center.

Requirement: 3 The center shall collect fault data from ramp meters, mainline metering, and lane controls.

Requirement: 4 The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, mainline metering, and lane controls), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the ramps themselves.

Functional Area: **TMC Traffic Information Dissemination**

Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.

Requirement: 1 The center shall remotely control dynamic messages signs for dissemination of traffic and other information to drivers.

Requirement: 2 The center shall remotely control driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers.

Requirement: 3 The center shall collect operational status for the driver information systems equipment (DMS, HAR, etc.).

Requirement: 4 The center shall collect fault data for the driver information systems equipment (DMS, HAR, etc.) for repair.

Requirement: 5 The center shall retrieve locally stored traffic information, including current and forecasted traffic information, road and weather conditions, traffic incident information, information on diversions and alternate routes, closures, and special traffic restrictions (lane/shoulder use, weight restrictions, width restrictions, HOV requirements), etc.

Requirement: 6 The center shall distribute traffic data to maintenance and construction centers, transit centers, emergency management centers, and traveler information providers.

Requirement: 7 The center shall distribute traffic data to the media upon request; the capability to provide the information in both data stream and graphical display shall be supported.

Requirement: 8 The center shall provide the capability for center personnel to control the nature of the data that is available to non-traffic operations centers and the media.

Functional Area: **TMC Regional Traffic Control**

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

Requirement: 1 The center shall exchange traffic information with other traffic management centers, includes incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.

Requirement: 2 The center shall exchange traffic control information with other traffic management centers, includes remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).

Functional Area: **TMC Incident Detection**

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Counties TOCs***Entity:* **Traffic Management***Functional Area:* **TMC Incident Detection**

Remotely controls traffic and video sensors to support incident detection and verification; exchange information with other agencies including emergency management, maintenance and construction, alerting and advisory systems, event promoters, intermodal freight depots, and traveler information systems.

- Requirement:* 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.
- Requirement:* 2 The center shall collect and store traffic flow and image data from the field equipment to detect and verify incidents.
- Requirement:* 3 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, and intermodal freight depots.
- Requirement:* 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.
- Requirement:* 5 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field.
- Requirement:* 6 The center shall provide road network conditions and traffic images to emergency management centers to support the detection, verification, and classification of incidents.
- Requirement:* 7 The center shall provide video and traffic sensor control commands to the field equipment to detect and verify incidents.

Functional Area: **TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

- Requirement:* 1 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction for distribution to the public. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, and information and instructions necessary for the public to respond to the alert. This may also identify specific information that should not be released to the public.
- Requirement:* 2 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.
- Requirement:* 3 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field, provide special routing for emergency vehicles, and to provide responding emergency vehicles with signal preemption.
- Requirement:* 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.
- Requirement:* 5 The center shall respond to requests from emergency management to provide traffic management resources to implement special traffic control measures, assist in clean up, verify an incident, etc. This may also involve coordination with maintenance centers.
- Requirement:* 6 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, media, and rail operations centers.
- Requirement:* 7 The center shall provide road network conditions and traffic images to emergency management centers, maintenance and construction centers, and traveler information service providers.

Architecture

Northern New Jersey ITS Architecture

Element: **NJTPA Counties TOCs**

Entity: **Traffic Management**

Functional Area: **TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

- Requirement:* 8 The center shall exchange road network status assessment information with emergency management and maintenance centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.
-
- Requirement:* 9 The center shall coordinate information and controls with other traffic management centers.
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- Requirement:* 10 The center shall receive inputs from emergency management and transit management centers to develop an overall status of the transportation system including emergency transit schedules in effect and current status and condition of the transportation infrastructure.
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- Requirement:* 11 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic incident management.
-

Functional Area: **TMC Evacuation Support**

Development, coordination, and execution of special traffic management strategies during evacuation and subsequent reentry of a population in the vicinity of a disaster or major emergency. Interfaces with emergency management and other traffic management centers.

- Requirement:* 1 The center shall coordinate planning for evacuation with emergency management centers - including pre-planning activities such as establishing routes, areas to be evacuated, timing, etc.
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- Requirement:* 2 The center shall support requests from emergency management centers to preempt the current traffic control strategy, activate traffic control and closure systems such as gates and barriers, activate safeguard systems, or use driver information systems to support evacuation traffic control plans.
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- Requirement:* 3 The center shall coordinate information and controls with other traffic management centers.
-
- Requirement:* 4 The center shall coordinate execution of evacuation strategies with emergency management centers - including activities such as setting closures and detours, establishing routes, updating areas to be evacuated, timing the process, etc.
-

Functional Area: **TMC Environmental Monitoring**

Management of environmental sensors and assimilation of collected data with other current and forecast road conditions and surface weather information from weather service providers and roadway maintenance operations.

- Requirement:* 1 The center shall remotely control environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures.
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- Requirement:* 2 The center shall remotely control environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.
-
- Requirement:* 3 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services), data from roadway maintenance operations, and environmental data collected from sensors deployed on and about the roadway.
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- Requirement:* 4 The center shall provide weather and road condition information to weather service providers and center personnel.
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- Requirement:* 5 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.
-

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Counties TOCs***Entity:* **Traffic Management***Functional Area:* **HRI Traffic Management**

Remotely monitor and control highway-rail intersection (HRI) equipment, includes standard speed active warning systems and high speed systems which provide additional information on approaching trains and detect and report on obstructions in the HRI.

Requirement: 1 The center shall remotely control highway-rail intersection (HRI) equipment located in the field.

Requirement: 2 The center shall accept collect highway-rail intersection (HRI) advisory or alert data from rail operations centers.

Requirement: 3 The center shall collect highway-rail intersection (HRI) equipment operational status and compare against the control information sent by the center.

Requirement: 4 The center shall provide the highway-rail intersection (HRI) equipment operational status to rail operations centers.

Requirement: 5 The center shall collect incident information related to a highway-rail intersection (HRI), such as intersection blockages or crashes or equipment malfunctions.

Requirement: 6 The center shall implement control plans to coordinate signalized intersections around highway-rail intersections (HRI), under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, equipment faults, pedestrian crossings, etc.

Functional Area: **Rail Operations Coordination**

Coordination between rail operations and traffic management centers - exchanging train schedules, maintenance schedules, as well as incidents and priority messages which result in highway-rail intersection (HRI). Supports advanced traffic control strategies and enhanced traveler information.

Requirement: 1 The center shall exchange highway-rail intersection (HRI) information with rail operations centers. This information may include event schedules, requests for information from the Rail Operators, incident notification based on rail operations messages, and priority messages like notifications of a HAZMAT spill, equipment failure, or an intersection blockage.

Requirement: 2 The center shall receive highway-rail intersection (HRI) maintenance schedules, train schedules, and incident notifications from rail operations centers.

Requirement: 3 The center shall use the rail operations information to develop forecast HRI closure times and durations which may be applied in advanced traffic control strategies or delivered as enhanced traveler information.

Functional Area: **TMC Multimodal Crossing Management**

Remotely monitors and manages multimodal crossings, such as draw bridges and other crossings between highway traffic and other modes; does not include highway-rail intersection.

Requirement: 1 The center shall receive requests from non-highway traffic to cross at multimodal crossings for specified durations (such as draw bridges and miscellaneous other interference crossings between highway traffic and other modes such as river traffic, aircraft, etc.)

Requirement: 2 The center shall remotely control traffic signal controllers for use at major multimodal crossings.

Requirement: 3 The center shall remotely control driver information systems (such as dynamic messages signs, highway advisory radios (HAR), and equipment that controls warning lights and gates) to notify drivers of closure durations and times at multimodal crossings.

Requirement: 4 The center shall collect operational status for the equipment at multimodal crossings.

Requirement: 5 The center shall collect fault data for the equipment at multimodal crossings for repair.

Requirement: 6 The center shall receive and respond to requests for right-of-way at multimodal crossings.

Requirement: 7 The center shall collect and analyze the planned multimodal crossing closures as a possible incident.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Counties TOCs***Entity:* **Traffic Management***Functional Area:* **TMC Multimodal Crossing Management**

Remotely monitors and manages multimodal crossings, such as draw bridges and other crossings between highway traffic and other modes; does not include highway-rail intersection.

- Requirement:* 8 The center shall distribute multimodal crossing information to other centers for dissemination to travelers.

Functional Area: **Traffic Maintenance**

Monitoring and remote diagnostics of field equipment - detect failures, issue problem reports, and track the repair or replacement of the failed equipment.

- Requirement:* 1 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) operational status.
- Requirement:* 2 The center shall collect and store CCTV surveillance system (traffic, pedestrian) operational status.
- Requirement:* 3 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) fault data and send to the maintenance center for repair.
- Requirement:* 4 The center shall collect and store CCTV surveillance system (traffic, pedestrian) fault data send to the maintenance center for repair.
- Requirement:* 5 The center shall collect environmental sensor operational status.
- Requirement:* 6 The center shall collect environmental sensor equipment fault data and send to the maintenance center for repair.
- Requirement:* 7 The center shall exchange data with maintenance centers concerning the reporting of faulty equipment and the schedule/status of their repair. Information exchanged includes details of new equipment faults, and clearances when the faults are cleared.
- Requirement:* 8 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic maintenance data.

Functional Area: **TMC Work Zone Traffic Management**

Coordination with maintenance systems using work zone images and traveler information systems (such as DMS), and distribution of work plans so that work zones are established that have minimum traffic impact.

- Requirement:* 1 The center shall receive work zone images from a maintenance center.
- Requirement:* 2 The center shall analyze work zone images for indications of a possible incident.
- Requirement:* 3 The center shall remotely control driver information systems (such as dynamic messages signs, highway advisory radios) to advise drivers of activity around a work zone.
- Requirement:* 4 The center shall collect operational status for the driver information systems equipment in work zones.
- Requirement:* 5 The center shall collect fault data for the driver information systems equipment in work zones for repair.
- Requirement:* 6 The center shall receive proposed maintenance and construction work plans, analyze the activity as a possible incident, and provide work plan feedback to the sending center.

Functional Area: **TMC Multimodal Coordination**

Provides traffic signal priority for transit vehicles based on center-to-center communications with the transit management center; also exchange traffic and transit information.

- Requirement:* 1 The center shall respond to requests from transit management centers for signal priority at one or more intersections along a particular transit route.

Architecture**Northern New Jersey ITS Architecture***Element:***NJTPA Counties TOCs***Entity:***Traffic Management***Functional Area:* **TMC Multimodal Coordination**

Provides traffic signal priority for transit vehicles based on center-to-center communications with the transit management center; also exchange traffic and transit information.

- Requirement:* 2 The center shall exchange information with transit management centers including details current transit routes, the level of service on each route, and the progress of individual vehicles along their routes.

Functional Area: **Traffic Data Collection**

Collection and storage of traffic management data. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect traffic management data such as operational data, event logs, etc.
- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.
- Requirement:* 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the traffic data or for the data itself.
- Requirement:* 4 The center shall be able to produce sample products of the data available.

*Element:***NJTPA Counties/Municipalities EMS/Fire Vehicles***Entity:***Emergency Vehicle Subsystem***Functional Area:* **On-board EV En Route Support**

On-board systems for gathering of dispatch and routing information for emergency vehicle personnel, vehicle tracking, communications with care facilities, and signal preemption via short range communication directly with traffic control equipment at the roadside.

- Requirement:* 1 The emergency vehicle, including roadway service patrols, shall compute the location of the emergency vehicle based on inputs from a vehicle location determination function.
- Requirement:* 2 The emergency vehicle, including roadway service patrols, shall send the vehicle's location and operational data to the center for emergency management and dispatch.
- Requirement:* 3 The emergency vehicle, including roadway service patrols, shall receive incident details and a suggested route when dispatched to a scene.
- Requirement:* 4 The emergency vehicle shall send the current en route status (including estimated time of arrival) and requests for emergency dispatch updates.
- Requirement:* 5 The emergency vehicle shall send requests to traffic signal control equipment at the roadside to preempt the signal.
- Requirement:* 6 The emergency vehicle shall provide the personnel on-board with dispatch information, including incident type and location, and forward an acknowledgment from personnel to the center that the vehicle is on its way to the incident scene.
- Requirement:* 7 The emergency vehicle shall send patient status information to the care facility along with a request for further information.
- Requirement:* 8 The emergency vehicle shall forward care facility status information to emergency vehicle personnel, including the location, specialized services, quality of care, waiting time, number of rooms available, and emergency room status of hospitals or emergency care providers.

Functional Area: **On-board EV Incident Management Communication**

On-board systems providing the direct interface between the emergency vehicle and incident management personnel at the incident site.

Architecture

Northern New Jersey ITS Architecture

Element: NJTPA Counties/Municipalities EMS/Fire Vehicles

Entity: Emergency Vehicle Subsystem

Functional Area: On-board EV Incident Management Communication

On-board systems providing the direct interface between the emergency vehicle and incident management personnel at the incident site.

- Requirement:*
- 1 The emergency vehicle shall receive dispatch instructions sufficient to enable emergency personnel in the field to implement an effective incident response. It includes local traffic, road, and weather conditions, hazardous material information, and the current status of resources that have been allocated to an incident.
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- Requirement:*
- 2 The emergency vehicle shall provide an interface to the center for emergency personnel to transmit information about the incident site such as the extent of injuries, identification of vehicles and people involved, hazardous material, etc.
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- Requirement:*
- 3 The emergency vehicle shall provide an interface to the center for emergency personnel to transmit information about the current incident response status such as the identification of the resources on site, site management strategies in effect, and current clearance status.

Element: NJTPA Counties/Municipalities Transit Customer Information / Display Systems

Entity: Remote Traveler Support

Functional Area: Remote Transit Information Services

Public traveler interface that provides real-time travel-related information at transit stops and multi-modal transfer points, including general annunciation, display of imminent arrival information, the latest available information on transit routes, schedules, transfer options, bicycle accessibility, fares, real-time schedule adherence, current incidents, weather conditions, and special events

- Requirement:*
- 1 The public interface for travelers shall collect and provide real-time travel-related information at transit stops, multi-modal transfer points, and other public transportation areas.
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- Requirement:*
- 2 The public interface for travelers shall collect and present to the transit traveler information on transit routes, schedules, and real-time schedule adherence.
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- Requirement:*
- 3 The public interface for travelers shall provide support for general annunciation and/or display of imminent arrival information and other information of general interest to transit users.
-
- Requirement:*
- 4 The public interface for travelers shall present information to the traveler in a form suitable for travelers with physical disabilities.

Element: NJTPA Counties/Municipalities Transit Fare Management Systems

Entity: Transit Management

Functional Area: Transit Center Fare and Load Management

Management of fare collection at the center - includes setting and distributing fare information, central processing of fares for transit as well as other ITS services, links to financial institutions and enforcement agencies.

- Requirement:*
- 1 The center shall manage the actual value of transit fares for each segment of each regular transit route, including the transmission of the information to transit vehicles and transit stops or stations.
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- Requirement:*
- 2 The center shall provide the capability for a system operator to manage the transit fares and control the exchange of transit fare information.
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- Requirement:*
- 3 The center shall process the financial requests from the transit vehicles or roadside and manage an interface to a Financial Institution.
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- Requirement:*
- 4 The center shall support the payment of transit fare transactions using data provided by the traveler cards / payment instruments.
-
- Requirement:*
- 5 The center shall collect data on fare payment violations and send the data, including images of the violator, to the appropriate enforcement agency.

Architecture

Northern New Jersey ITS Architecture

Element: **NJTPA Counties/Municipalities Transit Fare Management Systems**

Entity: **Transit Management**

Functional Area: **Transit Center Fare and Load Management**

Management of fare collection at the center - includes setting and distributing fare information, central processing of fares for transit as well as other ITS services, links to financial institutions and enforcement agencies.

- Requirement:* 6 The center shall process requests for transit fares to be paid in advance.
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- Requirement:* 7 The center shall process requests for the advanced payment of tolls and parking lot charges as well as other non-transportation services, e.g. yellow-pages services.
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- Requirement:* 8 The center shall be capable of establishing emergency fare structures to override all other fares during disasters, states of emergency, or evacuations.
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- Requirement:* 9 The center shall maintain a list of invalid traveler credit identities, or bad tag lists that can be forwarded to transit vehicles and transit stops or stations.
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- Requirement:* 10 The center shall collect passenger loading and fare statistics data to implement variable and flexible fare structures.
-
- Requirement:* 11 The center shall exchange fare and load information with other transit management centers, including potential Centralized Payments facilities.
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- Requirement:* 12 The center shall provide transit fare information to other centers, including traveler information providers upon request.
-

Element: **NJTPA Counties/Municipalities Transit Systems**

Entity: **Transit Management**

Functional Area: **Transit Center Tracking and Dispatch**

Monitoring transit vehicle locations via interactions with on-board systems and determining vehicle schedule adherence. Furnish users with real-time transit related information and maintain interface with digital map providers.

- Requirement:* 1 The center shall monitor the locations of all transit vehicles within its network.
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- Requirement:* 2 The center shall determine adherence of transit vehicles to their assigned schedule.
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- Requirement:* 3 The center shall collect trip monitoring data from on-board systems including transit vehicle mileage, fuel usage, passenger loading, availability, etc.
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- Requirement:* 4 The center shall provide transit operational data to traveler information service providers.
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- Requirement:* 5 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for transit tracking and dispatch.
-

Functional Area: **Transit Center Fixed-Route Operations**

Planning and scheduling associated with fixed and flexible route transit services, automatically updates customer service operator systems, and provides current vehicle schedule adherence and optimum scenarios for schedule adjustment.

- Requirement:* 1 The center shall generate transit routes and schedules based on such factors as parameters input by the system operator, road network conditions, operational data on current routes and schedules, and digitized map data.
-
- Requirement:* 2 The center shall provide the interface to the system operator to control the generation of new routes and schedules (transit services) including the ability to review and update the parameters used by the routes and schedules generation processes and to initiate these processes
-
- Requirement:* 3 The center shall be able to generate special routes and schedules to support an incident, disaster, evacuation, or other emergency.
-

Architecture**Northern New Jersey ITS Architecture****Element: NJTPA Counties/Municipalities Transit Systems****Entity: Transit Management****Functional Area: Transit Center Fixed-Route Operations**

Planning and scheduling associated with fixed and flexible route transit services, automatically updates customer service operator systems, and provides current vehicle schedule adherence and optimum scenarios for schedule adjustment.

- Requirement:* 4 The center shall accept requests from traffic management to change routes and schedules as part of the implementation of demand management strategies.
- Requirement:* 5 The center shall collect transit operational data for use in the generation of routes and schedules.
- Requirement:* 6 The center shall assign transit vehicle operators based on factors such as eligibility, route preferences, seniority, and transit vehicle availability.
- Requirement:* 7 The center shall manage large deviations of individual transit vehicles, deviations in rural areas, and deviations of large numbers of vehicles.
- Requirement:* 8 The center shall generate the necessary corrective actions which may involve more than the vehicles concerned and more far reaching action, such as, the introduction of extra vehicles, wide area signal priority by traffic management, the premature termination of some services, etc.
- Requirement:* 9 The center shall exchange information with Maintenance and Construction Operations concerning work zones, roadway conditions, asset restrictions, work plans, etc.
- Requirement:* 10 The center shall disseminate up-to-date schedules and route information to other centers for fixed and flexible route services.

Functional Area: Transit Center Paratransit Operations

Planning and scheduling of demand responsive transit (i.e. paratransit) services, includes automatic operator assignment and monitoring.

- Requirement:* 1 The center shall process trip requests for demand responsive transit services, i.e. paratransit. Sources of the requests may include traveler information service providers.
- Requirement:* 2 The center shall track the location and availability of transit vehicles for use in demand responsive transit (paratransit) operations.
- Requirement:* 3 The center shall generate demand responsive transit (paratransit) routes and schedules based on such factors as parameters input by the system operator, what other demand responsive transit schedules have been planned, the availability and location of vehicles, the relevance of any fixed transit routes and schedules, and road network information.
- Requirement:* 4 The center shall assign transit vehicle operators for confirmed demand responsive transit (paratransit) trips based on factors such as eligibility, route preferences, seniority, and transit vehicle availability.
- Requirement:* 5 The center shall exchange information with Maintenance and Construction Operations concerning work zones, roadway conditions, asset restrictions, work plans, etc.
- Requirement:* 6 The center shall disseminate up-to-date schedules and route information to other centers for demand responsive transit services (paratransit).

Functional Area: Transit Center Security

Monitor transit vehicle operator or traveler activated alarms; authenticate transit vehicle operators; remotely disable a transit vehicle; alert operators, travelers, and police to potential incidents identified by these security features.

- Requirement:* 1 The center shall monitor transit vehicle operational data to determine if the transit vehicle is off-route and assess whether a security incident is occurring.
- Requirement:* 2 The center shall receive reports of emergencies on-board transit vehicles entered directly by the transit vehicle operator or from a traveler through interfaces such as panic buttons or alarm switches.

Architecture

Northern New Jersey ITS Architecture

Element: **NJTPA Counties/Municipalities Transit Systems**

Entity: **Transit Management**

Functional Area: **Transit Center Security**

Monitor transit vehicle operator or traveler activated alarms; authenticate transit vehicle operators; remotely disable a transit vehicle; alert operators, travelers, and police to potential incidents identified by these security features.

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| <i>Requirement:</i> | 3 The center shall support the back-office portion of functionality to authenticate transit vehicle operators. |
| <i>Requirement:</i> | 4 The center shall exchange transit incident information along with other service data with other transit agencies. |
| <i>Requirement:</i> | 5 The center shall receive information pertaining to a wide-area alert such as weather alerts, disaster situations, or child abductions. This information may come from Emergency Management or from other Alerting and Advisory Systems. |
| <i>Requirement:</i> | 6 The center shall send wide-area alert information to travelers (on-board transit vehicles or at stations/stops) and transit vehicle operators. |
| <i>Requirement:</i> | 7 The center shall coordinate the response to security incidents involving transit with other agencies including Emergency Management, other transit agencies, media, traffic management, and traveler information service providers. |
| <i>Requirement:</i> | 8 The center shall receive threat information and status on the integrity of the transit infrastructure. |
| <i>Requirement:</i> | 9 The center shall provide support to remotely disable (or reset the disabling of) a transit vehicle in service. |
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Functional Area: **Transit Garage Operations**

Assignment of transit vehicles and operators to routes or service areas in a fair manner while minimizing labor and overtime services, considering operator preferences, qualifications, accumulated work hours, and other information about each operator.

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| <i>Requirement:</i> | 1 The center shall maintain records of a transit vehicle operator's performance. This may be done utilizing standardized performance evaluation criteria set forth by governmental regulations and transit operating company policies, assessing the transit vehicle operator's driving history, and assessing comments from the transit vehicle operator's supervisor(s) as well as noting any moving violations or accidents, supervisor comments, government regulations, and company policies. |
| <i>Requirement:</i> | 2 The center shall assess the transit vehicle operator's availability based on previous work assignments, accumulated hours, plus health and vacation commitments. |
| <i>Requirement:</i> | 3 The center shall assign transit vehicle operators to transit schedules based on their eligibility, route preferences, seniority, and transit vehicle availability. |
| <i>Requirement:</i> | 4 The center shall provide an interface through which the transit vehicle operator information can be maintained - either from the transit vehicle operator, a transit system operator (i.e. center personnel), or other functions. |
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Functional Area: **Transit Center Information Services**

Provide interactive traveler information to travelers (on-board transit vehicles, at stops/stations, using personal devices), traveler information service providers, media, and other transit organizations. Includes routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, yellow pages, and special events.

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| <i>Requirement:</i> | 1 The center shall provide travelers using public transportation with traffic and advisory information upon request. Such information may include transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events. |
| <i>Requirement:</i> | 2 The center shall provide transit information to the media including details of deviations from schedule of regular transit services. |

Architecture

Northern New Jersey ITS Architecture

Element: **NJTPA Counties/Municipalities Transit Systems**

Entity: **Transit Management**

Functional Area: **Transit Center Information Services**

Provide interactive traveler information to travelers (on-board transit vehicles, at stops/stations, using personal devices), traveler information service providers, media, and other transit organizations. Includes routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, yellow pages, and special events.

Requirement: 3 The center shall exchange transit schedules, real-time arrival information, fare schedules, and general transit service information with other transit organizations to support transit traveler information systems.

Requirement: 4 The center shall provide transit service information to traveler information service providers including routes, schedules, schedule adherence, and fare information as well as transit service information during evacuation.

Requirement: 5 The center shall enable yellow pages (including non-motorized transportation) information to be output to the traveler.

Requirement: 6 The center shall broadcast transit advisory data, including alerts and advisories pertaining to major emergencies, or man made disasters.

Functional Area: **Transit Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and vehicle probes. The information is monitored and forwarded to other agencies to more effectively manage transit operations.

Requirement: 1 The center shall assimilate current and forecast road conditions and surface weather information to more effectively manage transit operations.

Requirement: 2 The center shall collect current and forecast road and weather information from weather service providers and vehicle probes.

Requirement: 3 The center shall receive road network probe information from its fleet of transit vehicles.

Requirement: 4 The center shall provide road network probe information from its fleet of transit vehicles to traffic management as well as maintenance and construction management.

Functional Area: **Transit Center Multi-Modal Coordination**

Generate requests for transit priority on routes and at certain intersections. Coordinate schedules with other agencies and modes, including transit transfer cluster and transfer point information.

Requirement: 1 The center shall analyze transit vehicle schedule performance to determine the need for priority along certain routes or at certain intersections.

Requirement: 2 The center shall send requests for priority along routes or at intersections to traffic management.

Requirement: 3 The center shall coordinate schedules and services between transit agencies, traffic management, maintenance and construction operations, parking management, and other surface or air transportation modes.

Requirement: 4 The center shall share transfer cluster and transfer point information with multimodal transportation service providers, other transit agencies, and traveler information service providers. A transfer cluster is a collection of stops, stations, or terminals where transfers can be made conveniently.

Functional Area: **Transit Evacuation Support**

Support evacuation and subsequent reentry of a population in the vicinity of a disaster or other emergency. Coordinate regional evacuation plans and resources including transit and school bus fleets.

Requirement: 1 The center shall manage the use of transit resources to support evacuation and subsequent reentry of a population in the vicinity of a disaster or other emergency.

Architecture**Northern New Jersey ITS Architecture***Element:***NJTPA Counties/Municipalities Transit Systems***Entity:***Transit Management***Functional Area:* **Transit Evacuation Support**

Support evacuation and subsequent reentry of a population in the vicinity of a disaster or other emergency. Coordinate regional evacuation plans and resources including transit and school bus fleets.

Requirement: 2 The center shall coordinate regional evacuation plans with Emergency Management - identifying the transit role in an evacuation and the transit resources that would be used.

Requirement: 3 The center shall coordinate the use of transit and school bus fleets during an evacuation, supporting evacuation of those with special needs and the general population.

Requirement: 4 The center shall adjust and update transit service and fare schedules and provide that information to other agencies as they coordinate evacuations.

Functional Area: **Transit Data Collection**

Collection and storage of transit management data. For use by operations personnel or data archives in the region.

Requirement: 1 The center shall collect transit management data such as transit fares and passenger use, transit services, paratransit operations, transit vehicle maintenance data, etc.

Requirement: 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

Requirement: 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the transit data or for the data itself.

Requirement: 4 The center shall be able to produce sample products of the data available.

*Element:***NJTPA Counties/Municipalities Transit Vehicles***Entity:***Transit Vehicle Subsystem***Functional Area:* **On-board Transit Trip Monitoring**

Support fleet management with automatic vehicle location (AVL) and automated mileage and fuel reporting and auditing.

Requirement: 1 The transit vehicle shall compute the location of the transit vehicle based on inputs from a vehicle location determination function.

Requirement: 2 The transit vehicle shall support the computation of the location of a transit vehicle using on-board sensors to augment the location determination function. This may include proximity to the transit stops or other known reference points as well as recording trip length.

Requirement: 3 The transit vehicle shall record transit trip monitoring data including vehicle mileage and fuel usage.

Requirement: 4 The transit vehicle shall record transit trip monitoring data including operational status information such as doors open/closed, passenger loading, running times, etc.

Requirement: 5 The transit vehicle shall send the transit vehicle trip monitoring data to center-based trip monitoring functions.

Functional Area: **On-board Fixed Route Schedule Management**

Collecting of data for schedule generation and adjustment on-board a transit vehicle. Supports communication between the vehicle, operator, and center.

Requirement: 1 The transit vehicle shall receive transit route information for its assigned route including transit service instructions, traffic information, road conditions, and other information for the operator.

Requirement: 2 The transit vehicle shall use the route information and its current location to determine the deviation from the predetermined schedule.

Requirement: 3 The transit vehicle shall calculate the estimated times of arrival (ETA) at transit stops.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Counties/Municipalities Transit Vehicles***Entity:* **Transit Vehicle Subsystem***Functional Area:* **On-board Fixed Route Schedule Management**

Collecting of data for schedule generation and adjustment on-board a transit vehicle. Supports communication between the vehicle, operator, and center.

- Requirement:* 4 The transit vehicle shall determine scenarios to correct the schedule deviation.
- Requirement:* 5 The transit vehicle shall provide the schedule deviations and instructions for schedule corrections to the transit vehicle operator if the deviation is small, or the transit vehicle is operating in an urban area.
- Requirement:* 6 The transit vehicle shall send the schedule deviation and estimated arrival time information to the center.
- Requirement:* 7 The transit vehicle shall support the operations of a flexible route service. This may include requests for route deviations that would then lead to schedule corrective actions.

Functional Area: **On-board Paratransit Operations**

On-board systems to manage paratransit and flexible-route dispatch requests, including multi-stop runs. Inputs based on the transit vehicle's type and passenger capacity.

- Requirement:* 1 The transit vehicle shall manage data input to sensor(s) on-board a transit vehicle to determine the vehicle's availability for use in demand responsive and flexible-route transit services based on identity, type, and passenger capacity.
- Requirement:* 2 The transit vehicle shall receive the status of demand responsive or flexible-route transit schedules and passenger loading from the transit vehicle operator.
- Requirement:* 3 The transit vehicle shall provide the transit vehicle operator instructions about the demand responsive or flexible-route transit schedule that has been confirmed from the center.

Functional Area: **On-board Transit Security**

On-board video/audio surveillance systems, threat sensors, and object detection sensors to enhance security and safety on-board a transit vehicles. Also includes silent alarms activated by transit user or vehicle operator, operator authentication, and remote vehicle disabling.

- Requirement:* 1 The transit vehicle shall perform video and audio surveillance inside of transit vehicles and output raw video or audio data for either local monitoring (for processing or direct output to the transit vehicle operator), remote monitoring or for local storage (e.g., in an event recorder).
- Requirement:* 2 The transit vehicle shall perform local monitoring of video or audio surveillance data collected inside of transit vehicles, and identify potential incidents or threats based on received processing parameters.
- Requirement:* 3 The transit vehicle shall output an indication of potential incidents or threats and the processed video or audio information to the center along with the vehicle's current location.
- Requirement:* 4 The transit vehicle shall detect potential threats via sensors for chemical agents, toxic industrial chemicals, biological agents, explosives, and radiation.
- Requirement:* 5 The transit vehicle shall detect potential threats via object detection sensors(e.g. metal detectors).
- Requirement:* 6 The transit vehicle shall output an indication of potential incidents or threats and the processed sensor information to the center along with the vehicle's current location.
- Requirement:* 7 The transit vehicle shall accept sensor control data to allow remote control of the sensors.
- Requirement:* 8 The transit vehicle shall monitor and output surveillance and sensor equipment status and fault indications.
- Requirement:* 9 The transit vehicle shall accept emergency inputs from either the transit vehicle operator or a traveler through such interfaces as panic buttons, silent or audible alarms, etc.
- Requirement:* 10 The transit vehicle shall output reported emergencies to the center.

Architecture

Northern New Jersey ITS Architecture

Element: **NJTPA Counties/Municipalities Transit Vehicles**

Entity: **Transit Vehicle Subsystem**

Functional Area: **On-board Transit Security**

On-board video/audio surveillance systems, threat sensors, and object detection sensors to enhance security and safety on-board a transit vehicles. Also includes silent alarms activated by transit user or vehicle operator, operator authentication, and remote vehicle disabling.

Requirement: 11 The transit vehicle shall receive acknowledgments of the emergency request from the center and output this acknowledgment to the transit vehicle operator or to the travelers.

Requirement: 12 The transit vehicle shall be capable of receiving an emergency message for broadcast to the travelers or to the transit vehicle operator.

Requirement: 13 The transit vehicle shall be capable of disabling or enabling the transit vehicle based on commands from the center or authentic inputs from the transit vehicle operator.

Requirement: 14 The transit vehicle shall perform authentication of the transit vehicle operator.

Functional Area: **On-board Transit Information Services**

On-board systems to furnish next-stop annunciation as well as interactive travel-related information, including routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, non-motorized transportation services, and special events.

Requirement: 1 The transit vehicle shall enable traffic and travel advisory information to be requested and output to the traveler. Such information may include transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events.

Requirement: 2 The transit vehicle shall enable yellow pages (including non-motorized transportation) information to be requested and output to the traveler.

Requirement: 3 The transit vehicle shall broadcast advisories about the imminent arrival of the transit vehicle at the next stop via an on-board automated annunciation system.

Requirement: 4 The transit vehicle shall support input and output forms that are suitable for travelers with physical disabilities.

Requirement: 5 The transit vehicle shall gather transit advisory data, including alerts and advisories pertaining to major emergencies, or man made disasters.

Requirement: 6 The transit vehicle shall tailor the output of the request traveler information based on the current location of the transit vehicle.

Element: **NJTPA Counties/Municipalities Websites**

Entity: **Information Service Provider**

Functional Area: **Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

Requirement: 1 The center shall collect, process, store, and disseminate customized traffic and highway condition information to travelers, including incident information, detours and road closures, recommended routes, and current speeds on specific routes upon request.

Requirement: 2 The center shall collect, process, store, and disseminate customized maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities upon request.

Requirement: 3 The center shall collect, process, store, and disseminate customized transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers upon request.

Requirement: 4 The center shall collect, process, store, and disseminate customized parking information to travelers, including location, availability, and fees upon request.

Architecture**Northern New Jersey ITS Architecture***Element:***NJTPA Counties/Municipalities Websites***Entity:***Information Service Provider***Functional Area:* **Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

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| <i>Requirement:</i> | 5 | The center shall collect, process, store, and disseminate customized toll fee information to travelers upon request. |
| <i>Requirement:</i> | 6 | The center shall collect, process, store, and disseminate customized weather information to travelers upon request. |
| <i>Requirement:</i> | 7 | The center shall collect, process, store, and disseminate customized multimodal transportation service information (for example, from ferry and airline operators), including transfer points and other information, to travelers upon request. |
| <i>Requirement:</i> | 8 | The center shall collect, process, store, and disseminate customized event information to travelers upon request. |
| <i>Requirement:</i> | 9 | The center shall collect, process, store, and disseminate customized air quality information to travelers upon request. |
| <i>Requirement:</i> | 10 | The center shall provide all traveler information based on the traveler's current location or a specific location identified by the traveler, and filter or customize the provided information accordingly. |
| <i>Requirement:</i> | 11 | The center shall accept traveler profiles for determining the type of personalized data to send to the traveler. |
| <i>Requirement:</i> | 12 | The center shall manage payment for services, such as tolls, transit fares, parking lot charges, map updates, and advanced payment for tolls, and provide transaction success or failure details. |
| <i>Requirement:</i> | 13 | The center shall support requests for traveler information and advanced payment for traveler services from commercial fleet operators. |
| <i>Requirement:</i> | 14 | The center shall provide the capability to exchange information with another traveler information service provider current or predicted data for road links that are outside the area served by the local supplier. |
| <i>Requirement:</i> | 15 | The center shall manage updates of digitized map data and provide updates to traveler interface systems upon request. |
| <i>Requirement:</i> | 16 | The center shall provide the capability to support requests from the media for traffic and incident data. |
| <i>Requirement:</i> | 17 | The center shall provide the capability for a system operator to control the type and update frequency of traveler information. |

*Element:***NJTPA ITS Data Archive***Entity:***Archived Data Management Subsystem***Functional Area:* **ITS Data Repository**

Collect and maintain data and data catalogs from one or more data sources. May include quality checks, error notification, and archive coordination.

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| <i>Requirement:</i> | 1 | The center shall collect data to be archived from one or more data sources. |
| <i>Requirement:</i> | 2 | The center shall collect data catalogs from one or more data sources. A catalog describes the data contained in the collection of archived data and may include descriptions of the schema or structure of the data, a description of the contents of the data; e.g., time range of entries, number of entries; or a sample of the data (e. g. a thumbnail). |
| <i>Requirement:</i> | 3 | The center shall store the archived data in a focused repository that is suited to a particular set of ITS data users. |
| <i>Requirement:</i> | 4 | The center shall include capabilities for performing quality checks on the incoming archived data. |

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA ITS Data Archive***Entity:* **Archived Data Management Subsystem***Functional Area:* **ITS Data Repository**

Collect and maintain data and data catalogs from one or more data sources. May include quality checks, error notification, and archive coordination.

- Requirement:* 5 The center shall include capabilities for error notification on the incoming archived data.
- Requirement:* 6 The center shall include capabilities for archive to archive coordination.
- Requirement:* 7 The center shall support a broad range of archived data management implementations, ranging from simple data marts that collect a focused set of data and serve a particular user community to large-scale data warehouses that collect, integrate, and summarize transportation data from multiple sources and serve a broad array of users within a region.
- Requirement:* 8 The center shall perform quality checks on received data.
- Requirement:* 9 The center shall provide the capability to execute methods on the incoming data such as cleansing, summarizations, aggregations, or transformations applied to the data before it is stored in the archive.
- Requirement:* 10 The center shall respond to requests from the administrator interface function to maintain the archive data.
- Requirement:* 11 When data or a catalog of data is received from the archive, the center shall generate the requested data product for the users systems.
- Requirement:* 12 For archive data requiring financial payment, the center shall process the financial requests and manage an interface to a Financial Institution.

Functional Area: **Traffic and Roadside Data Archival**

Collects and archives traffic and environmental information directly from the roadside for use in off-line planning, research, and analysis.

- Requirement:* 1 The center shall manage the collection of archive data directly from collection equipment located at the roadside.
- Requirement:* 2 The center shall collect traffic sensor information from roadside devices.
- Requirement:* 3 The center shall collect environmental sensor information that from roadside devices.
- Requirement:* 4 The center shall respond to requests from the Archive Data Administer to input the parameters that control the collection process.
- Requirement:* 5 The center shall send the request for data and control parameters to the field equipment where the information is collected and returned.
- Requirement:* 6 The center shall record the status about the imported traffic and roadside data.
- Requirement:* 7 The center shall use the status information to adjust the collection of traffic and roadside data.

Functional Area: **Government Reporting Systems Support**

Selects and formats data residing in an ITS archive to facilitate local, state, and federal government data reporting requirements.

- Requirement:* 1 The center shall provide data from an ITS archive to federal, state, or local government reporting systems.
- Requirement:* 2 The center shall provide the capability to select data from an ITS archive for use in government reports.
- Requirement:* 3 The center shall provide the capability to format data from an ITS archive suitable for input into government reports.
- Requirement:* 4 The center shall support requests for ITS archived data from Government Reporting Systems.

Architecture**Northern New Jersey ITS Architecture***Element:***NJTPA ITS Data Archive***Entity:***Archived Data Management Subsystem***Functional Area:* **Government Reporting Systems Support**

Selects and formats data residing in an ITS archive to facilitate local, state, and federal government data reporting requirements.

- Requirement:* 5 The center shall provide the applicable meta-data for any ITS archived data to satisfy government reporting system requests. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

Functional Area: **Virtual Data Warehouse Services**

Provides access to data from geographically dispersed archives and coordinates information exchange with a local data warehouse. Also provides the specialized publishing, directory services, and transaction management functions associated with coordinating remote archives.

- Requirement:* 1 The center shall provide capabilities to access "in-place" data from geographically dispersed archives. These capabilities may include analysis, data fusion, or data mining.

- Requirement:* 2 The center shall coordinate information exchange with a local data warehouse.

- Requirement:* 3 The center shall provide the specialized publishing, directory services, and transaction management functions associated with coordinating remote archives.

- Requirement:* 4 The center shall support the collection of archived data from other archives on an as-needed basis. (This minimizes the need to duplicate the comprehensive set of data from the remote archives in the local data warehouse.)

- Requirement:* 5 The center shall use data collected from different archives to build a set of global schema including the data archive definitions for the local archive plus any archives known to the local archive.

- Requirement:* 6 The center shall provide the local archived data schema to other archive systems.

*Element:***NJTPA Municipalities EOCs***Entity:***Emergency Management***Functional Area:* **Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

- Requirement:* 1 The center shall support the interface to the Emergency Telecommunications System (e.g. 911 or 7-digit call routing) to receive emergency notification information and provide it to the emergency system operator.

- Requirement:* 2 The center shall receive emergency call information from 911 services and present the possible incident information to the emergency system operator.

- Requirement:* 3 The center shall receive emergency call information from motorist call-boxes and present the possible incident information to the emergency system operator.

- Requirement:* 4 The center shall receive emergency call information from mayday service providers and present the possible incident information to the emergency system operator.

- Requirement:* 5 The center shall receive emergency notification information from other public safety agencies and present the possible incident information to the emergency system operator.

- Requirement:* 6 The center shall receive emergency notification information from public transit systems and present the possible incident information to the emergency system operator.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Municipalities EOCs***Entity:* **Emergency Management***Functional Area:* **Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

- Requirement:* 7 The center shall receive emergency notification information from commercial vehicles, commercial vehicle check stations, or commercial fleet operators and present the possible incident information to the emergency system operator. This may include detection of non-permitted transport of security sensitive hazmat, hazardous cargo spills, etc.
- Requirement:* 8 The center shall receive details of the cargo being carried by commercial vehicles from their commercial fleet manager for incidents involving potential hazardous materials.
- Requirement:* 9 The center shall coordinate, correlate, and verify all emergency inputs, including those identified based on external calls and internal analysis of security sensor and surveillance data, and assign each a level of confidence.
- Requirement:* 10 The center shall send a request for remote control of CCTV systems from a traffic management center in order to verify the reported incident.
- Requirement:* 11 The center shall update the incident information log once the emergency system operator has verified the incident.
- Requirement:* 12 The center shall provide the capability for digitized map data to act as the background to the emergency information presented to the emergency system operator.
- Requirement:* 13 The center shall forward the verified emergency information to the responding agency based on the location and nature of the emergency.

Functional Area: **Emergency Dispatch**

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

- Requirement:* 1 The center shall dispatch emergency vehicles to respond to verified emergencies and provide suggested routing under center personnel control.
- Requirement:* 2 The center shall store the current status of all emergency vehicles available for dispatch and those that have been dispatched.
- Requirement:* 3 The center shall relay location and incident details to the responding vehicles.
- Requirement:* 4 The center shall provide the capability to request traffic control measures from traffic management centers such as signal preemption, traffic barriers and road closures.
- Requirement:* 5 The center shall track the location and status of emergency vehicles responding to an emergency and update the incident status based on information from the emergency vehicle.
- Requirement:* 6 The center shall receive status information from care facilities to determine the appropriate facility and its location.
- Requirement:* 7 The center shall store and maintain the emergency service responses in an action log.
- Requirement:* 8 The center shall receive asset restriction information from maintenance centers to support the dispatching of appropriate emergency resources.
- Requirement:* 9 The center shall receive traffic information, including closures, traffic conditions, etc. from traffic management centers.
- Requirement:* 10 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Municipalities EOCs***Entity:* **Emergency Management***Functional Area:* **Emergency Dispatch**

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

Requirement: 11 The center shall receive road network conditions and traffic images to support dispatch of emergency vehicles.

Requirement: 12 The center shall coordinate response to incidents with other Emergency Management centers to ensure appropriate resources are dispatched and utilized.

Functional Area: **Emergency Early Warning System**

Monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies in order to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to other ITS centers to notify the traveling public. Includes support for Child Abduction notices.

Requirement: 1 The center shall monitor information from Alerting and Advisory Systems such as the Information Sharing and Analysis Centers (ISACs), the National Infrastructure Protection Center (NIPC), the Homeland Security Advisory System (HSAS), etc. The information may include assessments (general incident and vulnerability awareness information), advisories (identification of threats or recommendations to increase preparedness levels), or alerts (information on imminent or in-progress emergencies).

Requirement: 2 The center shall provide the capability to correlate alerts and advisories, incident information, and security sensor and surveillance data.

Requirement: 3 The center shall broadcast wide-area alerts and advisories to traffic management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.

Requirement: 4 The center shall broadcast wide-area alerts and advisories to transit management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.

Requirement: 5 The center shall broadcast wide-area alerts and advisories to toll administration centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.

Requirement: 6 The center shall broadcast wide-area alerts and advisories to traveler information service providers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.

Requirement: 7 The center shall broadcast wide-area alerts and advisories to maintenance centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.

Requirement: 8 The center shall broadcast wide-area alerts and advisories to other emergency management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.

Requirement: 9 The center shall process status information from each of the centers that have been sent the wide-area alert.

Requirement: 10 The center shall coordinate the broadcast of wide-area alerts and advisories with other emergency management centers.

Requirement: 11 The center shall receive incident information from other transportation management centers to support the early warning system.

Requirement: 12 The center shall present the alert and advisory information and the status of the actions taken in response to the alert by the other centers to the emergency system operator as received from other system inputs.

Architecture

Northern New Jersey ITS Architecture

Element: **NJTPA Municipalities EOCs**

Entity: **Emergency Management**

Functional Area: **Emergency Early Warning System**

Monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies in order to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to other ITS centers to notify the traveling public. Includes support for Child Abduction notices.

- Requirement:* 13 The center shall support the entry of alert and advisory information directly from the emergency system operator.
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Functional Area: **Emergency Evacuation Support**

Evacuation planning and coordination to manage evacuation and reentry of a population in the vicinity of a disaster or other emergency that poses a risk to public safety.

- Requirement:* 1 The center shall manage inter-agency coordination of evacuation operations, from initial planning through the evacuation process and reentry.
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- Requirement:* 2 The center shall develop and exchange evacuation plans with allied agencies prior to the occurrence of a disaster.
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- Requirement:* 3 The center shall provide an interface to the emergency system operator to enter evacuation plans and procedures and present the operator with other agencies' plans.
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- Requirement:* 4 The center shall coordinate evacuation destinations and shelter needs with shelter providers (e.g., the American Red Cross) in the region.
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- Requirement:* 5 The center shall provide evacuation information to traffic, transit, maintenance and construction, rail operations, and other emergency management centers as needed.
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- Requirement:* 6 The center shall request resources from transit agencies as needed to support the evacuation.
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- Requirement:* 7 The center shall request traffic management agencies to implement special traffic control strategies and to control evacuation traffic, including traffic on local streets and arterials as well as the major evacuation routes.
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- Requirement:* 8 The center shall provide traveler information systems with evacuation guidance including basic information to assist potential evacuees in determining whether evacuation is necessary and when it is safe to return.
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- Requirement:* 9 The center shall monitor the progress or status of the evacuation once it begins and exchange tactical plans, prepared during the incident, with allied agencies.
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- Requirement:* 10 The center shall monitor the progress of the reentry process.
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- Requirement:* 11 The center shall submit evacuation information to toll administration centers along with requests for changes in the toll services or fee collection during an evacuation.
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Functional Area: **Emergency Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and emergency vehicles equipped with environmental sensors; used by the operator to more effectively manage incidents.

- Requirement:* 1 The center shall collect current and forecast road and weather information from weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
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- Requirement:* 2 The center shall receive environmental probe information from its fleet of emergency vehicles.
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- Requirement:* 3 The center shall collect current road and weather information from roadway maintenance operations.
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- Requirement:* 4 The center shall assimilate current and forecast road conditions and surface weather information to support incident management.
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- Requirement:* 5 The center shall present the current and forecast road and weather information to the emergency system operator.
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Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Municipalities EOCs***Entity:* **Emergency Management***Functional Area:* **Emergency Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and emergency vehicles equipped with environmental sensors; used by the operator to more effectively manage incidents.

- Requirement:* 6 The center shall provide aggregated or processed environmental probe information from its fleet of emergency vehicles to traffic management and maintenance centers.

Functional Area: **Center Secure Area Surveillance**

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 1 The center shall remotely monitor video images and audio surveillance data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The data may be raw or pre-processed in the field.

- Requirement:* 2 The center shall remotely monitor video images and audio surveillance data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The data may be raw or pre-processed in the field.

- Requirement:* 3 The center shall remotely monitor video images and audio surveillance data collected on-board transit vehicles. The data may be raw or pre-processed in the field.

- Requirement:* 4 The center shall exchange surveillance data with other emergency centers.

- Requirement:* 5 The center shall identify potential security threats based on collected security surveillance data.

- Requirement:* 6 The center shall verify potential security threats by correlating security surveillance data from multiple sources.

- Requirement:* 7 The center shall remotely control security surveillance devices in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways).

- Requirement:* 8 The center shall remotely control security surveillance devices in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers).

- Requirement:* 9 The center shall remotely control security surveillance devices on-board transit vehicles.

- Requirement:* 10 The center shall match traveler video images against a database from the Alerting and Advisory Systems of known images that may represent criminals and terrorists.

- Requirement:* 11 The center shall exchange traveler images with other emergency management centers to support traveler image matching.

- Requirement:* 12 The center shall respond to control data from center personnel regarding security surveillance data collection, processing, threat detection, and image matching.

Functional Area: **Center Secure Area Sensor Management**

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

Architecture**Northern New Jersey ITS Architecture***Element:***NJTPA Municipalities EOCs***Entity:***Emergency Management***Functional Area:* **Center Secure Area Sensor Management**

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:*
- 1 The center shall remotely monitor and control security sensor data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), infrastructure condition and integrity, intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.
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- Requirement:*
- 2 The center shall remotely monitor and control security sensor data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.
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- Requirement:*
- 3 The center shall remotely monitor and control security sensor data collected on-board transit vehicles. The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors) and object detection sensors. The data may be raw or pre-processed in the field.
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- Requirement:*
- 4 The center shall exchange security sensor data with other emergency centers.
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- Requirement:*
- 5 The center shall identify potential security threats based on collected security sensor data.
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- Requirement:*
- 6 The center shall verify potential security threats by correlating security sensor data from multiple sources.
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- Requirement:*
- 7 The center shall perform threat analysis based on correlations of security sensor and surveillance data.
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- Requirement:*
- 8 The center shall exchange threat analysis data with Alerting and Advisory Systems and use that data in local threat analysis processing.
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- Requirement:*
- 9 The center shall disseminate threat information to other agencies, including traffic, transit, maintenance, rail operations, and other emergency management centers.
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- Requirement:*
- 10 The center shall respond to control data from center personnel regarding security sensor data collection, processing, threat detection, and threat analysis.

*Element:***NJTPA Municipalities ITS Field Equipment***Entity:***Roadway Subsystem***Functional Area:* **Roadway Basic Surveillance**

Field elements that monitor traffic conditions using loop detectors and CCTV cameras.

- Requirement:*
- 1 The field element shall collect, process, digitize, and send traffic sensor data (speed, volume, and occupancy) to the center for further analysis and storage, under center control.
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- Requirement:*
- 2 The field element shall collect, process, and send traffic images to the center for further analysis and distribution.
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- Requirement:*
- 3 The field element shall collect, digitize, and send pedestrian sensor data to the center for further analysis and storage.
-
- Requirement:*
- 4 The field element shall collect, process, and send pedestrian images to the center for further analysis and distribution.

Architecture**Northern New Jersey ITS Architecture****Element: NJTPA Municipalities ITS Field Equipment****Entity: Roadway Subsystem****Functional Area: Roadway Basic Surveillance**

Field elements that monitor traffic conditions using loop detectors and CCTV cameras.

Requirement: 5 The field element shall collect, digitize, and send multimodal crossing and high occupancy vehicle (HOV) lane sensor data to the center for further analysis and storage.

Requirement: 6 The field element shall return sensor and CCTV system operational status to the controlling center.

Requirement: 7 The field element shall return sensor and CCTV system fault data to the controlling center for repair.

Functional Area: Roadway Probe Beacons

Field elements to collect traffic and road conditions from passing vehicles; both anonymous toll/parking tag readings for link time calculations and smart probe data supported.

Requirement: 1 The field element shall use toll and parking tags on passing vehicles for traffic data link time calculations and send to the controlling center; tag identities will be removed to ensure anonymity.

Requirement: 2 The field element shall include equipment that monitors traffic conditions (e.g., average speed) by communicating with passing vehicles equipped with a transponder or other short range communications device; also called smart probes.

Requirement: 3 The field element shall include equipment that monitors road conditions by communicating with passing vehicles equipped with a transponder or other short range communications device; also called smart probes.

Requirement: 4 The field element shall aggregate, format, and store collected vehicle smart probe data (traffic and road conditions data), calculate link travel times and processed road condition data, and send to future passing vehicles.

Requirement: 5 The field element shall provide roadside beacon equipment operational status to the center.

Requirement: 6 The field element shall provide roadside beacon equipment fault indication to the center for repair.

Functional Area: Roadway Signal Controls

Field elements including traffic signal controllers for use at major intersections and on main highways for urban areas; also supports pedestrian crossings.

Requirement: 1 The field element shall control traffic signals at intersections and on main highways for urban and rural areas, under center control.

Requirement: 2 The field element shall collect pedestrian images and pedestrian sensor data, and respond to pedestrian crossing requests via display, audio signal, or other manner.

Requirement: 3 The field element shall provide the capability to notify the traffic management center that a pedestrian has requested right-of-way and when the request was or will be granted (request for right-of-way).

Requirement: 4 The field element shall monitor operation of traffic signal controllers and report to the center any instances in which the indicator response does not match that expected from the indicator control information.

Requirement: 5 The field element shall monitor operation of traffic signal controllers and report to the center any instances in which the indicator response does not match that expected from known indicator preemptions.

Requirement: 6 The field element shall return traffic signal controller operational status to the controlling center.

Requirement: 7 The field element shall return traffic signal controller fault data to the maintenance center for repair.

Functional Area: Roadway Signal Priority

Field elements that provide the capability to receive vehicle signal priority requests and control traffic signals accordingly.

Architecture**Northern New Jersey ITS Architecture****Element: NJTPA Municipalities ITS Field Equipment****Entity: Roadway Subsystem****Functional Area: Roadway Signal Priority**

Field elements that provide the capability to receive vehicle signal priority requests and control traffic signals accordingly.

- Requirement:* 1 The field element shall respond to requests for indicator (e.g., signal) preemption requests from emergency vehicles at intersections, pedestrian crossings, and multimodal crossings.
- Requirement:* 2 The field element shall respond to requests for indicator (e.g., signal) priority requests from transit vehicles at intersections, pedestrian crossings, and multimodal crossings.
- Requirement:* 3 The field element shall notify controlling traffic management center and maintenance center that the signal timing has changed based on a signal preemption/priority request to help those centers determine whether a fault detected at the signal is a true malfunction or due to a signal override.

Functional Area: Roadway Traffic Information Dissemination

Driver information systems, such as dynamic message signs and Highway Advisory Radio (HAR).

- Requirement:* 1 The field element shall include dynamic messages signs for dissemination of traffic and other information to drivers, under center control; the DMS may be either those that display variable text messages, or those that have fixed format display(s) (e.g. vehicle restrictions, or lane open/close).
- Requirement:* 2 The field element shall include driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers, under center control.
- Requirement:* 3 The field element shall include pedestrian information systems under center control (e.g. warning pedestrians of a potential hazard, or providing mandatory instructions as to the availability of pedestrian access).
- Requirement:* 4 The field element shall provide operational status for the driver information systems equipment (DMS, HAR, etc.) to the center.
- Requirement:* 5 The field element shall provide fault data for the driver information systems equipment (DMS, HAR, etc.) to the center for repair.

Functional Area: Standard Rail Crossing

Field elements at highway-rail intersections (HRIs) where operational requirements do not dictate advanced features (e.g., where rail operational speeds are less than 80 miles per hour). Includes traditional HRI warning systems augmented with other standard traffic management devices.

- Requirement:* 1 The field element shall collect and process, traffic sensor data in the vicinity of a highway-rail intersection (HRI).
- Requirement:* 2 The field element shall monitor the status of the highway-rail intersection (HRI) equipment, including both the current state and mode of operation and the current equipment condition, to be forwarded on to the traffic management center.
- Requirement:* 3 The field element shall monitor the status of the highway-rail intersection (HRI) equipment, including both the current state and mode of operation and the current equipment condition, to be forwarded on to the rail wayside equipment.
- Requirement:* 4 The field element shall receive track status from the rail wayside equipment that can be passed on to the traffic management center. This may include the current status of the tracks and whether a train is approaching.
- Requirement:* 5 The field element shall collect pedestrian images and pedestrian sensor data, and respond to pedestrian crossing requests via display, audio signal, or other manner.
- Requirement:* 6 The field element shall control the dynamic message signs (DMS) in the vicinity of a highway-rail intersection (HRI) to advise drivers, cyclists, and pedestrians of approaching trains.

Architecture**Northern New Jersey ITS Architecture****Element: NJTPA Municipalities ITS Field Equipment****Entity: Roadway Subsystem****Functional Area: Standard Rail Crossing**

Field elements at highway-rail intersections (HRIs) where operational requirements do not dictate advanced features (e.g., where rail operational speeds are less than 80 miles per hour). Includes traditional HRI warning systems augmented with other standard traffic management devices.

Requirement: 7 The field element shall close the highway-rail intersection (HRI) when a train is approaching using gates, lights/signs, barriers, and traffic control signals.

Requirement: 8 The field element shall support the integrated control of adjacent traffic signals to clear an area in advance of an approaching train and to manage traffic around the intersection.

Requirement: 9 The field element shall forward rail traffic advisories received from the Wayside Equipment to the traffic management center.

Functional Area: Advanced Rail Crossing

Field elements at highway-rail intersections (HRIs) where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). Capabilities from the Standard Rail Crossing plus systems which preclude entrance into the intersection when the barriers are activated, additional arriving train information, and detection of blocked intersections.

Requirement: 1 The field element shall collect and process, traffic sensor data in the vicinity of a highway-rail intersection (HRI).

Requirement: 2 The field element shall determine whether the highway-rail intersection (HRI) is blocked by traffic in the roadway or some other obstruction.

Requirement: 3 The field element shall notify the traffic management center and the rail wayside equipment of any intersection blockages, including trapped vehicles or other obstructions.

Requirement: 4 The field element shall monitor the status of the highway-rail intersection (HRI) equipment, including both the current state and mode of operation and the current equipment condition, to be forwarded on to the traffic management center.

Requirement: 5 The field element shall monitor the status of the highway-rail intersection (HRI) equipment, including both the current state and mode of operation and the current equipment condition, to be forwarded on to the rail wayside equipment.

Requirement: 6 The field element shall receive track status and arriving train information from the rail wayside equipment that can be passed on to the traffic management center. This may include the current status of the tracks and when a train is expected and/or how long the crossing will be closed.

Requirement: 7 The field element shall collect pedestrian images and pedestrian sensor data, and respond to pedestrian crossing requests via display, audio signal, or other manner.

Requirement: 8 The field element shall control the dynamic message signs (DMS) in the vicinity of a highway-rail intersection (HRI) to advise drivers, cyclists, and pedestrians of approaching trains.

Requirement: 9 The field element shall close the highway-rail intersection (HRI) when a train is approaching with enough time for traffic to safely clear the crossing using gates, lights/signs, barriers, and traffic control signals.

Requirement: 10 The field element shall support the integrated control of adjacent traffic signals to clear an area in advance of an approaching train and to manage traffic around the intersection.

Requirement: 11 The field element shall forward rail traffic advisories received from the Wayside Equipment to the traffic management center.

Functional Area: Roadway Equipment Coordination

Field elements that control and send data to other field elements (such as environmental sensors that send data to a DMS or coordination between traffic controllers on adjacent intersections), without center control.

Architecture**Northern New Jersey ITS Architecture****Element: NJTPA Municipalities ITS Field Equipment****Entity: Roadway Subsystem****Functional Area: Roadway Equipment Coordination**

Field elements that control and send data to other field elements (such as environmental sensors that send data to a DMS or coordination between traffic controllers on adjacent intersections), without center control.

- Requirement:* 1 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that provide data and status information to other field element devices (such as dynamic message signs, ramp meters, traffic signals, work zone intrusion alert systems), without center control.
- Requirement:* 2 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that receive control information from other field element devices, without center control.
- Requirement:* 3 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that provide data and status information to other field element devices (such as dynamic message signs, traffic controllers on adjacent intersections), without center control.
- Requirement:* 4 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that receive control information from other field element devices, without center control.

Functional Area: Roadway Environmental Monitoring

Environmental sensors, surface and sub-surface, that collect weather and road surface information. Weather conditions measured include temperature, wind, humidity, precipitation, and visibility. Sensors measure road surface temperature, moisture, icing, salinity, etc.

- Requirement:* 1 The field element shall include surface and sub-surface environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures.
- Requirement:* 2 The field element shall include environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.
- Requirement:* 3 The field element's environmental sensors shall be remotely controlled by a maintenance center.
- Requirement:* 4 The field element's environmental sensors shall be remotely controlled by a traffic management center.
- Requirement:* 5 The field element's environmental sensors shall be remotely controlled by weather service providers such as the National Weather Service or value-added sector specific meteorological services.
- Requirement:* 6 The field element's environmental sensors shall be remotely controlled by a maintenance and construction vehicle.
- Requirement:* 7 The field element shall provide environmental sensor equipment operational status to the controlling center or maintenance vehicle.
- Requirement:* 8 The field element shall provide environmental sensor equipment fault indication to the controlling center or maintenance vehicle.
- Requirement:* 9 The field element shall remotely aggregate environmental sensor data with environmental data collected from maintenance and construction vehicles.
- Requirement:* 10 The field element shall provide weather and road surface condition data to centers.
- Requirement:* 11 The field element shall provide weather and road surface condition data to maintenance and construction vehicles.

Element: NJTPA Municipalities PWD Operations**Entity: Maintenance and Construction Management****Functional Area: MCM Vehicle Tracking**

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Municipalities PWD Operations***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Vehicle Tracking**

Remotely tracks the location of maintenance and construction vehicles and other equipment; presented to the center personnel.

- Requirement:* 1 The center shall monitor the locations of all maintenance and construction vehicles and other equipment under its jurisdiction.
- Requirement:* 2 The center shall present location data to center personnel for the fleet of maintenance and construction vehicles and other equipment.
- Requirement:* 3 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for maintenance and construction vehicle tracking.

Functional Area: **MCM Vehicle and Equipment Maintenance Management**

Monitors vehicle and equipment condition, tracks maintenance history, and schedules routine and corrective maintenance.

- Requirement:* 1 The center shall collect and analyze vehicle diagnostics information from maintenance and construction vehicles. The information includes engine temperature, mileage, tire wear, brake wear, belt wear, and any warnings or alarms concerning the operational condition of the vehicle and ancillary equipment.
- Requirement:* 2 The center shall exchange information with equipment repair facilities including status and history of repairs concerning maintenance and construction vehicles. This information includes vehicle status and diagnostic information, vehicle utilization, and coordination of when vehicles will be available for preventative and corrective maintenance.
- Requirement:* 3 The center shall schedule preventive and corrective vehicle maintenance with the equipment repair facility based on fleet health reports, maintenance records, vehicle utilization and vehicle availability schedules.

Functional Area: **MCM Environmental Information Collection**

Remotely controls environmental sensors and assimilates collected data with other current and forecast road conditions and surface weather information from weather service providers and transportation operations.

- Requirement:* 1 The center shall remotely control environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures.
- Requirement:* 2 The center shall remotely control environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.
- Requirement:* 3 The center shall remotely control environmental sensors on-board maintenance and construction vehicles that measure road and weather conditions including air and surface temperatures, wind speed, humidity, precipitation, visibility and other measures.
- Requirement:* 4 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services), data from traffic, emergency, and transit management, traveler information providers, and environmental data collected from sensors deployed on and about the roadway as well as the fleet of maintenance and construction vehicles.
- Requirement:* 5 The center shall provide weather and road condition information to weather service providers and center personnel.
- Requirement:* 6 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.
- Requirement:* 7 The center shall collect operational status for the roadside and vehicle-based environmental sensor equipment.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Municipalities PWD Operations***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Environmental Information Collection**

Remotely controls environmental sensors and assimilates collected data with other current and forecast road conditions and surface weather information from weather service providers and transportation operations.

- Requirement:* 8 The center shall collect fault data for the roadside and vehicle-based environmental sensor equipment for repair.

Functional Area: **MCM Environmental Information Processing**

Processes current and forecast weather data, road condition information, local environmental data, and uses internal models to develop specialized detailed forecasts of local weather and surface conditions. Disseminates road weather information to other agencies and centers.

- Requirement:* 1 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.
- Requirement:* 2 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services) and local environmental sensor data.
- Requirement:* 3 The center shall use the various data inputs of environmental sensors and road weather data to develop a view of current and predicted road weather and road conditions.
- Requirement:* 4 The center shall disseminate current and forecasted road weather and road condition information to weather service providers (such as the National Weather Service and value-added sector specific meteorological services) as well as other agencies including traffic, emergency, and transit management, traveler information providers, rail operations centers, media, and other maintenance management centers.
- Requirement:* 5 The center shall provide value-added sector specific meteorological services with information on basic road facility and treatment information that supports forecasts for road conditions.

Functional Area: **MCM Incident Management**

Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.

- Requirement:* 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.
- Requirement:* 2 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, etc.
- Requirement:* 3 The center shall exchange incident and threat information with emergency management centers as well as traffic management centers; including notification of existence of incident and expected severity, location, time and nature of incident.
- Requirement:* 4 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.
- Requirement:* 5 The center shall respond to requests from emergency management to provide maintenance and construction resources to implement response plans, assist in clean up, verify an incident, etc. This may also involve coordination with traffic management centers and other maintenance centers.
- Requirement:* 6 The center shall exchange road network status assessment information with emergency management and traffic management centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.

Architecture

Northern New Jersey ITS Architecture

Element: **NJTPA Municipalities PWD Operations**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Incident Management**

Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.

Requirement: 7 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

Requirement: 8 The center shall receive information indicating the damage sustained by transportation assets, derived from aerial surveillance, field reports, inspections, tests, and analyses to support incident management.

Functional Area: **MCM Maintenance Decision Support**

Maintenance Decision Support Systems recommend courses of action based on current and forecast environmental and road conditions (filtered and fused for specific time horizons) and additional application specific information. Recommendations and dispatch instructions are generated based on this integrated information.

Requirement: 1 The center shall provide the center personnel with tailored external information, including weather or road condition observations, forecasted weather information or road conditions, current usage of treatments and materials, available resources, equipment and vehicle availability, road network information, and source reliability information.

Requirement: 2 The center shall tailor the decision support information to include filtering (selection from a large amount of external information), error reduction ('smoothing' the information), fusion (combination of disparate information to match the decision needs), and analysis (creating the decision).

Requirement: 3 The center shall provide an interface to the center personnel to input control parameters for the decision support process and receive decisions or information presentation.

Requirement: 4 The center shall provide dispatch information to maintenance and construction vehicles based on the outputs of the decision support system, including recommended roadway treatment actions.

Functional Area: **MCM Winter Maintenance Management**

Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.

Requirement: 1 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other winter roadway maintenance.

Requirement: 2 The center shall exchange information with administrative systems to support the planning and scheduling of winter maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.

Requirement: 3 The center shall provide status information about scheduled winter maintenance activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, and the media.

Requirement: 4 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of winter maintenance activities.

Requirement: 5 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of winter maintenance activities.

Architecture

Northern New Jersey ITS Architecture

Element: **NJTPA Municipalities PWD Operations**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Winter Maintenance Management**

Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.

- Requirement:* 6 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
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- Requirement:* 7 The center shall dispatch and route winter maintenance vehicle drivers and support them with route-specific environmental, incident, advisory, threat, alert, and traffic congestion information.
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- Requirement:* 8 The center shall determine the need for roadway treatment based on current and forecasted weather information, current usage of treatments and materials, available resources, requests for action from other agencies, and recommendations from the Maintenance Decision Support system, specifically under winter conditions. This supports winter maintenance such as plowing, treating, anti-icing, etc.
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- Requirement:* 9 The center shall provide dispatch instructions for vehicle operators based on input parameters from center personnel, specifically for winter conditions. This could include a treatment route, treatment application rates, start and end times, and other treatment instructions.
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- Requirement:* 10 The center shall support remote control of on-board maintenance and construction vehicle systems and field equipment that is remotely controlled by the vehicle such as adjusting material application rates and spread patterns.
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- Requirement:* 11 The center shall assess the current status of all winter maintenance activities, including actual work activities performed, current locations and operational conditions of vehicles, materials and equipment inventories, field equipment status, environmental information, etc.
-

Functional Area: **MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

- Requirement:* 1 The center shall maintain an interface with asset management systems to track the inventory, restrictions, repair needs and status updates of transportation assets (pavement, bridges, signs, etc.) including location, installation and materials information, vendor/contractor, current maintenance status, standard height, width, and weight restrictions.
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- Requirement:* 2 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other roadway maintenance.
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- Requirement:* 3 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
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- Requirement:* 4 The center shall provide emergency management and traffic management centers with information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.
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- Requirement:* 5 The center shall collect the status and fault data from roadside equipment, such as traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
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Architecture

Northern New Jersey ITS Architecture

Element: **NJTPA Municipalities PWD Operations**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

- Requirement:* 6 The center shall collect the status and fault data from traffic management centers, including data for traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
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- Requirement:* 7 The center shall remotely control and collect data from infrastructure monitoring sensors located along the roadway infrastructure or on maintenance and construction vehicles.
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- Requirement:* 8 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of roadway maintenance and construction activities.
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- Requirement:* 9 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of roadway maintenance and construction activities.
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- Requirement:* 10 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
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- Requirement:* 11 The center shall dispatch and route maintenance and construction vehicle drivers and support them with route- specific environmental, incident, advisory, threat, alert, and traffic congestion information.
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- Requirement:* 12 The center shall manage an interface with center personnel to accept vehicle systems control information and remotely control maintenance and construction vehicle on-board equipment.
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- Requirement:* 13 The center shall track the status of roadway maintenance and construction activities by monitoring collected data from the dispatched vehicles and equipment.
-

Functional Area: **MCM Work Zone Management**

Remotely monitors and supports work zone activities, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).

- Requirement:* 1 The center shall generate new work zone activity schedules for use by maintenance and construction vehicles, maintenance and construction operators, and for information coordination purposes.
-
- Requirement:* 2 The center shall control the collection of work zone status information including video images from cameras located in or near the work zone.
-
- Requirement:* 3 The center shall disseminate work zone information to other agencies and centers including traffic, transit, emergency management centers, other maintenance centers, traveler information providers, and the media.
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- Requirement:* 4 The center shall control traffic in work zones by providing remote control of dynamic message signs and highway advisory radio systems located in or near the work zone.
-
- Requirement:* 5 The center shall exchange information with administrative systems to support the planning and scheduling of work zone activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
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Functional Area: **MCM Work Activity Coordination**

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

Architecture

Northern New Jersey ITS Architecture

Element: **NJTPA Municipalities PWD Operations**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Work Activity Coordination**

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

Requirement: 1 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

Requirement: 2 The center shall provide status information about scheduled maintenance and construction activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, multimodal transportation providers, rail operations, and the media.

Requirement: 3 The center shall collect and respond to feedback concerning scheduled maintenance and construction activities with other management centers such as traffic, emergency, transit, and rail operations.

Requirement: 4 The center shall collect and disseminate asset restriction information levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.

Requirement: 5 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance and construction activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.

Requirement: 6 The center shall exchange rail schedules and work plans with rail operations centers.

Element: **NJTPA Municipalities PWD Vehicles**

Entity: **Maintenance and Construction Vehicle**

Functional Area: **MCV Vehicle Location Tracking**

On-board systems to track vehicle location and reports the position and timestamp information to the dispatch center.

Requirement: 1 The maintenance and construction vehicle shall compute the location of the vehicle based on inputs from a vehicle location determination function.

Requirement: 2 The maintenance and construction vehicle shall send the timestamped vehicle location to the controlling center.

Functional Area: **MCV Vehicle System Monitoring and Diagnostics**

On-board sensors capable of monitoring the condition of each of the vehicle systems and diagnostics that can be used to support vehicle maintenance.

Requirement: 1 The maintenance and construction vehicle shall collect vehicle diagnostics and operating status data from the maintenance vehicle platform including engine temperature, mileage, tire wear, brake wear, belt wear, and other operational status measures as well as the status of maintenance and construction-specific systems on the vehicle.

Requirement: 2 The maintenance and construction vehicle shall use the diagnostic and status information to support scheduling vehicle maintenance, monitoring safety status, and informing the vehicle operator of the conditions.

Requirement: 3 The maintenance and construction vehicle shall the vehicle diagnostic and safety information to an equipment repair facility.

Architecture

Northern New Jersey ITS Architecture

Element: **NJTPA Municipalities PWD Vehicles**

Entity: **Maintenance and Construction Vehicle**

Functional Area: **MCV Vehicle System Monitoring and Diagnostics**

On-board sensors capable of monitoring the condition of each of the vehicle systems and diagnostics that can be used to support vehicle maintenance.

- Requirement:* 4 The maintenance and construction vehicle shall send the vehicle diagnostic and safety information to the controlling maintenance center.
-

Functional Area: **MCV Winter Maintenance**

On-board systems that support snow plow operations and other roadway treatments (e.g., salt spraying and other material applications). Supports platooning of snow plows.

- Requirement:* 1 The maintenance and construction vehicle shall track the location and status of safety systems on-board the vehicle.
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- Requirement:* 2 The maintenance and construction vehicle shall respond to control information from the center to allow remote operation of the on-board vehicle systems. These systems include winter maintenance equipment for plowing, treating, and anti-icing.
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- Requirement:* 3 The maintenance and construction vehicle shall monitor materials information including remaining quantity and current application rate of materials on the vehicle.
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- Requirement:* 4 The maintenance and construction vehicle shall respond to dispatch information from the center, presented to the vehicle operator for acknowledgement and returning status.
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- Requirement:* 5 The maintenance and construction vehicle shall send operational data to the center including the operational state of the maintenance equipment (e.g., blade up/down, spreader pattern), types and quantities of materials used for construction and maintenance activities, and a record of the actual work performed.
-

- Requirement:* 6 The maintenance and construction vehicle shall exchange operational and environmental data with other maintenance and construction vehicles. Operational data includes operational state of the maintenance equipment (e.g., blade up/down, spreader pattern, equipment configuration) and a record of the actual work performed while the environmental data includes environmental sensor data collected on-board a maintenance and construction vehicle, either raw or processed data.
-

Functional Area: **MCV Infrastructure Monitoring**

On-board systems to monitor the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts). Includes vehicle-based sensors and communications with roadway-based infrastructure monitoring sensors.

- Requirement:* 1 The maintenance and construction vehicle shall collect infrastructure data from on-board sensors relating to the physical characteristics of the roadway infrastructure, including pavement, bridges, culverts, signs, etc.
-

Functional Area: **MCV Roadway Maintenance and Construction**

On-board systems that support routine non-winter maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of equipment on the roadway.

- Requirement:* 1 The maintenance and construction vehicle shall track the location and status of safety systems on-board the vehicle.
-

- Requirement:* 2 The maintenance and construction vehicle shall respond to control information from the center to allow remote operation of the on-board vehicle systems. These systems include routine maintenance equipment for cutting, repairs, hazard removal, etc.
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Functional Area: **MCV Infrastructure Monitoring**

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Municipalities PWD Vehicles***Entity:* **Maintenance and Construction Vehicle***Functional Area:* **MCV Infrastructure Monitoring**

On-board systems to monitor the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts). Includes vehicle-based sensors and communications with roadway-based infrastructure monitoring sensors.

- Requirement:* 2 The maintenance and construction vehicle shall collect infrastructure data from sensors located along the roadway relating to the physical characteristics of the roadway infrastructure, including pavement, bridges, culverts, signs, etc.

Functional Area: **MCV Roadway Maintenance and Construction**

On-board systems that support routine non-winter maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of equipment on the roadway.

- Requirement:* 3 The maintenance and construction vehicle shall monitor materials information including remaining quantity and current application rate of materials on the vehicle.

Functional Area: **MCV Infrastructure Monitoring**

On-board systems to monitor the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts). Includes vehicle-based sensors and communications with roadway-based infrastructure monitoring sensors.

- Requirement:* 3 The maintenance and construction vehicle shall provide control signals to infrastructure monitoring sensors located at the roadway.

- Requirement:* 4 The maintenance and construction vehicle shall send current condition of pavement, bridges, culverts, signs, and other roadway infrastructure as measured by on-board sensors or read from infrastructure-based sensors to the center. The data may include raw data or images (e.g., photo logs) that indicate the current status of the infrastructure.

Functional Area: **MCV Roadway Maintenance and Construction**

On-board systems that support routine non-winter maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of equipment on the roadway.

- Requirement:* 4 The maintenance and construction vehicle shall respond to dispatch information from the center, presented to the vehicle operator for acknowledgement and returning status.

- Requirement:* 5 The maintenance and construction vehicle shall send operational data to the center including the operational state of the maintenance equipment (e.g., blade up/down, spreader pattern), types and quantities of materials used for construction and maintenance activities, and a record of the actual work performed.

Functional Area: **MCV Infrastructure Monitoring**

On-board systems to monitor the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts). Includes vehicle-based sensors and communications with roadway-based infrastructure monitoring sensors.

- Requirement:* 5 The maintenance and construction vehicle shall provide infrastructure sensor equipment operational status to the center.

Element: **NJTPA Municipalities TOCs***Entity:* **Traffic Management***Functional Area:* **Collect Traffic Surveillance**

Management of traffic sensors and surveillance (CCTV) equipment, and distribution of the collected information to other centers and operators.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Municipalities TOCs***Entity:* **Traffic Management***Functional Area:* **Collect Traffic Surveillance**

Management of traffic sensors and surveillance (CCTV) equipment, and distribution of the collected information to other centers and operators.

- Requirement:* 1 The center shall monitor, analyze, and store traffic sensor data (speed, volume, occupancy) collected from field elements under remote control of the center.
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- Requirement:* 2 The center shall monitor, analyze, and distribute traffic images from CCTV systems under remote control of the center.
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- Requirement:* 3 The center shall monitor, analyze, and store pedestrian sensor data collected from field elements under remote control of the center.
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- Requirement:* 4 The center shall monitor, analyze, and distribute pedestrian images from CCTV systems under remote control of the center.
-
- Requirement:* 5 The center shall monitor, analyze, and store multimodal crossing and high occupancy vehicle (HOV) lane sensor data under remote control of the center.
-
- Requirement:* 6 The center shall maintain a database of surveillance and sensors and the freeways, surface street and rural roadways, e.g. where they are located, to which part(s) of the network their data applies, the type of data, and the ownership of each link (that is, the agency or entity responsible for collecting and storing surveillance of the link) in the network.
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- Requirement:* 7 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic data.
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- Requirement:* 8 The center shall distribute road network conditions data (raw or processed) based on collected and analyzed traffic sensor and surveillance data to other centers.
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- Requirement:* 9 The center shall respond to control data from center personnel regarding sensor and surveillance data collection, analysis, storage, and distribution.

Functional Area: **TMC Probe Information Collection**

Collects, assimilates, and disseminates vehicle probe data collected from roadside beacons and centers controlling transit vehicles, emergency vehicles, toll collection points, and route-guided vehicles.

- Requirement:* 1 The center shall collect probe data including traffic and road conditions from vehicles via roadside beacon field elements; the data may be aggregated and initial link time calculations performed in the field.
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- Requirement:* 2 The center shall collect road condition data from probe-equipped transit vehicles via transit management centers; the data may be aggregated and preliminarily processed at the sending center.
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- Requirement:* 3 The center shall collect traffic data from probe-equipped emergency vehicles via emergency management centers; the data may be aggregated and initial link time calculations performed at the sending center.
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- Requirement:* 4 The center shall collect traffic data from traveler information centers based on data from their subscriber vehicles; the data may be aggregated and initial link time calculations performed at the sending center.
-
- Requirement:* 5 The center shall collect traffic data from toll administrative centers containing journey times between toll collection points for those vehicles equipped for electronic toll collection; the data may be aggregated and processed at the sending center.
-
- Requirement:* 6 The center shall assimilate current and forecast traffic and road conditions based on collected probe data and distribute to other centers for dissemination to travelers.
-
- Requirement:* 7 The center shall collect operational status for the roadside probe data collection equipment.
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- Requirement:* 8 The center shall collect fault data for the roadside probe data collection equipment for repair.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Municipalities TOCs***Entity:* **Traffic Management***Functional Area:* **TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

- Requirement:* 1 The center shall remotely control traffic signal controllers.
- Requirement:* 2 The center shall accept notifications of right-of-way requests from pedestrians.
- Requirement:* 3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center.
- Requirement:* 4 The center shall collect traffic signal controller fault data from the field.
- Requirement:* 5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.

Functional Area: **TMC Freeway Management**

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

- Requirement:* 1 The center shall remotely control systems to manage use of the freeways, including ramp meters, mainline metering, and lane controls.
- Requirement:* 2 The center shall collect operational status from ramp meters, mainline metering, and lane controls and compare against the control information sent by the center.
- Requirement:* 3 The center shall collect fault data from ramp meters, mainline metering, and lane controls.
- Requirement:* 4 The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, mainline metering, and lane controls), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the ramps themselves.

Functional Area: **TMC Traffic Information Dissemination**

Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.

- Requirement:* 1 The center shall remotely control dynamic messages signs for dissemination of traffic and other information to drivers.
- Requirement:* 2 The center shall remotely control driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers.
- Requirement:* 3 The center shall collect operational status for the driver information systems equipment (DMS, HAR, etc.).
- Requirement:* 4 The center shall collect fault data for the driver information systems equipment (DMS, HAR, etc.) for repair.
- Requirement:* 5 The center shall retrieve locally stored traffic information, including current and forecasted traffic information, road and weather conditions, traffic incident information, information on diversions and alternate routes, closures, and special traffic restrictions (lane/shoulder use, weight restrictions, width restrictions, HOV requirements), etc.
- Requirement:* 6 The center shall distribute traffic data to maintenance and construction centers, transit centers, emergency management centers, and traveler information providers.
- Requirement:* 7 The center shall distribute traffic data to the media upon request; the capability to provide the information in both data stream and graphical display shall be supported.

Architecture

Northern New Jersey ITS Architecture

Element: **NJTPA Municipalities TOCs**

Entity: **Traffic Management**

Functional Area: **TMC Traffic Information Dissemination**

Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.

- Requirement:* 8 The center shall provide the capability for center personnel to control the nature of the data that is available to non-traffic operations centers and the media.
-

Functional Area: **TMC Regional Traffic Control**

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

- Requirement:* 1 The center shall exchange traffic information with other traffic management centers, includes incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.
-

- Requirement:* 2 The center shall exchange traffic control information with other traffic management centers, includes remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).
-

Functional Area: **TMC Incident Detection**

Remotely controls traffic and video sensors to support incident detection and verification; exchange information with other agencies including emergency management, maintenance and construction, alerting and advisory systems, event promoters, intermodal freight depots, and traveler information systems.

- Requirement:* 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.
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- Requirement:* 2 The center shall collect and store traffic flow and image data from the field equipment to detect and verify incidents.
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- Requirement:* 3 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, and intermodal freight depots.
-

- Requirement:* 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.
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- Requirement:* 5 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field.
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- Requirement:* 6 The center shall provide road network conditions and traffic images to emergency management centers to support the detection, verification, and classification of incidents.
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- Requirement:* 7 The center shall provide video and traffic sensor control commands to the field equipment to detect and verify incidents.
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Functional Area: **TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Municipalities TOCs***Entity:* **Traffic Management***Functional Area:* **TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

- Requirement:* 1 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction for distribution to the public. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, and information and instructions necessary for the public to respond to the alert. This may also identify specific information that should not be released to the public.
-
- Requirement:* 2 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.
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- Requirement:* 3 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field, provide special routing for emergency vehicles, and to provide responding emergency vehicles with signal preemption.
-
- Requirement:* 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.
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- Requirement:* 5 The center shall respond to requests from emergency management to provide traffic management resources to implement special traffic control measures, assist in clean up, verify an incident, etc. This may also involve coordination with maintenance centers.
-
- Requirement:* 6 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, media, and rail operations centers.
-
- Requirement:* 7 The center shall provide road network conditions and traffic images to emergency management centers, maintenance and construction centers, and traveler information service providers.
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- Requirement:* 8 The center shall exchange road network status assessment information with emergency management and maintenance centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.
-
- Requirement:* 9 The center shall coordinate information and controls with other traffic management centers.
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- Requirement:* 10 The center shall receive inputs from emergency management and transit management centers to develop an overall status of the transportation system including emergency transit schedules in effect and current status and condition of the transportation infrastructure.
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- Requirement:* 11 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic incident management.

Functional Area: **TMC Evacuation Support**

Development, coordination, and execution of special traffic management strategies during evacuation and subsequent reentry of a population in the vicinity of a disaster or major emergency. Interfaces with emergency management and other traffic management centers.

- Requirement:* 1 The center shall coordinate planning for evacuation with emergency management centers - including pre-planning activities such as establishing routes, areas to be evacuated, timing, etc.
-
- Requirement:* 2 The center shall support requests from emergency management centers to preempt the current traffic control strategy, activate traffic control and closure systems such as gates and barriers, activate safeguard systems, or use driver information systems to support evacuation traffic control plans.

Architecture

Northern New Jersey ITS Architecture

Element: **NJTPA Municipalities TOCs**

Entity: **Traffic Management**

Functional Area: **TMC Evacuation Support**

Development, coordination, and execution of special traffic management strategies during evacuation and subsequent reentry of a population in the vicinity of a disaster or major emergency. Interfaces with emergency management and other traffic management centers.

Requirement: 3 The center shall coordinate information and controls with other traffic management centers.

Requirement: 4 The center shall coordinate execution of evacuation strategies with emergency management centers - including activities such as setting closures and detours, establishing routes, updating areas to be evacuated, timing the process, etc.

Functional Area: **TMC Environmental Monitoring**

Management of environmental sensors and assimilation of collected data with other current and forecast road conditions and surface weather information from weather service providers and roadway maintenance operations.

Requirement: 1 The center shall remotely control environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures.

Requirement: 2 The center shall remotely control environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.

Requirement: 3 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services), data from roadway maintenance operations, and environmental data collected from sensors deployed on and about the roadway.

Requirement: 4 The center shall provide weather and road condition information to weather service providers and center personnel.

Requirement: 5 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.

Functional Area: **HRI Traffic Management**

Remotely monitor and control highway-rail intersection (HRI) equipment, includes standard speed active warning systems and high speed systems which provide additional information on approaching trains and detect and report on obstructions in the HRI.

Requirement: 1 The center shall remotely control highway-rail intersection (HRI) equipment located in the field.

Requirement: 2 The center shall accept collect highway-rail intersection (HRI) advisory or alert data from rail operations centers.

Requirement: 3 The center shall collect highway-rail intersection (HRI) equipment operational status and compare against the control information sent by the center.

Requirement: 4 The center shall provide the highway-rail intersection (HRI) equipment operational status to rail operations centers.

Requirement: 5 The center shall collect incident information related to a highway-rail intersection (HRI), such as intersection blockages or crashes or equipment malfunctions.

Requirement: 6 The center shall implement control plans to coordinate signalized intersections around highway-rail intersections (HRI), under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, equipment faults, pedestrian crossings, etc.

Functional Area: **Rail Operations Coordination**

Coordination between rail operations and traffic management centers - exchanging train schedules, maintenance schedules, as well as incidents and priority messages which result in highway-rail intersection (HRI). Supports advanced traffic control strategies and enhanced traveler information.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Municipalities TOCs***Entity:* **Traffic Management***Functional Area:* **Rail Operations Coordination**

Coordination between rail operations and traffic management centers - exchanging train schedules, maintenance schedules, as well as incidents and priority messages which result in highway-rail intersection (HRI). Supports advanced traffic control strategies and enhanced traveler information.

- Requirement:* 1 The center shall exchange highway-rail intersection (HRI) information with rail operations centers. This information may include event schedules, requests for information from the Rail Operators, incident notification based on rail operations messages, and priority messages like notifications of a HAZMAT spill, equipment failure, or an intersection blockage.
- Requirement:* 2 The center shall receive highway-rail intersection (HRI) maintenance schedules, train schedules, and incident notifications from rail operations centers.
- Requirement:* 3 The center shall use the rail operations information to develop forecast HRI closure times and durations which may be applied in advanced traffic control strategies or delivered as enhanced traveler information.

Functional Area: **Traffic Maintenance**

Monitoring and remote diagnostics of field equipment - detect failures, issue problem reports, and track the repair or replacement of the failed equipment.

- Requirement:* 1 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) operational status.
- Requirement:* 2 The center shall collect and store CCTV surveillance system (traffic, pedestrian) operational status.
- Requirement:* 3 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) fault data and send to the maintenance center for repair.
- Requirement:* 4 The center shall collect and store CCTV surveillance system (traffic, pedestrian) fault data send to the maintenance center for repair.
- Requirement:* 5 The center shall collect environmental sensor operational status.
- Requirement:* 6 The center shall collect environmental sensor equipment fault data and send to the maintenance center for repair.
- Requirement:* 7 The center shall exchange data with maintenance centers concerning the reporting of faulty equipment and the schedule/status of their repair. Information exchanged includes details of new equipment faults, and clearances when the faults are cleared.
- Requirement:* 8 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic maintenance data.

Functional Area: **TMC Work Zone Traffic Management**

Coordination with maintenance systems using work zone images and traveler information systems (such as DMS), and distribution of work plans so that work zones are established that have minimum traffic impact.

- Requirement:* 1 The center shall receive work zone images from a maintenance center.
- Requirement:* 2 The center shall analyze work zone images for indications of a possible incident.
- Requirement:* 3 The center shall remotely control driver information systems (such as dynamic messages signs, highway advisory radios) to advise drivers of activity around a work zone.
- Requirement:* 4 The center shall collect operational status for the driver information systems equipment in work zones.
- Requirement:* 5 The center shall collect fault data for the driver information systems equipment in work zones for repair.
- Requirement:* 6 The center shall receive proposed maintenance and construction work plans, analyze the activity as a possible incident, and provide work plan feedback to the sending center.

Architecture

Northern New Jersey ITS Architecture

Element: **NJTPA Municipalities TOCs**

Entity: **Traffic Management**

Functional Area: **TMC Multimodal Coordination**

Provides traffic signal priority for transit vehicles based on center-to-center communications with the transit management center; also exchange traffic and transit information.

Requirement: 1 The center shall respond to requests from transit management centers for signal priority at one or more intersections along a particular transit route.

Requirement: 2 The center shall exchange information with transit management centers including details current transit routes, the level of service on each route, and the progress of individual vehicles along their routes.

Functional Area: **Traffic Data Collection**

Collection and storage of traffic management data. For use by operations personnel or data archives in the region.

Requirement: 1 The center shall collect traffic management data such as operational data, event logs, etc.

Requirement: 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

Requirement: 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the traffic data or for the data itself.

Requirement: 4 The center shall be able to produce sample products of the data available.

Element: **NJTPA Region Incident and Mutual Aid Network**

Entity: **Emergency Management**

Functional Area: **Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

Requirement: 1 The center shall support the interface to the Emergency Telecommunications System (e.g. 911 or 7-digit call routing) to receive emergency notification information and provide it to the emergency system operator.

Requirement: 2 The center shall receive emergency call information from 911 services and present the possible incident information to the emergency system operator.

Requirement: 3 The center shall receive emergency call information from motorist call-boxes and present the possible incident information to the emergency system operator.

Requirement: 4 The center shall receive emergency call information from mayday service providers and present the possible incident information to the emergency system operator.

Requirement: 5 The center shall receive emergency notification information from other public safety agencies and present the possible incident information to the emergency system operator.

Requirement: 6 The center shall receive emergency notification information from public transit systems and present the possible incident information to the emergency system operator.

Requirement: 7 The center shall receive emergency notification information from commercial vehicles, commercial vehicle check stations, or commercial fleet operators and present the possible incident information to the emergency system operator. This may include detection of non-permitted transport of security sensitive hazmat, hazardous cargo spills, etc.

Requirement: 8 The center shall receive details of the cargo being carried by commercial vehicles from their commercial fleet manager for incidents involving potential hazardous materials.

Architecture**Northern New Jersey ITS Architecture****Element: NJTPA Region Incident and Mutual Aid Network****Entity: Emergency Management****Functional Area: Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

- Requirement:* 9 The center shall coordinate, correlate, and verify all emergency inputs, including those identified based on external calls and internal analysis of security sensor and surveillance data, and assign each a level of confidence.
- Requirement:* 10 The center shall send a request for remote control of CCTV systems from a traffic management center in order to verify the reported incident.
- Requirement:* 11 The center shall update the incident information log once the emergency system operator has verified the incident.
- Requirement:* 12 The center shall provide the capability for digitized map data to act as the background to the emergency information presented to the emergency system operator.
- Requirement:* 13 The center shall forward the verified emergency information to the responding agency based on the location and nature of the emergency.

Functional Area: Emergency Dispatch

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

- Requirement:* 1 The center shall dispatch emergency vehicles to respond to verified emergencies and provide suggested routing under center personnel control.
- Requirement:* 2 The center shall store the current status of all emergency vehicles available for dispatch and those that have been dispatched.
- Requirement:* 3 The center shall relay location and incident details to the responding vehicles.
- Requirement:* 4 The center shall provide the capability to request traffic control measures from traffic management centers such as signal preemption, traffic barriers and road closures.
- Requirement:* 5 The center shall track the location and status of emergency vehicles responding to an emergency and update the incident status based on information from the emergency vehicle.
- Requirement:* 6 The center shall receive status information from care facilities to determine the appropriate facility and its location.
- Requirement:* 7 The center shall store and maintain the emergency service responses in an action log.
- Requirement:* 8 The center shall receive asset restriction information from maintenance centers to support the dispatching of appropriate emergency resources.
- Requirement:* 9 The center shall receive traffic information, including closures, traffic conditions, etc. from traffic management centers.
- Requirement:* 10 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.
- Requirement:* 11 The center shall receive road network conditions and traffic images to support dispatch of emergency vehicles.
- Requirement:* 12 The center shall coordinate response to incidents with other Emergency Management centers to ensure appropriate resources are dispatched and utilized.

Element: NJTPA Region Probe Data**Entity: Archived Data Management Subsystem**

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Region Probe Data***Entity:* **Archived Data Management Subsystem***Functional Area:* **ITS Data Repository**

Collect and maintain data and data catalogs from one or more data sources. May include quality checks, error notification, and archive coordination.

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| <i>Requirement:</i> | 1 The center shall collect data to be archived from one or more data sources. |
| <i>Requirement:</i> | 2 The center shall collect data catalogs from one or more data sources. A catalog describes the data contained in the collection of archived data and may include descriptions of the schema or structure of the data, a description of the contents of the data; e.g., time range of entries, number of entries; or a sample of the data (e. g. a thumbnail). |
| <i>Requirement:</i> | 3 The center shall store the archived data in a focused repository that is suited to a particular set of ITS data users. |
| <i>Requirement:</i> | 4 The center shall include capabilities for performing quality checks on the incoming archived data. |
| <i>Requirement:</i> | 5 The center shall include capabilities for error notification on the incoming archived data. |
| <i>Requirement:</i> | 6 The center shall include capabilities for archive to archive coordination. |
| <i>Requirement:</i> | 7 The center shall support a broad range of archived data management implementations, ranging from simple data marts that collect a focused set of data and serve a particular user community to large-scale data warehouses that collect, integrate, and summarize transportation data from multiple sources and serve a broad array of users within a region. |
| <i>Requirement:</i> | 8 The center shall perform quality checks on received data. |
| <i>Requirement:</i> | 9 The center shall provide the capability to execute methods on the incoming data such as cleansing, summarizations, aggregations, or transformations applied to the data before it is stored in the archive. |
| <i>Requirement:</i> | 10 The center shall respond to requests from the administrator interface function to maintain the archive data. |
| <i>Requirement:</i> | 11 When data or a catalog of data is received from the archive, the center shall generate the requested data product for the users systems. |
| <i>Requirement:</i> | 12 For archive data requiring financial payment, the center shall process the financial requests and manage an interface to a Financial Institution. |

Functional Area: **Traffic and Roadside Data Archival**

Collects and archives traffic and environmental information directly from the roadside for use in off-line planning, research, and analysis.

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| <i>Requirement:</i> | 1 The center shall manage the collection of archive data directly from collection equipment located at the roadside. |
| <i>Requirement:</i> | 2 The center shall collect traffic sensor information from roadside devices. |
| <i>Requirement:</i> | 3 The center shall collect environmental sensor information that from roadside devices. |
| <i>Requirement:</i> | 4 The center shall respond to requests from the Archive Data Administer to input the parameters that control the collection process. |
| <i>Requirement:</i> | 5 The center shall send the request for data and control parameters to the field equipment where the information is collected and returned. |
| <i>Requirement:</i> | 6 The center shall record the status about the imported traffic and roadside data. |
| <i>Requirement:</i> | 7 The center shall use the status information to adjust the collection of traffic and roadside data. |

Functional Area: **Government Reporting Systems Support**

Selects and formats data residing in an ITS archive to facilitate local, state, and federal government data reporting requirements.

Architecture**Northern New Jersey ITS Architecture***Element:***NJTPA Region Probe Data***Entity:***Archived Data Management Subsystem***Functional Area:* **Government Reporting Systems Support**

Selects and formats data residing in an ITS archive to facilitate local, state, and federal government data reporting requirements.

- Requirement:* 1 The center shall provide data from an ITS archive to federal, state, or local government reporting systems.
- Requirement:* 2 The center shall provide the capability to select data from an ITS archive for use in government reports.
- Requirement:* 3 The center shall provide the capability to format data from an ITS archive suitable for input into government reports.
- Requirement:* 4 The center shall support requests for ITS archived data from Government Reporting Systems.
- Requirement:* 5 The center shall provide the applicable meta-data for any ITS archived data to satisfy government reporting system requests. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

Functional Area: **Virtual Data Warehouse Services**

Provides access to data from geographically dispersed archives and coordinates information exchange with a local data warehouse. Also provides the specialized publishing, directory services, and transaction management functions associated with coordinating remote archives.

- Requirement:* 1 The center shall provide capabilities to access "in-place" data from geographically dispersed archives. These capabilities may include analysis, data fusion, or data mining.
- Requirement:* 2 The center shall coordinate information exchange with a local data warehouse.
- Requirement:* 3 The center shall provide the specialized publishing, directory services, and transaction management functions associated with coordinating remote archives.
- Requirement:* 4 The center shall support the collection of archived data from other archives on an as-needed basis. (This minimizes the need to duplicate the comprehensive set of data from the remote archives in the local data warehouse.)
- Requirement:* 5 The center shall use data collected from different archives to build a set of global schema including the data archive definitions for the local archive plus any archives known to the local archive.
- Requirement:* 6 The center shall provide the local archived data schema to other archive systems.

*Element:***NJTPA Region Public Safety Dispatch***Entity:***Emergency Management***Functional Area:* **Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

- Requirement:* 1 The center shall support the interface to the Emergency Telecommunications System (e.g. 911 or 7-digit call routing) to receive emergency notification information and provide it to the emergency system operator.
- Requirement:* 2 The center shall receive emergency call information from 911 services and present the possible incident information to the emergency system operator.
- Requirement:* 3 The center shall receive emergency call information from motorist call-boxes and present the possible incident information to the emergency system operator.
- Requirement:* 4 The center shall receive emergency call information from mayday service providers and present the possible incident information to the emergency system operator.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Region Public Safety Dispatch***Entity:* **Emergency Management***Functional Area:* **Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

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| <i>Requirement:</i> | 5 The center shall receive emergency notification information from other public safety agencies and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 6 The center shall receive emergency notification information from public transit systems and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 7 The center shall receive emergency notification information from commercial vehicles, commercial vehicle check stations, or commercial fleet operators and present the possible incident information to the emergency system operator. This may include detection of non-permitted transport of security sensitive hazmat, hazardous cargo spills, etc. |
| <i>Requirement:</i> | 8 The center shall receive details of the cargo being carried by commercial vehicles from their commercial fleet manager for incidents involving potential hazardous materials. |
| <i>Requirement:</i> | 9 The center shall coordinate, correlate, and verify all emergency inputs, including those identified based on external calls and internal analysis of security sensor and surveillance data, and assign each a level of confidence. |
| <i>Requirement:</i> | 10 The center shall send a request for remote control of CCTV systems from a traffic management center in order to verify the reported incident. |
| <i>Requirement:</i> | 11 The center shall update the incident information log once the emergency system operator has verified the incident. |
| <i>Requirement:</i> | 12 The center shall provide the capability for digitized map data to act as the background to the emergency information presented to the emergency system operator. |
| <i>Requirement:</i> | 13 The center shall forward the verified emergency information to the responding agency based on the location and nature of the emergency. |

Functional Area: **Emergency Dispatch**

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

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| <i>Requirement:</i> | 1 The center shall dispatch emergency vehicles to respond to verified emergencies and provide suggested routing under center personnel control. |
| <i>Requirement:</i> | 2 The center shall store the current status of all emergency vehicles available for dispatch and those that have been dispatched. |
| <i>Requirement:</i> | 3 The center shall relay location and incident details to the responding vehicles. |
| <i>Requirement:</i> | 4 The center shall provide the capability to request traffic control measures from traffic management centers such as signal preemption, traffic barriers and road closures. |
| <i>Requirement:</i> | 5 The center shall track the location and status of emergency vehicles responding to an emergency and update the incident status based on information from the emergency vehicle. |
| <i>Requirement:</i> | 6 The center shall receive status information from care facilities to determine the appropriate facility and its location. |
| <i>Requirement:</i> | 7 The center shall store and maintain the emergency service responses in an action log. |
| <i>Requirement:</i> | 8 The center shall receive asset restriction information from maintenance centers to support the dispatching of appropriate emergency resources. |

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Region Public Safety Dispatch***Entity:* **Emergency Management***Functional Area:* **Emergency Dispatch**

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

Requirement: 9 The center shall receive traffic information, including closures, traffic conditions, etc. from traffic management centers.

Requirement: 10 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.

Requirement: 11 The center shall receive road network conditions and traffic images to support dispatch of emergency vehicles.

Requirement: 12 The center shall coordinate response to incidents with other Emergency Management centers to ensure appropriate resources are dispatched and utilized.

Functional Area: **Emergency Routing**

Routing of emergency vehicles to facilitate the quickest/safest arrival. Routes may be determined based on real-time traffic information and road conditions or routes may be provided by Traffic Management on request.

Requirement: 1 The center shall collect current traffic and road condition information from traffic management centers for emergency vehicle route calculation.

Requirement: 2 The center shall receive inputs from traffic management and maintenance centers on the location and status of traffic control equipment and work zones along potential emergency routes.

Requirement: 3 The center shall calculate emergency vehicle routes based on information from traffic management and maintenance centers.

Requirement: 4 In special circumstances such as during disasters and evacuations when normal routes are not available, the center shall request a route from the traffic management center.

Requirement: 5 The center shall provide the capability to request special traffic control measures from the traffic management center to facilitate emergency vehicle progress along the suggested route.

Requirement: 6 Once the route is calculated the route shall be provided to the dispatch function.

Functional Area: **Emergency Early Warning System**

Monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies in order to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to other ITS centers to notify the traveling public. Includes support for Child Abduction notices.

Requirement: 1 The center shall monitor information from Alerting and Advisory Systems such as the Information Sharing and Analysis Centers (ISACs), the National Infrastructure Protection Center (NIPC), the Homeland Security Advisory System (HSAS), etc. The information may include assessments (general incident and vulnerability awareness information), advisories (identification of threats or recommendations to increase preparedness levels), or alerts (information on imminent or in-progress emergencies).

Requirement: 2 The center shall provide the capability to correlate alerts and advisories, incident information, and security sensor and surveillance data.

Requirement: 3 The center shall broadcast wide-area alerts and advisories to traffic management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.

Requirement: 4 The center shall broadcast wide-area alerts and advisories to transit management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Region Public Safety Dispatch***Entity:* **Emergency Management***Functional Area:* **Emergency Early Warning System**

Monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies in order to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to other ITS centers to notify the traveling public. Includes support for Child Abduction notices.

- Requirement:* 5 The center shall broadcast wide-area alerts and advisories to toll administration centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 6 The center shall broadcast wide-area alerts and advisories to traveler information service providers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 7 The center shall broadcast wide-area alerts and advisories to maintenance centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 8 The center shall broadcast wide-area alerts and advisories to other emergency management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
- Requirement:* 9 The center shall process status information from each of the centers that have been sent the wide-area alert.
- Requirement:* 10 The center shall coordinate the broadcast of wide-area alerts and advisories with other emergency management centers.
- Requirement:* 11 The center shall receive incident information from other transportation management centers to support the early warning system.
- Requirement:* 12 The center shall present the alert and advisory information and the status of the actions taken in response to the alert by the other centers to the emergency system operator as received from other system inputs.
- Requirement:* 13 The center shall support the entry of alert and advisory information directly from the emergency system operator.

Functional Area: **Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

- Requirement:* 1 The center shall provide strategic emergency response capabilities such as that of an Emergency Operations Center for large-scale incidents and disasters.
- Requirement:* 2 The center shall manage coordinated inter-agency responses to and recovery from large-scale emergencies. Such agencies include traffic management, transit, maintenance and construction management, rail operations, and other emergency management agencies.
- Requirement:* 3 The center shall provide the capability to implement response plans and track progress through the incident by exchanging incident information and distributing response status to allied agencies.
- Requirement:* 4 The center shall develop, coordinate with other agencies, and store emergency response plans.
- Requirement:* 5 The center shall track the availability of resources (including vehicles, roadway cleanup?, etc.), request additional resources from traffic, maintenance, or other emergency centers if needed.
- Requirement:* 6 The center shall allocate the appropriate emergency services, resources, and vehicle (s) to respond to incidents, and shall provide the capability to override the current allocation to suit the special needs of a current incident.
- Requirement:* 7 The center shall receive event scheduling information from Event Promoters.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Region Public Safety Dispatch***Entity:* **Emergency Management***Functional Area:* **Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

- Requirement:* 8 The center shall receive hazardous materials incident information from commercial fleet operators.
- Requirement:* 9 The center shall provide the capability to request the safe disabling of a commercial vehicle during a hazardous materials incident.
- Requirement:* 10 The center shall provide the capability to request transit resource availability from transit centers for use during disaster and evacuation operations.
- Requirement:* 11 The center shall assimilate the status of the transit, traffic, rail, maintenance, and other emergency center services and systems to create an overall transportation system status, and disseminate to each of these centers and the traveling public via traveler information providers.
- Requirement:* 12 The center shall provide information to the media concerning the status of an emergency response.
- Requirement:* 13 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.
- Requirement:* 14 The center shall provide the capability for center personnel to provide inputs to the management of incidents, disasters and evacuations.

Functional Area: **Incident Command**

Tactical decision support, resource coordination, and communications integration among emergency management agencies for Incident Commands that are established by first responders to support local management of an incident.

- Requirement:* 1 The center shall provide tactical decision support, resource coordination, and communications integration for Incident Commands that are established by first responders to support local management of an incident.
- Requirement:* 2 The center shall provide incident command communications with public safety, emergency management, transportation, and other allied response agency centers.
- Requirement:* 3 The center shall track and maintain resource information and action plans pertaining to the incident command.
- Requirement:* 4 The center shall share incident command information with other public safety agencies including resource deployment status, hazardous material information, rail incident information, evacuation advice as well as traffic, road, and weather conditions.
- Requirement:* 5 The center shall assess the status of responding emergency vehicles as part of an incident command.

Functional Area: **Emergency Evacuation Support**

Evacuation planning and coordination to manage evacuation and reentry of a population in the vicinity of a disaster or other emergency that poses a risk to public safety.

- Requirement:* 1 The center shall manage inter-agency coordination of evacuation operations, from initial planning through the evacuation process and reentry.
- Requirement:* 2 The center shall develop and exchange evacuation plans with allied agencies prior to the occurrence of a disaster.
- Requirement:* 3 The center shall provide an interface to the emergency system operator to enter evacuation plans and procedures and present the operator with other agencies' plans.
- Requirement:* 4 The center shall coordinate evacuation destinations and shelter needs with shelter providers (e.g., the American Red Cross) in the region.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Region Public Safety Dispatch***Entity:* **Emergency Management***Functional Area:* **Emergency Evacuation Support**

Evacuation planning and coordination to manage evacuation and reentry of a population in the vicinity of a disaster or other emergency that poses a risk to public safety.

- Requirement:* 5 The center shall provide evacuation information to traffic, transit, maintenance and construction, rail operations, and other emergency management centers as needed.
- Requirement:* 6 The center shall request resources from transit agencies as needed to support the evacuation.
- Requirement:* 7 The center shall request traffic management agencies to implement special traffic control strategies and to control evacuation traffic, including traffic on local streets and arterials as well as the major evacuation routes.
- Requirement:* 8 The center shall provide traveler information systems with evacuation guidance including basic information to assist potential evacuees in determining whether evacuation is necessary and when it is safe to return.
- Requirement:* 9 The center shall monitor the progress or status of the evacuation once it begins and exchange tactical plans, prepared during the incident, with allied agencies.
- Requirement:* 10 The center shall monitor the progress of the reentry process.
- Requirement:* 11 The center shall submit evacuation information to toll administration centers along with requests for changes in the toll services or fee collection during an evacuation.

Functional Area: **Emergency Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and emergency vehicles equipped with environmental sensors; used by the operator to more effectively manage incidents.

- Requirement:* 1 The center shall collect current and forecast road and weather information from weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
- Requirement:* 2 The center shall receive environmental probe information from its fleet of emergency vehicles.
- Requirement:* 3 The center shall collect current road and weather information from roadway maintenance operations.
- Requirement:* 4 The center shall assimilate current and forecast road conditions and surface weather information to support incident management.
- Requirement:* 5 The center shall present the current and forecast road and weather information to the emergency system operator.
- Requirement:* 6 The center shall provide aggregated or processed environmental probe information from its fleet of emergency vehicles to traffic management and maintenance centers.

Functional Area: **Center Secure Area Surveillance**

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 1 The center shall remotely monitor video images and audio surveillance data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The data may be raw or pre-processed in the field.
- Requirement:* 2 The center shall remotely monitor video images and audio surveillance data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The data may be raw or pre-processed in the field.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Region Public Safety Dispatch***Entity:* **Emergency Management***Functional Area:* **Center Secure Area Surveillance**

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 3 The center shall remotely monitor video images and audio surveillance data collected on-board transit vehicles. The data may be raw or pre-processed in the field.
- Requirement:* 4 The center shall exchange surveillance data with other emergency centers.
- Requirement:* 5 The center shall identify potential security threats based on collected security surveillance data.
- Requirement:* 6 The center shall verify potential security threats by correlating security surveillance data from multiple sources.
- Requirement:* 7 The center shall remotely control security surveillance devices in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways).
- Requirement:* 8 The center shall remotely control security surveillance devices in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers).
- Requirement:* 9 The center shall remotely control security surveillance devices on-board transit vehicles.
- Requirement:* 10 The center shall match traveler video images against a database from the Alerting and Advisory Systems of known images that may represent criminals and terrorists.
- Requirement:* 11 The center shall exchange traveler images with other emergency management centers to support traveler image matching.
- Requirement:* 12 The center shall respond to control data from center personnel regarding security surveillance data collection, processing, threat detection, and image matching.

Functional Area: **Center Secure Area Sensor Management**

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 1 The center shall remotely monitor and control security sensor data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), infrastructure condition and integrity, intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 2 The center shall remotely monitor and control security sensor data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 3 The center shall remotely monitor and control security sensor data collected on-board transit vehicles. The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors) and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 4 The center shall exchange security sensor data with other emergency centers.

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Region Public Safety Dispatch***Entity:* **Emergency Management***Functional Area:* **Center Secure Area Sensor Management**

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 5 The center shall identify potential security threats based on collected security sensor data.
- Requirement:* 6 The center shall verify potential security threats by correlating security sensor data from multiple sources.
- Requirement:* 7 The center shall perform threat analysis based on correlations of security sensor and surveillance data.
- Requirement:* 8 The center shall exchange threat analysis data with Alerting and Advisory Systems and use that data in local threat analysis processing.
- Requirement:* 9 The center shall disseminate threat information to other agencies, including traffic, transit, maintenance, rail operations, and other emergency management centers.
- Requirement:* 10 The center shall respond to control data from center personnel regarding security sensor data collection, processing, threat detection, and threat analysis.

Functional Area: **Center Secure Area Alarm Support**

Collection and response to silent and audible alarms received from travelers in secure areas (such as transit stops, rest areas, park-and-ride lots) and from on-board transit vehicles.

- Requirement:* 1 The center shall collect silent and audible alarms received from travelers in secure areas (such as transit stops, rest areas, park and ride lots, modal interchange facilities).
- Requirement:* 2 The center shall collect silent and audible alarms received from transit vehicles, originated by the traveler or the transit vehicle operator.
- Requirement:* 3 After the alarm message has been received, the center shall generate an alarm acknowledgment to the sender.
- Requirement:* 4 After the alarm message becomes a verified incident, the center shall determine the appropriate response.
- Requirement:* 5 The center shall determine whether the alarm message indicates an emergency that requires the attention of public safety agencies, and forward alarm message data to the appropriate agency as necessary.
- Requirement:* 6 The center shall forward the alarm message to center personnel and respond to the traveler or transit vehicle operator as directed by the personnel.

Functional Area: **Mayday Support**

Collection and response to Mayday messages received from vehicles and drivers.

- Requirement:* 1 The center shall collect mayday messages from vehicles and drivers.
- Requirement:* 2 The center shall collect mayday messages from travelers via personal handheld devices.
- Requirement:* 3 The center shall acknowledge the request for emergency assistance, whether originated by the driver, automatically by the vehicle's safety systems, or by a traveler via a personal handheld device.
- Requirement:* 4 After the mayday becomes a verified incident, the center shall determine the appropriate response to the mayday message.
- Requirement:* 5 The center shall determine whether the mayday message indicates an emergency that requires the attention of public safety agencies, and forward mayday emergency data to the appropriate agency as necessary.

Architecture**Northern New Jersey ITS Architecture***Element:***NJTPA Region Public Safety Dispatch***Entity:***Emergency Management***Functional Area:* **Mayday Support**

Collection and response to Mayday messages received from vehicles and drivers.

- Requirement:* 6 The center shall support the activation of remote controlled functions requested by a vehicle, such as requests to unlock doors.
- Requirement:* 7 The center shall request additional emergency details from or issue commands to the vehicle's security systems or vehicle driver if needed.
- Requirement:* 8 The center shall maintain a log of all mayday signals received from vehicles.
- Requirement:* 9 The center shall provide all mayday data to center personnel and respond to the vehicle, driver, or traveler using the portable handheld device as directed by the personnel.

Functional Area: **Emergency Data Collection**

Collection and storage of information related to Emergency Management. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect emergency service data, emergency vehicle management data, emergency vehicle data, sensor and surveillance data, threat data, and incident data.
- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.
- Requirement:* 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the emergency management data or for the data itself.
- Requirement:* 4 The center shall be able to produce sample products of the data available.

*Element:***NJTPA Region RWIS Database***Entity:***Archived Data Management Subsystem***Functional Area:* **ITS Data Repository**

Collect and maintain data and data catalogs from one or more data sources. May include quality checks, error notification, and archive coordination.

- Requirement:* 1 The center shall collect data to be archived from one or more data sources.
- Requirement:* 2 The center shall collect data catalogs from one or more data sources. A catalog describes the data contained in the collection of archived data and may include descriptions of the schema or structure of the data, a description of the contents of the data; e.g., time range of entries, number of entries; or a sample of the data (e. g. a thumbnail).
- Requirement:* 3 The center shall store the archived data in a focused repository that is suited to a particular set of ITS data users.
- Requirement:* 4 The center shall include capabilities for performing quality checks on the incoming archived data.
- Requirement:* 5 The center shall include capabilities for error notification on the incoming archived data.
- Requirement:* 6 The center shall include capabilities for archive to archive coordination.
- Requirement:* 7 The center shall support a broad range of archived data management implementations, ranging from simple data marts that collect a focused set of data and serve a particular user community to large-scale data warehouses that collect, integrate, and summarize transportation data from multiple sources and serve a broad array of users within a region.
- Requirement:* 8 The center shall perform quality checks on received data.
- Requirement:* 9 The center shall provide the capability to execute methods on the incoming data such as cleansing, summarizations, aggregations, or transformations applied to the data before it is stored in the archive.

Architecture

Northern New Jersey ITS Architecture

Element: **NJTPA Region RWIS Database**

Entity: **Archived Data Management Subsystem**

Functional Area: **ITS Data Repository**

Collect and maintain data and data catalogs from one or more data sources. May include quality checks, error notification, and archive coordination.

- Requirement:* 10 The center shall respond to requests from the administrator interface function to maintain the archive data.
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- Requirement:* 11 When data or a catalog of data is received from the archive, the center shall generate the requested data product for the users systems.
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- Requirement:* 12 For archive data requiring financial payment, the center shall process the financial requests and manage an interface to a Financial Institution.
-

Functional Area: **Virtual Data Warehouse Services**

Provides access to data from geographically dispersed archives and coordinates information exchange with a local data warehouse. Also provides the specialized publishing, directory services, and transaction management functions associated with coordinating remote archives.

- Requirement:* 1 The center shall provide capabilities to access "in-place" data from geographically dispersed archives. These capabilities may include analysis, data fusion, or data mining.
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- Requirement:* 2 The center shall coordinate information exchange with a local data warehouse.
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- Requirement:* 3 The center shall provide the specialized publishing, directory services, and transaction management functions associated with coordinating remote archives.
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- Requirement:* 4 The center shall support the collection of archived data from other archives on an as-needed basis. (This minimizes the need to duplicate the comprehensive set of data from the remote archives in the local data warehouse.)
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- Requirement:* 5 The center shall use data collected from different archives to build a set of global schema including the data archive definitions for the local archive plus any archives known to the local archive.
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- Requirement:* 6 The center shall provide the local archived data schema to other archive systems.
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Element: **NJTPA Region Sheriffs/Police Vehicles**

Entity: **Emergency Vehicle Subsystem**

Functional Area: **On-board EV En Route Support**

On-board systems for gathering of dispatch and routing information for emergency vehicle personnel, vehicle tracking, communications with care facilities, and signal preemption via short range communication directly with traffic control equipment at the roadside.

- Requirement:* 1 The emergency vehicle, including roadway service patrols, shall compute the location of the emergency vehicle based on inputs from a vehicle location determination function.
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- Requirement:* 2 The emergency vehicle, including roadway service patrols, shall send the vehicle's location and operational data to the center for emergency management and dispatch.
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- Requirement:* 3 The emergency vehicle, including roadway service patrols, shall receive incident details and a suggested route when dispatched to a scene.
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- Requirement:* 4 The emergency vehicle shall send the current en route status (including estimated time of arrival) and requests for emergency dispatch updates.
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- Requirement:* 5 The emergency vehicle shall send requests to traffic signal control equipment at the roadside to preempt the signal.
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- Requirement:* 6 The emergency vehicle shall provide the personnel on-board with dispatch information, including incident type and location, and forward an acknowledgment from personnel to the center that the vehicle is on its way to the incident scene.
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Architecture**Northern New Jersey ITS Architecture***Element:***NJTPA Region Sheriffs/Police Vehicles***Entity:***Emergency Vehicle Subsystem***Functional Area:* **On-board EV En Route Support**

On-board systems for gathering of dispatch and routing information for emergency vehicle personnel, vehicle tracking, communications with care facilities, and signal preemption via short range communication directly with traffic control equipment at the roadside.

Requirement: 7 The emergency vehicle shall send patient status information to the care facility along with a request for further information.

Requirement: 8 The emergency vehicle shall forward care facility status information to emergency vehicle personnel, including the location, specialized services, quality of care, waiting time, number of rooms available, and emergency room status of hospitals or emergency care providers.

Functional Area: **On-board EV Incident Management Communication**

On-board systems providing the direct interface between the emergency vehicle and incident management personnel at the incident site.

Requirement: 1 The emergency vehicle shall receive dispatch instructions sufficient to enable emergency personnel in the field to implement an effective incident response. It includes local traffic, road, and weather conditions, hazardous material information, and the current status of resources that have been allocated to an incident.

Requirement: 2 The emergency vehicle shall provide an interface to the center for emergency personnel to transmit information about the incident site such as the extent of injuries, identification of vehicles and people involved, hazardous material, etc.

Requirement: 3 The emergency vehicle shall provide an interface to the center for emergency personnel to transmit information about the current incident response status such as the identification of the resources on site, site management strategies in effect, and current clearance status.

*Element:***NJTPA Region TMA Fare Management Systems***Entity:***Transit Management***Functional Area:* **Transit Center Fare and Load Management**

Management of fare collection at the center - includes setting and distributing fare information, central processing of fares for transit as well as other ITS services, links to financial institutions and enforcement agencies.

Requirement: 1 The center shall manage the actual value of transit fares for each segment of each regular transit route, including the transmission of the information to transit vehicles and transit stops or stations.

Requirement: 2 The center shall provide the capability for a system operator to manage the transit fares and control the exchange of transit fare information.

Requirement: 3 The center shall process the financial requests from the transit vehicles or roadside and manage an interface to a Financial Institution.

Requirement: 4 The center shall support the payment of transit fare transactions using data provided by the traveler cards / payment instruments.

Requirement: 5 The center shall collect data on fare payment violations and send the data, including images of the violator, to the appropriate enforcement agency.

Requirement: 6 The center shall process requests for transit fares to be paid in advance.

Requirement: 7 The center shall process requests for the advanced payment of tolls and parking lot charges as well as other non-transportation services, e.g. yellow-pages services.

Requirement: 8 The center shall be capable of establishing emergency fare structures to override all other fares during disasters, states of emergency, or evacuations.

Architecture**Northern New Jersey ITS Architecture****Element: NJTPA Region TMA Fare Management Systems****Entity: Transit Management****Functional Area: Transit Center Fare and Load Management**

Management of fare collection at the center - includes setting and distributing fare information, central processing of fares for transit as well as other ITS services, links to financial institutions and enforcement agencies.

- Requirement:* 9 The center shall maintain a list of invalid traveler credit identities, or bad tag lists that can be forwarded to transit vehicles and transit stops or stations.
- Requirement:* 10 The center shall collect passenger loading and fare statistics data to implement variable and flexible fare structures.
- Requirement:* 11 The center shall exchange fare and load information with other transit management centers, including potential Centralized Payments facilities.
- Requirement:* 12 The center shall provide transit fare information to other centers, including traveler information providers upon request.

Element: NJTPA Region TMA Kiosks**Entity: Remote Traveler Support****Functional Area: Remote Transit Information Services**

Public traveler interface that provides real-time travel-related information at transit stops and multi-modal transfer points, including general annunciation, display of imminent arrival information, the latest available information on transit routes, schedules, transfer options, bicycle accessibility, fares, real-time schedule adherence, current incidents, weather conditions, and special events

- Requirement:* 1 The public interface for travelers shall collect and provide real-time travel-related information at transit stops, multi-modal transfer points, and other public transportation areas.
- Requirement:* 2 The public interface for travelers shall collect and present to the transit traveler information on transit routes, schedules, and real-time schedule adherence.
- Requirement:* 3 The public interface for travelers shall provide support for general annunciation and/or display of imminent arrival information and other information of general interest to transit users.
- Requirement:* 4 The public interface for travelers shall present information to the traveler in a form suitable for travelers with physical disabilities.

Element: NJTPA Region TMA Systems**Entity: Transit Management****Functional Area: Transit Center Tracking and Dispatch**

Monitoring transit vehicle locations via interactions with on-board systems and determining vehicle schedule adherence. Furnish users with real-time transit related information and maintain interface with digital map providers.

- Requirement:* 1 The center shall monitor the locations of all transit vehicles within its network.
- Requirement:* 2 The center shall determine adherence of transit vehicles to their assigned schedule.
- Requirement:* 3 The center shall collect trip monitoring data from on-board systems including transit vehicle mileage, fuel usage, passenger loading, availability, etc.
- Requirement:* 4 The center shall provide transit operational data to traveler information service providers.
- Requirement:* 5 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for transit tracking and dispatch.

Functional Area: Transit Center Fixed-Route Operations

Architecture

Northern New Jersey ITS Architecture

Element: **NJTPA Region TMA Systems**

Entity: **Transit Management**

Functional Area: **Transit Center Fixed-Route Operations**

Planning and scheduling associated with fixed and flexible route transit services, automatically updates customer service operator systems, and provides current vehicle schedule adherence and optimum scenarios for schedule adjustment.

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| <i>Requirement:</i> | 1 The center shall generate transit routes and schedules based on such factors as parameters input by the system operator, road network conditions, operational data on current routes and schedules, and digitized map data. |
| <i>Requirement:</i> | 2 The center shall provide the interface to the system operator to control the generation of new routes and schedules (transit services) including the ability to review and update the parameters used by the routes and schedules generation processes and to initiate these processes |
| <i>Requirement:</i> | 3 The center shall be able to generate special routes and schedules to support an incident, disaster, evacuation, or other emergency. |
| <i>Requirement:</i> | 4 The center shall accept requests from traffic management to change routes and schedules as part of the implementation of demand management strategies. |
| <i>Requirement:</i> | 5 The center shall collect transit operational data for use in the generation of routes and schedules. |
| <i>Requirement:</i> | 6 The center shall assign transit vehicle operators based on factors such as eligibility, route preferences, seniority, and transit vehicle availability. |
| <i>Requirement:</i> | 7 The center shall manage large deviations of individual transit vehicles, deviations in rural areas, and deviations of large numbers of vehicles. |
| <i>Requirement:</i> | 8 The center shall generate the necessary corrective actions which may involve more than the vehicles concerned and more far reaching action, such as, the introduction of extra vehicles, wide area signal priority by traffic management, the premature termination of some services, etc. |
| <i>Requirement:</i> | 9 The center shall exchange information with Maintenance and Construction Operations concerning work zones, roadway conditions, asset restrictions, work plans, etc. |
| <i>Requirement:</i> | 10 The center shall disseminate up-to-date schedules and route information to other centers for fixed and flexible route services. |
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Functional Area: **Transit Center Paratransit Operations**

Planning and scheduling of demand responsive transit (i.e. paratransit) services, includes automatic operator assignment and monitoring.

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| <i>Requirement:</i> | 1 The center shall process trip requests for demand responsive transit services, i.e. paratransit. Sources of the requests may include traveler information service providers. |
| <i>Requirement:</i> | 2 The center shall track the location and availability of transit vehicles for use in demand responsive transit (paratransit) operations. |
| <i>Requirement:</i> | 3 The center shall generate demand responsive transit (paratransit) routes and schedules based on such factors as parameters input by the system operator, what other demand responsive transit schedules have been planned, the availability and location of vehicles, the relevance of any fixed transit routes and schedules, and road network information. |
| <i>Requirement:</i> | 4 The center shall assign transit vehicle operators for confirmed demand responsive transit (paratransit) trips based on factors such as eligibility, route preferences, seniority, and transit vehicle availability. |
| <i>Requirement:</i> | 5 The center shall exchange information with Maintenance and Construction Operations concerning work zones, roadway conditions, asset restrictions, work plans, etc. |
| <i>Requirement:</i> | 6 The center shall disseminate up-to-date schedules and route information to other centers for demand responsive transit services (paratransit). |
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Functional Area: **Transit Center Security**

Architecture

Northern New Jersey ITS Architecture

Element: **NJTPA Region TMA Systems**

Entity: **Transit Management**

Functional Area: **Transit Center Security**

Monitor transit vehicle operator or traveler activated alarms; authenticate transit vehicle operators; remotely disable a transit vehicle; alert operators, travelers, and police to potential incidents identified by these security features.

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| <i>Requirement:</i> | 1 The center shall monitor transit vehicle operational data to determine if the transit vehicle is off-route and assess whether a security incident is occurring. |
| <i>Requirement:</i> | 2 The center shall receive reports of emergencies on-board transit vehicles entered directly by the transit vehicle operator or from a traveler through interfaces such as panic buttons or alarm switches. |
| <i>Requirement:</i> | 3 The center shall support the back-office portion of functionality to authenticate transit vehicle operators. |
| <i>Requirement:</i> | 4 The center shall exchange transit incident information along with other service data with other transit agencies. |
| <i>Requirement:</i> | 5 The center shall receive information pertaining to a wide-area alert such as weather alerts, disaster situations, or child abductions. This information may come from Emergency Management or from other Alerting and Advisory Systems. |
| <i>Requirement:</i> | 6 The center shall send wide-area alert information to travelers (on-board transit vehicles or at stations/stops) and transit vehicle operators. |
| <i>Requirement:</i> | 7 The center shall coordinate the response to security incidents involving transit with other agencies including Emergency Management, other transit agencies, media, traffic management, and traveler information service providers. |
| <i>Requirement:</i> | 8 The center shall receive threat information and status on the integrity of the transit infrastructure. |
| <i>Requirement:</i> | 9 The center shall provide support to remotely disable (or reset the disabling of) a transit vehicle in service. |
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Functional Area: **Transit Garage Operations**

Assignment of transit vehicles and operators to routes or service areas in a fair manner while minimizing labor and overtime services, considering operator preferences, qualifications, accumulated work hours, and other information about each operator.

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| <i>Requirement:</i> | 1 The center shall maintain records of a transit vehicle operator's performance. This may be done utilizing standardized performance evaluation criteria set forth by governmental regulations and transit operating company policies, assessing the transit vehicle operator's driving history, and assessing comments from the transit vehicle operator's supervisor(s) as well as noting any moving violations or accidents, supervisor comments, government regulations, and company policies. |
| <i>Requirement:</i> | 2 The center shall assess the transit vehicle operator's availability based on previous work assignments, accumulated hours, plus health and vacation commitments. |
| <i>Requirement:</i> | 3 The center shall assign transit vehicle operators to transit schedules based on their eligibility, route preferences, seniority, and transit vehicle availability. |
| <i>Requirement:</i> | 4 The center shall provide an interface through which the transit vehicle operator information can be maintained - either from the transit vehicle operator, a transit system operator (i.e. center personnel), or other functions. |
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Functional Area: **Transit Center Information Services**

Provide interactive traveler information to travelers (on-board transit vehicles, at stops/stations, using personal devices), traveler information service providers, media, and other transit organizations. Includes routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, yellow pages, and special events.

Architecture

Northern New Jersey ITS Architecture

Element: **NJTPA Region TMA Systems**

Entity: **Transit Management**

Functional Area: **Transit Center Information Services**

Provide interactive traveler information to travelers (on-board transit vehicles, at stops/stations, using personal devices), traveler information service providers, media, and other transit organizations. Includes routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, yellow pages, and special events.

- Requirement:*
- 1 The center shall provide travelers using public transportation with traffic and advisory information upon request. Such information may include transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events.
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- Requirement:*
- 2 The center shall provide transit information to the media including details of deviations from schedule of regular transit services.
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- Requirement:*
- 3 The center shall exchange transit schedules, real-time arrival information, fare schedules, and general transit service information with other transit organizations to support transit traveler information systems.
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- Requirement:*
- 4 The center shall provide transit service information to traveler information service providers including routes, schedules, schedule adherence, and fare information as well as transit service information during evacuation.
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- Requirement:*
- 5 The center shall enable yellow pages (including non-motorized transportation) information to be output to the traveler.
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- Requirement:*
- 6 The center shall broadcast transit advisory data, including alerts and advisories pertaining to major emergencies, or man made disasters.
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Functional Area: **Transit Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and vehicle probes. The information is monitored and forwarded to other agencies to more effectively manage transit operations.

- Requirement:*
- 1 The center shall assimilate current and forecast road conditions and surface weather information to more effectively manage transit operations.
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- Requirement:*
- 2 The center shall collect current and forecast road and weather information from weather service providers and vehicle probes.
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- Requirement:*
- 3 The center shall receive road network probe information from its fleet of transit vehicles.
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- Requirement:*
- 4 The center shall provide road network probe information from its fleet of transit vehicles to traffic management as well as maintenance and construction management.
-

Functional Area: **Transit Center Multi-Modal Coordination**

Generate requests for transit priority on routes and at certain intersections. Coordinate schedules with other agencies and modes, including transit transfer cluster and transfer point information.

- Requirement:*
- 1 The center shall analyze transit vehicle schedule performance to determine the need for priority along certain routes or at certain intersections.
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- Requirement:*
- 2 The center shall send requests for priority along routes or at intersections to traffic management.
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- Requirement:*
- 3 The center shall coordinate schedules and services between transit agencies, traffic management, maintenance and construction operations, parking management, and other surface or air transportation modes.
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- Requirement:*
- 4 The center shall share transfer cluster and transfer point information with multimodal transportation service providers, other transit agencies, and traveler information service providers. A transfer cluster is a collection of stops, stations, or terminals where transfers can be made conveniently.
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Functional Area: **Transit Evacuation Support**

Architecture**Northern New Jersey ITS Architecture***Element:* **NJTPA Region TMA Systems***Entity:* **Transit Management***Functional Area:* **Transit Evacuation Support**

Support evacuation and subsequent reentry of a population in the vicinity of a disaster or other emergency.
Coordinate regional evacuation plans and resources including transit and school bus fleets.

- Requirement:* 1 The center shall manage the use of transit resources to support evacuation and subsequent reentry of a population in the vicinity of a disaster or other emergency.
- Requirement:* 2 The center shall coordinate regional evacuation plans with Emergency Management - identifying the transit role in an evacuation and the transit resources that would be used.
- Requirement:* 3 The center shall coordinate the use of transit and school bus fleets during an evacuation, supporting evacuation of those with special needs and the general population.
- Requirement:* 4 The center shall adjust and update transit service and fare schedules and provide that information to other agencies as they coordinate evacuations.

Functional Area: **Transit Data Collection**

Collection and storage of transit management data. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect transit management data such as transit fares and passenger use, transit services, paratransit operations, transit vehicle maintenance data, etc.
- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.
- Requirement:* 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the transit data or for the data itself.
- Requirement:* 4 The center shall be able to produce sample products of the data available.

Element: **NJTPA Region TMA Traveler Information Systems***Entity:* **Information Service Provider***Functional Area:* **Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

- Requirement:* 1 The center shall collect, process, store, and disseminate customized traffic and highway condition information to travelers, including incident information, detours and road closures, recommended routes, and current speeds on specific routes upon request.
- Requirement:* 2 The center shall collect, process, store, and disseminate customized maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities upon request.
- Requirement:* 3 The center shall collect, process, store, and disseminate customized transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers upon request.
- Requirement:* 4 The center shall collect, process, store, and disseminate customized parking information to travelers, including location, availability, and fees upon request.
- Requirement:* 5 The center shall collect, process, store, and disseminate customized toll fee information to travelers upon request.
- Requirement:* 6 The center shall collect, process, store, and disseminate customized weather information to travelers upon request.
- Requirement:* 7 The center shall collect, process, store, and disseminate customized multimodal transportation service information (for example, from ferry and airline operators), including transfer points and other information, to travelers upon request.

Architecture**Northern New Jersey ITS Architecture****Element: NJTPA Region TMA Traveler Information Systems****Entity: Information Service Provider****Functional Area: Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

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| <i>Requirement:</i> | 8 | The center shall collect, process, store, and disseminate customized event information to travelers upon request. |
| <i>Requirement:</i> | 9 | The center shall collect, process, store, and disseminate customized air quality information to travelers upon request. |
| <i>Requirement:</i> | 10 | The center shall provide all traveler information based on the traveler's current location or a specific location identified by the traveler, and filter or customize the provided information accordingly. |
| <i>Requirement:</i> | 11 | The center shall accept traveler profiles for determining the type of personalized data to send to the traveler. |
| <i>Requirement:</i> | 12 | The center shall manage payment for services, such as tolls, transit fares, parking lot charges, map updates, and advanced payment for tolls, and provide transaction success or failure details. |
| <i>Requirement:</i> | 13 | The center shall support requests for traveler information and advanced payment for traveler services from commercial fleet operators. |
| <i>Requirement:</i> | 14 | The center shall provide the capability to exchange information with another traveler information service provider current or predicted data for road links that are outside the area served by the local supplier. |
| <i>Requirement:</i> | 15 | The center shall manage updates of digitized map data and provide updates to traveler interface systems upon request. |
| <i>Requirement:</i> | 16 | The center shall provide the capability to support requests from the media for traffic and incident data. |
| <i>Requirement:</i> | 17 | The center shall provide the capability for a system operator to control the type and update frequency of traveler information. |

Element: NJTPA Region Transit Coordination Network**Entity: Transit Management****Functional Area: Transit Center Multi-Modal Coordination**

Generate requests for transit priority on routes and at certain intersections. Coordinate schedules with other agencies and modes, including transit transfer cluster and transfer point information.

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| <i>Requirement:</i> | 1 | The center shall analyze transit vehicle schedule performance to determine the need for priority along certain routes or at certain intersections. |
| <i>Requirement:</i> | 2 | The center shall send requests for priority along routes or at intersections to traffic management. |
| <i>Requirement:</i> | 3 | The center shall coordinate schedules and services between transit agencies, traffic management, maintenance and construction operations, parking management, and other surface or air transportation modes. |
| <i>Requirement:</i> | 4 | The center shall share transfer cluster and transfer point information with multimodal transportation service providers, other transit agencies, and traveler information service providers. A transfer cluster is a collection of stops, stations, or terminals where transfers can be made conveniently. |

Element: NJTPA Regional Fare Reciprocity Network**Entity: Transit Management****Functional Area: Transit Center Fare and Load Management**

Management of fare collection at the center - includes setting and distributing fare information, central processing of fares for transit as well as other ITS services, links to financial institutions and enforcement agencies.

Architecture**Northern New Jersey ITS Architecture****Element: NJTPA Regional Fare Reciprocity Network****Entity: Transit Management****Functional Area: Transit Center Fare and Load Management**

Management of fare collection at the center - includes setting and distributing fare information, central processing of fares for transit as well as other ITS services, links to financial institutions and enforcement agencies.

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| <i>Requirement:</i> | 1 The center shall manage the actual value of transit fares for each segment of each regular transit route, including the transmission of the information to transit vehicles and transit stops or stations. |
| <i>Requirement:</i> | 2 The center shall provide the capability for a system operator to manage the transit fares and control the exchange of transit fare information. |
| <i>Requirement:</i> | 3 The center shall process the financial requests from the transit vehicles or roadside and manage an interface to a Financial Institution. |
| <i>Requirement:</i> | 4 The center shall support the payment of transit fare transactions using data provided by the traveler cards / payment instruments. |
| <i>Requirement:</i> | 5 The center shall collect data on fare payment violations and send the data, including images of the violator, to the appropriate enforcement agency. |
| <i>Requirement:</i> | 6 The center shall process requests for transit fares to be paid in advance. |
| <i>Requirement:</i> | 7 The center shall process requests for the advanced payment of tolls and parking lot charges as well as other non-transportation services, e.g. yellow-pages services. |
| <i>Requirement:</i> | 8 The center shall be capable of establishing emergency fare structures to override all other fares during disasters, states of emergency, or evacuations. |
| <i>Requirement:</i> | 9 The center shall maintain a list of invalid traveler credit identities, or bad tag lists that can be forwarded to transit vehicles and transit stops or stations. |
| <i>Requirement:</i> | 10 The center shall collect passenger loading and fare statistics data to implement variable and flexible fare structures. |
| <i>Requirement:</i> | 11 The center shall exchange fare and load information with other transit management centers, including potential Centralized Payments facilities. |
| <i>Requirement:</i> | 12 The center shall provide transit fare information to other centers, including traveler information providers upon request. |

Element: NYSDOT IEN**Entity: Traffic Management****Functional Area: TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

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| <i>Requirement:</i> | 1 The center shall remotely control traffic signal controllers. |
| <i>Requirement:</i> | 2 The center shall accept notifications of right-of-way requests from pedestrians. |
| <i>Requirement:</i> | 3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center. |
| <i>Requirement:</i> | 4 The center shall collect traffic signal controller fault data from the field. |
| <i>Requirement:</i> | 5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc. |

Functional Area: TMC Freeway Management

Architecture**Northern New Jersey ITS Architecture***Element:***NYSDOT IEN***Entity:***Traffic Management***Functional Area:* **TMC Freeway Management**

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

- Requirement:* 1 The center shall remotely control systems to manage use of the freeways, including ramp meters, mainline metering, and lane controls.
- Requirement:* 2 The center shall collect operational status from ramp meters, mainline metering, and lane controls and compare against the control information sent by the center.
- Requirement:* 3 The center shall collect fault data from ramp meters, mainline metering, and lane controls.
- Requirement:* 4 The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, mainline metering, and lane controls), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the ramps themselves.

Functional Area: **TMC Regional Traffic Control**

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

- Requirement:* 1 The center shall exchange traffic information with other traffic management centers, includes incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.
- Requirement:* 2 The center shall exchange traffic control information with other traffic management centers, includes remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).

*Element:***NYSDOT Region 8 TMC***Entity:***Traffic Management***Functional Area:* **TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

- Requirement:* 1 The center shall remotely control traffic signal controllers.
- Requirement:* 2 The center shall accept notifications of right-of-way requests from pedestrians.
- Requirement:* 3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center.
- Requirement:* 4 The center shall collect traffic signal controller fault data from the field.
- Requirement:* 5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.

Functional Area: **TMC Freeway Management**

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

- Requirement:* 1 The center shall remotely control systems to manage use of the freeways, including ramp meters, mainline metering, and lane controls.
- Requirement:* 2 The center shall collect operational status from ramp meters, mainline metering, and lane controls and compare against the control information sent by the center.

Architecture**Northern New Jersey ITS Architecture***Element:***NYSDOT Region 8 TMC***Entity:***Traffic Management***Functional Area:* **TMC Freeway Management**

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

Requirement: 3 The center shall collect fault data from ramp meters, mainline metering, and lane controls.

Requirement: 4 The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, mainline metering, and lane controls), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the ramps themselves.

Functional Area: **TMC Regional Traffic Control**

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

Requirement: 1 The center shall exchange traffic information with other traffic management centers, includes incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.

Requirement: 2 The center shall exchange traffic control information with other traffic management centers, includes remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).

Functional Area: **TMC Work Zone Traffic Management**

Coordination with maintenance systems using work zone images and traveler information systems (such as DMS), and distribution of work plans so that work zones are established that have minimum traffic impact.

Requirement: 1 The center shall receive work zone images from a maintenance center.

Requirement: 2 The center shall analyze work zone images for indications of a possible incident.

Requirement: 3 The center shall remotely control driver information systems (such as dynamic messages signs, highway advisory radios) to advise drivers of activity around a work zone.

Requirement: 4 The center shall collect operational status for the driver information systems equipment in work zones.

Requirement: 5 The center shall collect fault data for the driver information systems equipment in work zones for repair.

Requirement: 6 The center shall receive proposed maintenance and construction work plans, analyze the activity as a possible incident, and provide work plan feedback to the sending center.

*Element:***NYSTA Operations Center***Entity:***Traffic Management***Functional Area:* **TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

Requirement: 1 The center shall remotely control traffic signal controllers.

Requirement: 2 The center shall accept notifications of right-of-way requests from pedestrians.

Requirement: 3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center.

Requirement: 4 The center shall collect traffic signal controller fault data from the field.

Architecture**Northern New Jersey ITS Architecture***Element:***NYSTA Operations Center***Entity:***Traffic Management***Functional Area:* **TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

- Requirement:* 5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.

Functional Area: **TMC Freeway Management**

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

- Requirement:* 1 The center shall remotely control systems to manage use of the freeways, including ramp meters, mainline metering, and lane controls.

- Requirement:* 2 The center shall collect operational status from ramp meters, mainline metering, and lane controls and compare against the control information sent by the center.

- Requirement:* 3 The center shall collect fault data from ramp meters, mainline metering, and lane controls.

- Requirement:* 4 The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, mainline metering, and lane controls), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the ramps themselves.

Functional Area: **TMC Regional Traffic Control**

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

- Requirement:* 1 The center shall exchange traffic information with other traffic management centers, includes incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.

- Requirement:* 2 The center shall exchange traffic control information with other traffic management centers, includes remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).

Functional Area: **TMC Work Zone Traffic Management**

Coordination with maintenance systems using work zone images and traveler information systems (such as DMS), and distribution of work plans so that work zones are established that have minimum traffic impact.

- Requirement:* 1 The center shall receive work zone images from a maintenance center.

- Requirement:* 2 The center shall analyze work zone images for indications of a possible incident.

- Requirement:* 3 The center shall remotely control driver information systems (such as dynamic messages signs, highway advisory radios) to advise drivers of activity around a work zone.

- Requirement:* 4 The center shall collect operational status for the driver information systems equipment in work zones.

- Requirement:* 5 The center shall collect fault data for the driver information systems equipment in work zones for repair.

- Requirement:* 6 The center shall receive proposed maintenance and construction work plans, analyze the activity as a possible incident, and provide work plan feedback to the sending center.

*Element:***Other Facility (Toll) Operations Centers***Entity:***Commercial Vehicle Administration**

Architecture

Northern New Jersey ITS Architecture

Element: **Other Facility (Toll) Operations Centers**

Entity: **Commercial Vehicle Administration**

Functional Area: **CV Safety Administration**

Provides commercial vehicle safety criteria to roadside check facilities, collects and reviews safety data from the field and distributes safety information to other centers, carriers, and enforcement agencies.

Requirement: 1 The center shall provide commercial vehicle safety data to roadside check facilities.

Requirement: 2 The center shall collect and review safety inspection reports and violations from the roadside check facilities and pass on appropriate portions to other commercial vehicle administrative centers and commercial vehicle fleet operators.

Requirement: 3 The center shall notify enforcement agencies of commercial vehicle safety violations by individual commercial vehicles, drivers, or carriers.

Functional Area: **CV Information Exchange**

Exchange information concerning safety, credentialing, and operations of commercial vehicles between the center and the roadside check stations, across jurisdictions, with fleet operators, enforcement agencies, and other information requestors.

Requirement: 1 The center shall exchange information with roadside check facilities, including credentials and credentials status information, safety status information, daily site activity data, and citations.

Requirement: 2 The center shall exchange safety and credentials data among other commercial vehicle administration centers; includes border clearance status, credentials information, credentials status information, and safety status information.

Requirement: 3 The center shall package data concerning commercial vehicle safety and credentials into snapshots (top-level summary and critical status information).

Requirement: 4 The center shall package data concerning commercial vehicle safety and credentials into profiles (detailed and historical data).

Requirement: 5 The center shall provide commercial vehicle accident reports and citations to enforcement agencies.

Requirement: 6 The center shall provide commercial vehicle credentials and safety status information to authorized requestors such as insurance agencies.

Requirement: 7 The center shall provide reports to the commercial vehicle fleet manager regarding fleet activity through roadside facilities including accident reports, citations, credentials status information, and safety status information.

Element: **Other NJTPA Counties TOCs**

Entity: **Traffic Management**

Functional Area: **TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

Requirement: 1 The center shall remotely control traffic signal controllers.

Requirement: 2 The center shall accept notifications of right-of-way requests from pedestrians.

Requirement: 3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center.

Requirement: 4 The center shall collect traffic signal controller fault data from the field.

Requirement: 5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.

Architecture**Northern New Jersey ITS Architecture***Element:Other NJTPA Counties TOCs**Entity:Traffic Management**Functional Area: TMC Freeway Management*

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

- Requirement:* 1 The center shall remotely control systems to manage use of the freeways, including ramp meters, mainline metering, and lane controls.
- Requirement:* 2 The center shall collect operational status from ramp meters, mainline metering, and lane controls and compare against the control information sent by the center.
- Requirement:* 3 The center shall collect fault data from ramp meters, mainline metering, and lane controls.
- Requirement:* 4 The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, mainline metering, and lane controls), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the ramps themselves.

Functional Area: TMC Regional Traffic Control

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

- Requirement:* 1 The center shall exchange traffic information with other traffic management centers, includes incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.
- Requirement:* 2 The center shall exchange traffic control information with other traffic management centers, includes remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).

*Element:Other NJTPA Municipalities PWD Operations**Entity:Maintenance and Construction Management**Functional Area: MCM Incident Management*

Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.

- Requirement:* 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.
- Requirement:* 2 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, etc.
- Requirement:* 3 The center shall exchange incident and threat information with emergency management centers as well as traffic management centers; including notification of existence of incident and expected severity, location, time and nature of incident.
- Requirement:* 4 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.
- Requirement:* 5 The center shall respond to requests from emergency management to provide maintenance and construction resources to implement response plans, assist in clean up, verify an incident, etc. This may also involve coordination with traffic management centers and other maintenance centers.
- Requirement:* 6 The center shall exchange road network status assessment information with emergency management and traffic management centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.

Architecture

Northern New Jersey ITS Architecture

*Element:***Other NJTPA Municipalities PWD Operations**

*Entity:***Maintenance and Construction Management**

Functional Area: **MCM Incident Management**

Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.

Requirement: 7 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

Requirement: 8 The center shall receive information indicating the damage sustained by transportation assets, derived from aerial surveillance, field reports, inspections, tests, and analyses to support incident management.

*Element:***Other NJTPA Municipalities TOCs**

*Entity:***Traffic Management**

Functional Area: **TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

Requirement: 1 The center shall remotely control traffic signal controllers.

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Requirement: 4 The center shall collect traffic signal controller fault data from the field.

Requirement: 5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.

Functional Area: **TMC Freeway Management**

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

Requirement: 1 The center shall remotely control systems to manage use of the freeways, including ramp meters, mainline metering, and lane controls.

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Requirement: 3 The center shall collect fault data from ramp meters, mainline metering, and lane controls.

Requirement: 4 The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, mainline metering, and lane controls), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the ramps themselves.

Functional Area: **TMC Regional Traffic Control**

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

Requirement: 1 The center shall exchange traffic information with other traffic management centers, includes incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.

Architecture

Northern New Jersey ITS Architecture

Element:Other NJTPA Municipalities TOCs

Entity:Traffic Management

Functional Area: TMC Regional Traffic Control

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

- Requirement:* 2 The center shall exchange traffic control information with other traffic management centers, includes remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).
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Element:Palisades Interstate Parkway HQ

Entity:Traffic Management

Functional Area: Collect Traffic Surveillance

Management of traffic sensors and surveillance (CCTV) equipment, and distribution of the collected information to other centers and operators.

- Requirement:* 1 The center shall monitor, analyze, and store traffic sensor data (speed, volume, occupancy) collected from field elements under remote control of the center.
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- Requirement:* 2 The center shall monitor, analyze, and distribute traffic images from CCTV systems under remote control of the center.
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- Requirement:* 3 The center shall monitor, analyze, and store pedestrian sensor data collected from field elements under remote control of the center.
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- Requirement:* 4 The center shall monitor, analyze, and distribute pedestrian images from CCTV systems under remote control of the center.
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- Requirement:* 5 The center shall monitor, analyze, and store multimodal crossing and high occupancy vehicle (HOV) lane sensor data under remote control of the center.
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- Requirement:* 6 The center shall maintain a database of surveillance and sensors and the freeways, surface street and rural roadways, e.g. where they are located, to which part(s) of the network their data applies, the type of data, and the ownership of each link (that is, the agency or entity responsible for collecting and storing surveillance of the link) in the network.
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- Requirement:* 7 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic data.
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- Requirement:* 8 The center shall distribute road network conditions data (raw or processed) based on collected and analyzed traffic sensor and surveillance data to other centers.
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- Requirement:* 9 The center shall respond to control data from center personnel regarding sensor and surveillance data collection, analysis, storage, and distribution.
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Functional Area: TMC Signal Control

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

- Requirement:* 1 The center shall remotely control traffic signal controllers.
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- Requirement:* 2 The center shall accept notifications of right-of-way requests from pedestrians.
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- Requirement:* 3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center.
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- Requirement:* 4 The center shall collect traffic signal controller fault data from the field.
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Architecture**Northern New Jersey ITS Architecture****Element: Palisades Interstate Parkway HQ****Entity: Traffic Management****Functional Area: TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

- Requirement:** 5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.

Functional Area: TMC Freeway Management

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

- Requirement:** 1 The center shall remotely control systems to manage use of the freeways, including ramp meters, mainline metering, and lane controls.

- Requirement:** 2 The center shall collect operational status from ramp meters, mainline metering, and lane controls and compare against the control information sent by the center.

- Requirement:** 3 The center shall collect fault data from ramp meters, mainline metering, and lane controls.

- Requirement:** 4 The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, mainline metering, and lane controls), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the ramps themselves.

Functional Area: TMC Traffic Information Dissemination

Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.

- Requirement:** 1 The center shall remotely control dynamic messages signs for dissemination of traffic and other information to drivers.

- Requirement:** 2 The center shall remotely control driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers.

- Requirement:** 3 The center shall collect operational status for the driver information systems equipment (DMS, HAR, etc.).

- Requirement:** 4 The center shall collect fault data for the driver information systems equipment (DMS, HAR, etc.) for repair.

- Requirement:** 5 The center shall retrieve locally stored traffic information, including current and forecasted traffic information, road and weather conditions, traffic incident information, information on diversions and alternate routes, closures, and special traffic restrictions (lane/shoulder use, weight restrictions, width restrictions, HOV requirements), etc.

- Requirement:** 6 The center shall distribute traffic data to maintenance and construction centers, transit centers, emergency management centers, and traveler information providers.

- Requirement:** 7 The center shall distribute traffic data to the media upon request; the capability to provide the information in both data stream and graphical display shall be supported.

- Requirement:** 8 The center shall provide the capability for center personnel to control the nature of the data that is available to non-traffic operations centers and the media.

Functional Area: TMC Regional Traffic Control

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

Architecture**Northern New Jersey ITS Architecture****Element: Palisades Interstate Parkway HQ****Entity: Traffic Management****Functional Area: TMC Regional Traffic Control**

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

- Requirement:* 1 The center shall exchange traffic information with other traffic management centers, includes incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.
- Requirement:* 2 The center shall exchange traffic control information with other traffic management centers, includes remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).

Functional Area: TMC Incident Dispatch Coordination/Communication

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

- Requirement:* 1 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction for distribution to the public. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, and information and instructions necessary for the public to respond to the alert. This may also identify specific information that should not be released to the public.
- Requirement:* 2 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.
- Requirement:* 3 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field, provide special routing for emergency vehicles, and to provide responding emergency vehicles with signal preemption.
- Requirement:* 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.
- Requirement:* 5 The center shall respond to requests from emergency management to provide traffic management resources to implement special traffic control measures, assist in clean up, verify an incident, etc. This may also involve coordination with maintenance centers.
- Requirement:* 6 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, media, and rail operations centers.
- Requirement:* 7 The center shall provide road network conditions and traffic images to emergency management centers, maintenance and construction centers, and traveler information service providers.
- Requirement:* 8 The center shall exchange road network status assessment information with emergency management and maintenance centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.
- Requirement:* 9 The center shall coordinate information and controls with other traffic management centers.
- Requirement:* 10 The center shall receive inputs from emergency management and transit management centers to develop an overall status of the transportation system including emergency transit schedules in effect and current status and condition of the transportation infrastructure.

Architecture**Northern New Jersey ITS Architecture****Element:Palisades Interstate Parkway HQ****Entity:Traffic Management****Functional Area: TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

- Requirement:** 11 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic incident management.

Functional Area: Traffic Maintenance

Monitoring and remote diagnostics of field equipment - detect failures, issue problem reports, and track the repair or replacement of the failed equipment.

- Requirement:** 1 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) operational status.
- Requirement:** 2 The center shall collect and store CCTV surveillance system (traffic, pedestrian) operational status.
- Requirement:** 3 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) fault data and send to the maintenance center for repair.
- Requirement:** 4 The center shall collect and store CCTV surveillance system (traffic, pedestrian) fault data send to the maintenance center for repair.
- Requirement:** 5 The center shall collect environmental sensor operational status.
- Requirement:** 6 The center shall collect environmental sensor equipment fault data and send to the maintenance center for repair.
- Requirement:** 7 The center shall exchange data with maintenance centers concerning the reporting of faulty equipment and the schedule/status of their repair. Information exchanged includes details of new equipment faults, and clearances when the faults are cleared.
- Requirement:** 8 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic maintenance data.

Functional Area: TMC Work Zone Traffic Management

Coordination with maintenance systems using work zone images and traveler information systems (such as DMS), and distribution of work plans so that work zones are established that have minimum traffic impact.

- Requirement:** 1 The center shall receive work zone images from a maintenance center.
- Requirement:** 2 The center shall analyze work zone images for indications of a possible incident.
- Requirement:** 3 The center shall remotely control driver information systems (such as dynamic messages signs, highway advisory radios) to advise drivers of activity around a work zone.
- Requirement:** 4 The center shall collect operational status for the driver information systems equipment in work zones.
- Requirement:** 5 The center shall collect fault data for the driver information systems equipment in work zones for repair.
- Requirement:** 6 The center shall receive proposed maintenance and construction work plans, analyze the activity as a possible incident, and provide work plan feedback to the sending center.

Element:Palisades Interstate Parkway ITS Field Equipment**Entity:Roadway Subsystem****Functional Area: Roadway Basic Surveillance**

Field elements that monitor traffic conditions using loop detectors and CCTV cameras.

Architecture**Northern New Jersey ITS Architecture****Element:Palisades Interstate Parkway ITS Field Equipment****Entity:Roadway Subsystem****Functional Area: Roadway Basic Surveillance**

Field elements that monitor traffic conditions using loop detectors and CCTV cameras.

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| <i>Requirement:</i> | 1 The field element shall collect, process, digitize, and send traffic sensor data (speed, volume, and occupancy) to the center for further analysis and storage, under center control. |
| <i>Requirement:</i> | 2 The field element shall collect, process, and send traffic images to the center for further analysis and distribution. |
| <i>Requirement:</i> | 3 The field element shall collect, digitize, and send pedestrian sensor data to the center for further analysis and storage. |
| <i>Requirement:</i> | 4 The field element shall collect, process, and send pedestrian images to the center for further analysis and distribution. |
| <i>Requirement:</i> | 5 The field element shall collect, digitize, and send multimodal crossing and high occupancy vehicle (HOV) lane sensor data to the center for further analysis and storage. |
| <i>Requirement:</i> | 6 The field element shall return sensor and CCTV system operational status to the controlling center. |
| <i>Requirement:</i> | 7 The field element shall return sensor and CCTV system fault data to the controlling center for repair. |

Functional Area: Roadway Equipment Coordination

Field elements that control and send data to other field elements (such as environmental sensors that send data to a DMS or coordination between traffic controllers on adjacent intersections), without center control.

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| <i>Requirement:</i> | 1 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that provide data and status information to other field element devices (such as dynamic message signs, ramp meters, traffic signals, work zone intrusion alert systems), without center control. |
| <i>Requirement:</i> | 2 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that receive control information from other field element devices, without center control. |
| <i>Requirement:</i> | 3 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that provide data and status information to other field element devices (such as dynamic message signs, traffic controllers on adjacent intersections), without center control. |
| <i>Requirement:</i> | 4 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that receive control information from other field element devices, without center control. |

Element:Palisades Interstate Parkway Police**Entity:Emergency Management****Functional Area: Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

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| <i>Requirement:</i> | 1 The center shall support the interface to the Emergency Telecommunications System (e.g. 911 or 7-digit call routing) to receive emergency notification information and provide it to the emergency system operator. |
| <i>Requirement:</i> | 2 The center shall receive emergency call information from 911 services and present the possible incident information to the emergency system operator. |

Architecture**Northern New Jersey ITS Architecture****Element: Palisades Interstate Parkway Police****Entity: Emergency Management****Functional Area: Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

Requirement: 3 The center shall receive emergency call information from motorist call-boxes and present the possible incident information to the emergency system operator.

Requirement: 4 The center shall receive emergency call information from mayday service providers and present the possible incident information to the emergency system operator.

Requirement: 5 The center shall receive emergency notification information from other public safety agencies and present the possible incident information to the emergency system operator.

Requirement: 6 The center shall receive emergency notification information from public transit systems and present the possible incident information to the emergency system operator.

Requirement: 7 The center shall receive emergency notification information from commercial vehicles, commercial vehicle check stations, or commercial fleet operators and present the possible incident information to the emergency system operator. This may include detection of non-permitted transport of security sensitive hazmat, hazardous cargo spills, etc.

Requirement: 8 The center shall receive details of the cargo being carried by commercial vehicles from their commercial fleet manager for incidents involving potential hazardous materials.

Requirement: 9 The center shall coordinate, correlate, and verify all emergency inputs, including those identified based on external calls and internal analysis of security sensor and surveillance data, and assign each a level of confidence.

Requirement: 10 The center shall send a request for remote control of CCTV systems from a traffic management center in order to verify the reported incident.

Requirement: 11 The center shall update the incident information log once the emergency system operator has verified the incident.

Requirement: 12 The center shall provide the capability for digitized map data to act as the background to the emergency information presented to the emergency system operator.

Requirement: 13 The center shall forward the verified emergency information to the responding agency based on the location and nature of the emergency.

Functional Area: Emergency Dispatch

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

Requirement: 1 The center shall dispatch emergency vehicles to respond to verified emergencies and provide suggested routing under center personnel control.

Requirement: 2 The center shall store the current status of all emergency vehicles available for dispatch and those that have been dispatched.

Requirement: 3 The center shall relay location and incident details to the responding vehicles.

Requirement: 4 The center shall provide the capability to request traffic control measures from traffic management centers such as signal preemption, traffic barriers and road closures.

Requirement: 5 The center shall track the location and status of emergency vehicles responding to an emergency and update the incident status based on information from the emergency vehicle.

Requirement: 6 The center shall receive status information from care facilities to determine the appropriate facility and its location.

Architecture**Northern New Jersey ITS Architecture****Element:Palisades Interstate Parkway Police****Entity:Emergency Management****Functional Area: Emergency Dispatch**

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

- Requirement:* 7 The center shall store and maintain the emergency service responses in an action log.
- Requirement:* 8 The center shall receive asset restriction information from maintenance centers to support the dispatching of appropriate emergency resources.
- Requirement:* 9 The center shall receive traffic information, including closures, traffic conditions, etc. from traffic management centers.
- Requirement:* 10 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.
- Requirement:* 11 The center shall receive road network conditions and traffic images to support dispatch of emergency vehicles.
- Requirement:* 12 The center shall coordinate response to incidents with other Emergency Management centers to ensure appropriate resources are dispatched and utilized.

Element:PANYNJ Airports AirTrain Operations Center**Entity:Transit Management****Functional Area: Transit Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and vehicle probes. The information is monitored and forwarded to other agencies to more effectively manage transit operations.

- Requirement:* 1 The center shall assimilate current and forecast road conditions and surface weather information to more effectively manage transit operations.
- Requirement:* 2 The center shall collect current and forecast road and weather information from weather service providers and vehicle probes.
- Requirement:* 3 The center shall receive road network probe information from its fleet of transit vehicles.
- Requirement:* 4 The center shall provide road network probe information from its fleet of transit vehicles to traffic management as well as maintenance and construction management.

Functional Area: Transit Center Multi-Modal Coordination

Generate requests for transit priority on routes and at certain intersections. Coordinate schedules with other agencies and modes, including transit transfer cluster and transfer point information.

- Requirement:* 1 The center shall analyze transit vehicle schedule performance to determine the need for priority along certain routes or at certain intersections.
- Requirement:* 2 The center shall send requests for priority along routes or at intersections to traffic management.
- Requirement:* 3 The center shall coordinate schedules and services between transit agencies, traffic management, maintenance and construction operations, parking management, and other surface or air transportation modes.
- Requirement:* 4 The center shall share transfer cluster and transfer point information with multimodal transportation service providers, other transit agencies, and traveler information service providers. A transfer cluster is a collection of stops, stations, or terminals where transfers can be made conveniently.

Element:PANYNJ Airports Communications Desk/Operations Center**Entity:Maintenance and Construction Management****Functional Area: MCM Environmental Information Processing**

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ Airports Communications Desk/Operations Center****Entity: Maintenance and Construction Management****Functional Area: MCM Environmental Information Processing**

Processes current and forecast weather data, road condition information, local environmental data, and uses internal models to develop specialized detailed forecasts of local weather and surface conditions. Disseminates road weather information to other agencies and centers.

- Requirement:* 1 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.
- Requirement:* 2 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services) and local environmental sensor data.
- Requirement:* 3 The center shall use the various data inputs of environmental sensors and road weather data to develop a view of current and predicted road weather and road conditions.
- Requirement:* 4 The center shall disseminate current and forecasted road weather and road condition information to weather service providers (such as the National Weather Service and value-added sector specific meteorological services) as well as other agencies including traffic, emergency, and transit management, traveler information providers, rail operations centers, media, and other maintenance management centers.
- Requirement:* 5 The center shall provide value-added sector specific meteorological services with information on basic road facility and treatment information that supports forecasts for road conditions.

Functional Area: MCM Work Zone Management

Remotely monitors and supports work zone activities, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).

- Requirement:* 1 The center shall generate new work zone activity schedules for use by maintenance and construction vehicles, maintenance and construction operators, and for information coordination purposes.
- Requirement:* 2 The center shall control the collection of work zone status information including video images from cameras located in or near the work zone.
- Requirement:* 3 The center shall disseminate work zone information to other agencies and centers including traffic, transit, emergency management centers, other maintenance centers, traveler information providers, and the media.
- Requirement:* 4 The center shall control traffic in work zones by providing remote control of dynamic message signs and highway advisory radio systems located in or near the work zone.
- Requirement:* 5 The center shall exchange information with administrative systems to support the planning and scheduling of work zone activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.

Functional Area: MCM Work Activity Coordination

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

- Requirement:* 1 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ Airports Communications Desk/Operations Center****Entity: Maintenance and Construction Management****Functional Area: MCM Work Activity Coordination**

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

- Requirement:* 2 The center shall provide status information about scheduled maintenance and construction activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, multimodal transportation providers, rail operations, and the media.
- Requirement:* 3 The center shall collect and respond to feedback concerning scheduled maintenance and construction activities with other management centers such as traffic, emergency, transit, and rail operations.
- Requirement:* 4 The center shall collect and disseminate asset restriction information levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.
- Requirement:* 5 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance and construction activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
- Requirement:* 6 The center shall exchange rail schedules and work plans with rail operations centers.

Entity: Traffic Management**Functional Area: Collect Traffic Surveillance**

Management of traffic sensors and surveillance (CCTV) equipment, and distribution of the collected information to other centers and operators.

- Requirement:* 1 The center shall monitor, analyze, and store traffic sensor data (speed, volume, occupancy) collected from field elements under remote control of the center.
- Requirement:* 2 The center shall monitor, analyze, and distribute traffic images from CCTV systems under remote control of the center.
- Requirement:* 3 The center shall monitor, analyze, and store pedestrian sensor data collected from field elements under remote control of the center.
- Requirement:* 4 The center shall monitor, analyze, and distribute pedestrian images from CCTV systems under remote control of the center.
- Requirement:* 5 The center shall monitor, analyze, and store multimodal crossing and high occupancy vehicle (HOV) lane sensor data under remote control of the center.
- Requirement:* 6 The center shall maintain a database of surveillance and sensors and the freeways, surface street and rural roadways, e.g. where they are located, to which part(s) of the network their data applies, the type of data, and the ownership of each link (that is, the agency or entity responsible for collecting and storing surveillance of the link) in the network.
- Requirement:* 7 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic data.
- Requirement:* 8 The center shall distribute road network conditions data (raw or processed) based on collected and analyzed traffic sensor and surveillance data to other centers.
- Requirement:* 9 The center shall respond to control data from center personnel regarding sensor and surveillance data collection, analysis, storage, and distribution.

Functional Area: TMC Signal Control

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ Airports Communications Desk/Operations Center****Entity: Traffic Management****Functional Area: TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

- Requirement:* 1 The center shall remotely control traffic signal controllers.
- Requirement:* 2 The center shall accept notifications of right-of-way requests from pedestrians.
- Requirement:* 3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center.
- Requirement:* 4 The center shall collect traffic signal controller fault data from the field.
- Requirement:* 5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.

Functional Area: TMC Freeway Management

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

- Requirement:* 1 The center shall remotely control systems to manage use of the freeways, including ramp meters, mainline metering, and lane controls.
- Requirement:* 2 The center shall collect operational status from ramp meters, mainline metering, and lane controls and compare against the control information sent by the center.
- Requirement:* 3 The center shall collect fault data from ramp meters, mainline metering, and lane controls.
- Requirement:* 4 The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, mainline metering, and lane controls), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the ramps themselves.

Functional Area: TMC Traffic Information Dissemination

Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.

- Requirement:* 1 The center shall remotely control dynamic messages signs for dissemination of traffic and other information to drivers.
- Requirement:* 2 The center shall remotely control driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers.
- Requirement:* 3 The center shall collect operational status for the driver information systems equipment (DMS, HAR, etc.).
- Requirement:* 4 The center shall collect fault data for the driver information systems equipment (DMS, HAR, etc.) for repair.
- Requirement:* 5 The center shall retrieve locally stored traffic information, including current and forecasted traffic information, road and weather conditions, traffic incident information, information on diversions and alternate routes, closures, and special traffic restrictions (lane/shoulder use, weight restrictions, width restrictions, HOV requirements), etc.
- Requirement:* 6 The center shall distribute traffic data to maintenance and construction centers, transit centers, emergency management centers, and traveler information providers.
- Requirement:* 7 The center shall distribute traffic data to the media upon request; the capability to provide the information in both data stream and graphical display shall be supported.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ Airports Communications Desk/Operations Center****Entity: Traffic Management****Functional Area: TMC Traffic Information Dissemination**

Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.

- Requirement:* 8 The center shall provide the capability for center personnel to control the nature of the data that is available to non-traffic operations centers and the media.

Functional Area: TMC Regional Traffic Control

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

- Requirement:* 1 The center shall exchange traffic information with other traffic management centers, includes incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.

- Requirement:* 2 The center shall exchange traffic control information with other traffic management centers, includes remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).

Functional Area: TMC Environmental Monitoring

Management of environmental sensors and assimilation of collected data with other current and forecast road conditions and surface weather information from weather service providers and roadway maintenance operations.

- Requirement:* 1 The center shall remotely control environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures.

- Requirement:* 2 The center shall remotely control environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.

- Requirement:* 3 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services), data from roadway maintenance operations, and environmental data collected from sensors deployed on and about the roadway.

- Requirement:* 4 The center shall provide weather and road condition information to weather service providers and center personnel.

- Requirement:* 5 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.

Functional Area: Traffic Maintenance

Monitoring and remote diagnostics of field equipment - detect failures, issue problem reports, and track the repair or replacement of the failed equipment.

- Requirement:* 1 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) operational status.

- Requirement:* 2 The center shall collect and store CCTV surveillance system (traffic, pedestrian) operational status.

- Requirement:* 3 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) fault data and send to the maintenance center for repair.

- Requirement:* 4 The center shall collect and store CCTV surveillance system (traffic, pedestrian) fault data send to the maintenance center for repair.

- Requirement:* 5 The center shall collect environmental sensor operational status.

- Requirement:* 6 The center shall collect environmental sensor equipment fault data and send to the maintenance center for repair.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ Airports Communications Desk/Operations Center****Entity: Traffic Management****Functional Area: Traffic Maintenance**

Monitoring and remote diagnostics of field equipment - detect failures, issue problem reports, and track the repair or replacement of the failed equipment.

Requirement: 7 The center shall exchange data with maintenance centers concerning the reporting of faulty equipment and the schedule/status of their repair. Information exchanged includes details of new equipment faults, and clearances when the faults are cleared.

Requirement: 8 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic maintenance data.

Functional Area: TMC Work Zone Traffic Management

Coordination with maintenance systems using work zone images and traveler information systems (such as DMS), and distribution of work plans so that work zones are established that have minimum traffic impact.

Requirement: 1 The center shall receive work zone images from a maintenance center.

Requirement: 2 The center shall analyze work zone images for indications of a possible incident.

Requirement: 3 The center shall remotely control driver information systems (such as dynamic messages signs, highway advisory radios) to advise drivers of activity around a work zone.

Requirement: 4 The center shall collect operational status for the driver information systems equipment in work zones.

Requirement: 5 The center shall collect fault data for the driver information systems equipment in work zones for repair.

Requirement: 6 The center shall receive proposed maintenance and construction work plans, analyze the activity as a possible incident, and provide work plan feedback to the sending center.

Functional Area: TMC Multimodal Coordination

Provides traffic signal priority for transit vehicles based on center-to-center communications with the transit management center; also exchange traffic and transit information.

Requirement: 1 The center shall respond to requests from transit management centers for signal priority at one or more intersections along a particular transit route.

Requirement: 2 The center shall exchange information with transit management centers including details current transit routes, the level of service on each route, and the progress of individual vehicles along their routes.

Entity: Transit Management**Functional Area: Transit Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and vehicle probes. The information is monitored and forwarded to other agencies to more effectively manage transit operations.

Requirement: 1 The center shall assimilate current and forecast road conditions and surface weather information to more effectively manage transit operations.

Requirement: 2 The center shall collect current and forecast road and weather information from weather service providers and vehicle probes.

Requirement: 3 The center shall receive road network probe information from its fleet of transit vehicles.

Requirement: 4 The center shall provide road network probe information from its fleet of transit vehicles to traffic management as well as maintenance and construction management.

Functional Area: Transit Center Multi-Modal Coordination

Architecture

Northern New Jersey ITS Architecture

Element: PANYNJ Airports Communications Desk/Operations Center

Entity: Transit Management

Functional Area: Transit Center Multi-Modal Coordination

Generate requests for transit priority on routes and at certain intersections. Coordinate schedules with other agencies and modes, including transit transfer cluster and transfer point information.

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| <i>Requirement:</i> | 1 The center shall analyze transit vehicle schedule performance to determine the need for priority along certain routes or at certain intersections. |
| <i>Requirement:</i> | 2 The center shall send requests for priority along routes or at intersections to traffic management. |
| <i>Requirement:</i> | 3 The center shall coordinate schedules and services between transit agencies, traffic management, maintenance and construction operations, parking management, and other surface or air transportation modes. |
| <i>Requirement:</i> | 4 The center shall share transfer cluster and transfer point information with multimodal transportation service providers, other transit agencies, and traveler information service providers. A transfer cluster is a collection of stops, stations, or terminals where transfers can be made conveniently. |

Element: PANYNJ Airports Field Equipment

Entity: Roadway Subsystem

Functional Area: Roadway Basic Surveillance

Field elements that monitor traffic conditions using loop detectors and CCTV cameras.

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| <i>Requirement:</i> | 1 The field element shall collect, process, digitize, and send traffic sensor data (speed, volume, and occupancy) to the center for further analysis and storage, under center control. |
| <i>Requirement:</i> | 2 The field element shall collect, process, and send traffic images to the center for further analysis and distribution. |
| <i>Requirement:</i> | 3 The field element shall collect, digitize, and send pedestrian sensor data to the center for further analysis and storage. |
| <i>Requirement:</i> | 4 The field element shall collect, process, and send pedestrian images to the center for further analysis and distribution. |
| <i>Requirement:</i> | 5 The field element shall collect, digitize, and send multimodal crossing and high occupancy vehicle (HOV) lane sensor data to the center for further analysis and storage. |
| <i>Requirement:</i> | 6 The field element shall return sensor and CCTV system operational status to the controlling center. |
| <i>Requirement:</i> | 7 The field element shall return sensor and CCTV system fault data to the controlling center for repair. |

Functional Area: Roadway Signal Controls

Field elements including traffic signal controllers for use at major intersections and on main highways for urban areas; also supports pedestrian crossings.

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| <i>Requirement:</i> | 1 The field element shall control traffic signals at intersections and on main highways for urban and rural areas, under center control. |
| <i>Requirement:</i> | 2 The field element shall collect pedestrian images and pedestrian sensor data, and respond to pedestrian crossing requests via display, audio signal, or other manner. |
| <i>Requirement:</i> | 3 The field element shall provide the capability to notify the traffic management center that a pedestrian has requested right-of-way and when the request was or will be granted (request for right-of-way). |
| <i>Requirement:</i> | 4 The field element shall monitor operation of traffic signal controllers and report to the center any instances in which the indicator response does not match that expected from the indicator control information. |
| <i>Requirement:</i> | 5 The field element shall monitor operation of traffic signal controllers and report to the center any instances in which the indicator response does not match that expected from known indicator preemptions. |

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ Airports Field Equipment****Entity: Roadway Subsystem****Functional Area: Roadway Signal Controls**

Field elements including traffic signal controllers for use at major intersections and on main highways for urban areas; also supports pedestrian crossings.

Requirement: 6 The field element shall return traffic signal controller operational status to the controlling center.

Requirement: 7 The field element shall return traffic signal controller fault data to the maintenance center for repair.

Functional Area: Roadway Traffic Information Dissemination

Driver information systems, such as dynamic message signs and Highway Advisory Radio (HAR).

Requirement: 1 The field element shall include dynamic messages signs for dissemination of traffic and other information to drivers, under center control; the DMS may be either those that display variable text messages, or those that have fixed format display(s) (e.g. vehicle restrictions, or lane open/close).

Requirement: 2 The field element shall include driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers, under center control.

Requirement: 3 The field element shall include pedestrian information systems under center control (e.g. warning pedestrians of a potential hazard, or providing mandatory instructions as to the availability of pedestrian access).

Requirement: 4 The field element shall provide operational status for the driver information systems equipment (DMS, HAR, etc.) to the center.

Requirement: 5 The field element shall provide fault data for the driver information systems equipment (DMS, HAR, etc.) to the center for repair.

Functional Area: Roadway Equipment Coordination

Field elements that control and send data to other field elements (such as environmental sensors that send data to a DMS or coordination between traffic controllers on adjacent intersections), without center control.

Requirement: 1 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that provide data and status information to other field element devices (such as dynamic message signs, ramp meters, traffic signals, work zone intrusion alert systems), without center control.

Requirement: 2 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that receive control information from other field element devices, without center control.

Requirement: 3 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that provide data and status information to other field element devices (such as dynamic message signs, traffic controllers on adjacent intersections), without center control.

Requirement: 4 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that receive control information from other field element devices, without center control.

Element: PANYNJ Airports In-Terminal Customer Information Systems**Entity: Remote Traveler Support****Functional Area: Remote Interactive Information Reception**

Public traveler interface, such as a kiosk, that provides traffic, transit, yellow pages, event, and trip planning information, as well as payment services for tolls, parking, and other personalized traveler information services upon request.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ Airports In-Terminal Customer Information Systems****Entity: Remote Traveler Support****Functional Area: Remote Interactive Information Reception**

Public traveler interface, such as a kiosk, that provides traffic, transit, yellow pages, event, and trip planning information, as well as payment services for tolls, parking, and other personalized traveler information services upon request.

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| <i>Requirement:</i> | 1 The public interface for travelers shall receive traffic information from a center and present it to the traveler upon request. |
| <i>Requirement:</i> | 2 The public interface for travelers shall receive transit information from a center and present it to the traveler upon request. |
| <i>Requirement:</i> | 3 The public interface for travelers shall receive yellow pages information (such as lodging, restaurants, theaters, bicycle facilities, and other tourist activities) from a center and present it to the traveler upon request. |
| <i>Requirement:</i> | 4 The public interface for travelers shall receive event information from a center and present it to the traveler upon request. |
| <i>Requirement:</i> | 5 The public interface for travelers shall receive evacuation information from a center and present it to the traveler. |
| <i>Requirement:</i> | 6 The public interface for travelers shall receive wide-area alerts and present it to the traveler. |
| <i>Requirement:</i> | 7 The public interface for travelers shall accept reservations for confirmed trip plans. |
| <i>Requirement:</i> | 8 The public interface for travelers shall support payment for services, such as confirmed trip plans, confirmed yellow pages services, tolls, transit fares, parking lot charges, and advanced payment for tolls. |
| <i>Requirement:</i> | 9 The public interface for travelers shall provide an interface through which credit identities and stored credit values may be collected from tags, traveler cards, or payment instruments used by travelers. |
| <i>Requirement:</i> | 10 The public interface for travelers shall base requests from the traveler on the traveler's current location or a specific location identified by the traveler, and filter the provided information accordingly. |
| <i>Requirement:</i> | 11 The public interface for travelers shall provide digitized map data to act as the background to the information presented to the traveler. |
| <i>Requirement:</i> | 12 The public interface for travelers shall support traveler input in audio or manual form. |
| <i>Requirement:</i> | 13 The public interface for travelers shall present information to the traveler in audible or visual forms consistent with a kiosk, including those that are suitable for travelers with hearing or vision physical disabilities. |
| <i>Requirement:</i> | 14 The public interface for travelers shall be able to store frequently requested data. |

Element: PANYNJ Airports Traveler Information Systems**Entity: Information Service Provider****Functional Area: Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

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| <i>Requirement:</i> | 1 The center shall collect, process, store, and disseminate customized traffic and highway condition information to travelers, including incident information, detours and road closures, recommended routes, and current speeds on specific routes upon request. |
| <i>Requirement:</i> | 2 The center shall collect, process, store, and disseminate customized maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities upon request. |

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ Airports Traveler Information Systems****Entity: Information Service Provider****Functional Area: Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

- Requirement:* 3 The center shall collect, process, store, and disseminate customized transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers upon request.
- Requirement:* 4 The center shall collect, process, store, and disseminate customized parking information to travelers, including location, availability, and fees upon request.
- Requirement:* 5 The center shall collect, process, store, and disseminate customized toll fee information to travelers upon request.
- Requirement:* 6 The center shall collect, process, store, and disseminate customized weather information to travelers upon request.
- Requirement:* 7 The center shall collect, process, store, and disseminate customized multimodal transportation service information (for example, from ferry and airline operators), including transfer points and other information, to travelers upon request.
- Requirement:* 8 The center shall collect, process, store, and disseminate customized event information to travelers upon request.
- Requirement:* 9 The center shall collect, process, store, and disseminate customized air quality information to travelers upon request.
- Requirement:* 10 The center shall provide all traveler information based on the traveler's current location or a specific location identified by the traveler, and filter or customize the provided information accordingly.
- Requirement:* 11 The center shall accept traveler profiles for determining the type of personalized data to send to the traveler.
- Requirement:* 12 The center shall manage payment for services, such as tolls, transit fares, parking lot charges, map updates, and advanced payment for tolls, and provide transaction success or failure details.
- Requirement:* 13 The center shall support requests for traveler information and advanced payment for traveler services from commercial fleet operators.
- Requirement:* 14 The center shall provide the capability to exchange information with another traveler information service provider current or predicted data for road links that are outside the area served by the local supplier.
- Requirement:* 15 The center shall manage updates of digitized map data and provide updates to traveler interface systems upon request.
- Requirement:* 16 The center shall provide the capability to support requests from the media for traffic and incident data.
- Requirement:* 17 The center shall provide the capability for a system operator to control the type and update frequency of traveler information.

Functional Area: Traveler Telephone Information

Collection and distribution of traveler information and wide-area alerts to traveler telephone information systems such as 511, based on voice-based traveler requests.

- Requirement:* 1 The center shall provide the capability to process voice-formatted requests for traveler information from a traveler telephone information system, and return the information in the requested format.
- Requirement:* 2 The center shall provide the capability to process dual-tone multifrequency (DTMF)-based requests (touch-tone) for traveler information from a traveler telephone information system.
- Requirement:* 3 The center shall provide the capability to process traveler information requests from a traveler telephone information system.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ Airports Traveler Information Systems****Entity: Information Service Provider****Functional Area: Traveler Telephone Information**

Collection and distribution of traveler information and wide-area alerts to traveler telephone information systems such as 511, based on voice-based traveler requests.

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| <i>Requirement:</i> | 4 | The center shall collect and provide information on traffic conditions in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 5 | The center shall collect and provide work zone and roadway maintenance information in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 6 | The center shall collect and provide roadway environment conditions information in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 7 | The center shall collect and provide weather and event information in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 8 | The center shall collect and provide transit service information in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 9 | The center shall collect and provide yellow pages services information in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 10 | The center shall collect and provide current ferry and rail schedule and airport status information in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 11 | The center shall provide the capability to support both specific caller requests as well as bulk upload of regional traveler information. |
| <i>Requirement:</i> | 12 | The center shall receive and forward region-specific wide-area alert and advisory information to the traveler telephone information system, including major emergencies such as a natural or man-made disaster, civil emergency, child abductions, severe weather watches and warnings, military activities, and law enforcement warnings. |

Element: PANYNJ PAPD 211 Communications Center Dispatch**Entity: Emergency Management****Functional Area: Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

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| <i>Requirement:</i> | 1 | The center shall support the interface to the Emergency Telecommunications System (e.g. 911 or 7-digit call routing) to receive emergency notification information and provide it to the emergency system operator. |
| <i>Requirement:</i> | 2 | The center shall receive emergency call information from 911 services and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 3 | The center shall receive emergency call information from motorist call-boxes and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 4 | The center shall receive emergency call information from mayday service providers and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 5 | The center shall receive emergency notification information from other public safety agencies and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 6 | The center shall receive emergency notification information from public transit systems and present the possible incident information to the emergency system operator. |

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ PAPD 211 Communications Center Dispatch****Entity: Emergency Management****Functional Area: Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

- Requirement:* 7 The center shall receive emergency notification information from commercial vehicles, commercial vehicle check stations, or commercial fleet operators and present the possible incident information to the emergency system operator. This may include detection of non-permitted transport of security sensitive hazmat, hazardous cargo spills, etc.
- Requirement:* 8 The center shall receive details of the cargo being carried by commercial vehicles from their commercial fleet manager for incidents involving potential hazardous materials.
- Requirement:* 9 The center shall coordinate, correlate, and verify all emergency inputs, including those identified based on external calls and internal analysis of security sensor and surveillance data, and assign each a level of confidence.
- Requirement:* 10 The center shall send a request for remote control of CCTV systems from a traffic management center in order to verify the reported incident.
- Requirement:* 11 The center shall update the incident information log once the emergency system operator has verified the incident.
- Requirement:* 12 The center shall provide the capability for digitized map data to act as the background to the emergency information presented to the emergency system operator.
- Requirement:* 13 The center shall forward the verified emergency information to the responding agency based on the location and nature of the emergency.

Functional Area: Emergency Dispatch

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

- Requirement:* 1 The center shall dispatch emergency vehicles to respond to verified emergencies and provide suggested routing under center personnel control.
- Requirement:* 2 The center shall store the current status of all emergency vehicles available for dispatch and those that have been dispatched.
- Requirement:* 3 The center shall relay location and incident details to the responding vehicles.
- Requirement:* 4 The center shall provide the capability to request traffic control measures from traffic management centers such as signal preemption, traffic barriers and road closures.
- Requirement:* 5 The center shall track the location and status of emergency vehicles responding to an emergency and update the incident status based on information from the emergency vehicle.
- Requirement:* 6 The center shall receive status information from care facilities to determine the appropriate facility and its location.
- Requirement:* 7 The center shall store and maintain the emergency service responses in an action log.
- Requirement:* 8 The center shall receive asset restriction information from maintenance centers to support the dispatching of appropriate emergency resources.
- Requirement:* 9 The center shall receive traffic information, including closures, traffic conditions, etc. from traffic management centers.
- Requirement:* 10 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ PAPD 211 Communications Center Dispatch****Entity: Emergency Management****Functional Area: Emergency Dispatch**

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

Requirement: 11 The center shall receive road network conditions and traffic images to support dispatch of emergency vehicles.

Requirement: 12 The center shall coordinate response to incidents with other Emergency Management centers to ensure appropriate resources are dispatched and utilized.

Functional Area: Emergency Response Management

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

Requirement: 1 The center shall provide strategic emergency response capabilities such as that of an Emergency Operations Center for large-scale incidents and disasters.

Requirement: 2 The center shall manage coordinated inter-agency responses to and recovery from large-scale emergencies. Such agencies include traffic management, transit, maintenance and construction management, rail operations, and other emergency management agencies.

Requirement: 3 The center shall provide the capability to implement response plans and track progress through the incident by exchanging incident information and distributing response status to allied agencies.

Requirement: 4 The center shall develop, coordinate with other agencies, and store emergency response plans.

Requirement: 5 The center shall track the availability of resources (including vehicles, roadway cleanup?, etc.), request additional resources from traffic, maintenance, or other emergency centers if needed.

Requirement: 6 The center shall allocate the appropriate emergency services, resources, and vehicle (s) to respond to incidents, and shall provide the capability to override the current allocation to suit the special needs of a current incident.

Requirement: 7 The center shall receive event scheduling information from Event Promoters.

Requirement: 8 The center shall receive hazardous materials incident information from commercial fleet operators.

Requirement: 9 The center shall provide the capability to request the safe disabling of a commercial vehicle during a hazardous materials incident.

Requirement: 10 The center shall provide the capability to request transit resource availability from transit centers for use during disaster and evacuation operations.

Requirement: 11 The center shall assimilate the status of the transit, traffic, rail, maintenance, and other emergency center services and systems to create an overall transportation system status, and disseminate to each of these centers and the traveling public via traveler information providers.

Requirement: 12 The center shall provide information to the media concerning the status of an emergency response.

Requirement: 13 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.

Requirement: 14 The center shall provide the capability for center personnel to provide inputs to the management of incidents, disasters and evacuations.

Functional Area: Center Secure Area Surveillance

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ PAPD 211 Communications Center Dispatch****Entity: Emergency Management****Functional Area: Center Secure Area Surveillance**

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 1 The center shall remotely monitor video images and audio surveillance data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The data may be raw or pre-processed in the field.
- Requirement:* 2 The center shall remotely monitor video images and audio surveillance data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The data may be raw or pre-processed in the field.
- Requirement:* 3 The center shall remotely monitor video images and audio surveillance data collected on-board transit vehicles. The data may be raw or pre-processed in the field.
- Requirement:* 4 The center shall exchange surveillance data with other emergency centers.
- Requirement:* 5 The center shall identify potential security threats based on collected security surveillance data.
- Requirement:* 6 The center shall verify potential security threats by correlating security surveillance data from multiple sources.
- Requirement:* 7 The center shall remotely control security surveillance devices in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways).
- Requirement:* 8 The center shall remotely control security surveillance devices in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers).
- Requirement:* 9 The center shall remotely control security surveillance devices on-board transit vehicles.
- Requirement:* 10 The center shall match traveler video images against a database from the Alerting and Advisory Systems of known images that may represent criminals and terrorists.
- Requirement:* 11 The center shall exchange traveler images with other emergency management centers to support traveler image matching.
- Requirement:* 12 The center shall respond to control data from center personnel regarding security surveillance data collection, processing, threat detection, and image matching.

Functional Area: Center Secure Area Sensor Management

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 1 The center shall remotely monitor and control security sensor data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), infrastructure condition and integrity, intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ PAPD 211 Communications Center Dispatch****Entity: Emergency Management****Functional Area: Center Secure Area Sensor Management**

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 2 The center shall remotely monitor and control security sensor data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 3 The center shall remotely monitor and control security sensor data collected on-board transit vehicles. The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors) and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 4 The center shall exchange security sensor data with other emergency centers.
- Requirement:* 5 The center shall identify potential security threats based on collected security sensor data.
- Requirement:* 6 The center shall verify potential security threats by correlating security sensor data from multiple sources.
- Requirement:* 7 The center shall perform threat analysis based on correlations of security sensor and surveillance data.
- Requirement:* 8 The center shall exchange threat analysis data with Alerting and Advisory Systems and use that data in local threat analysis processing.
- Requirement:* 9 The center shall disseminate threat information to other agencies, including traffic, transit, maintenance, rail operations, and other emergency management centers.
- Requirement:* 10 The center shall respond to control data from center personnel regarding security sensor data collection, processing, threat detection, and threat analysis.

Functional Area: Center Secure Area Alarm Support

Collection and response to silent and audible alarms received from travelers in secure areas (such as transit stops, rest areas, park-and-ride lots) and from on-board transit vehicles.

- Requirement:* 1 The center shall collect silent and audible alarms received from travelers in secure areas (such as transit stops, rest areas, park and ride lots, modal interchange facilities).
- Requirement:* 2 The center shall collect silent and audible alarms received from transit vehicles, originated by the traveler or the transit vehicle operator.
- Requirement:* 3 After the alarm message has been received, the center shall generate an alarm acknowledgment to the sender.
- Requirement:* 4 After the alarm message becomes a verified incident, the center shall determine the appropriate response.
- Requirement:* 5 The center shall determine whether the alarm message indicates an emergency that requires the attention of public safety agencies, and forward alarm message data to the appropriate agency as necessary.
- Requirement:* 6 The center shall forward the alarm message to center personnel and respond to the traveler or transit vehicle operator as directed by the personnel.

Functional Area: Mayday Support

Collection and response to Mayday messages received from vehicles and drivers.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ PAPD 211 Communications Center Dispatch****Entity: Emergency Management****Functional Area: Mayday Support**

Collection and response to Mayday messages received from vehicles and drivers.

- Requirement:* 1 The center shall collect mayday messages from vehicles and drivers.
- Requirement:* 2 The center shall collect mayday messages from travelers via personal handheld devices.
- Requirement:* 3 The center shall acknowledge the request for emergency assistance, whether originated by the driver, automatically by the vehicle's safety systems, or by a traveler via a personal handheld device.
- Requirement:* 4 After the mayday becomes a verified incident, the center shall determine the appropriate response to the mayday message.
- Requirement:* 5 The center shall determine whether the mayday message indicates an emergency that requires the attention of public safety agencies, and forward mayday emergency data to the appropriate agency as necessary.
- Requirement:* 6 The center shall support the activation of remote controlled functions requested by a vehicle, such as requests to unlock doors.
- Requirement:* 7 The center shall request additional emergency details from or issue commands to the vehicle's security systems or vehicle driver if needed.
- Requirement:* 8 The center shall maintain a log of all mayday signals received from vehicles.
- Requirement:* 9 The center shall provide all mayday data to center personnel and respond to the vehicle, driver, or traveler using the portable handheld device as directed by the personnel.

Functional Area: Emergency Data Collection

Collection and storage of information related to Emergency Management. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect emergency service data, emergency vehicle management data, emergency vehicle data, sensor and surveillance data, threat data, and incident data.
- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.
- Requirement:* 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the emergency management data or for the data itself.
- Requirement:* 4 The center shall be able to produce sample products of the data available.

Element: PANYNJ PATH CCTV Cameras**Entity: Remote Traveler Support****Functional Area: Traveler Secure Area Surveillance**

Security surveillance devices that monitor traveler-frequented areas such as transit stops and rest stops.

- Requirement:* 1 The field element shall include video and/or audio surveillance of traveler secure areas including transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and traveler information centers).
- Requirement:* 2 The field element shall be remotely controlled by a center.
- Requirement:* 3 The field element shall provide equipment status and fault indication of surveillance equipment to a center.
- Requirement:* 4 The field element shall provide raw video or audio data.
- Requirement:* 5 The field element shall remotely process video and audio data and provide an indication of potential incidents or threats to a center.

Architecture**Northern New Jersey ITS Architecture***Element:***PANYNJ PATH CCTV Cameras***Entity:***Remote Traveler Support***Functional Area:* **Traveler Secure Area Sensor Monitoring**

Security sensors monitoring traveler-frequented areas such as transit stops, park-and-ride lots, and rest stops for environmental threats, intrusion and motion, and object detection.

- Requirement:* 1 The field element shall include security sensors that monitor conditions in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers).
- Requirement:* 2 The field element shall be remotely controlled by a center.
- Requirement:* 3 The field element shall provide equipment status and fault indication of security sensor equipment to a center.
- Requirement:* 4 The field element shall include environmental threat sensors (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological).
- Requirement:* 5 The field element shall include motion and intrusion detection sensors.
- Requirement:* 6 The field element shall include object detection sensors (such as metal detectors).
- Requirement:* 7 The field element shall provide raw security sensor data.
- Requirement:* 8 The field element shall remotely process security sensor data and provide an indication of potential incidents or threats to a center.

Functional Area: **Remote Traveler Security**

Public traveler interface that provides the capability for travelers to report an emergency or activate a panic button to summon assistance in areas such as transit stops, park-and-ride areas, etc.

- Requirement:* 1 The public interface for travelers shall provide the capability for a traveler to report an emergency and summon assistance from secure areas such as transit stops, transit stations, modal transfer facilities, rest stops, park-and-ride areas, travel information areas, and emergency pull off areas.
- Requirement:* 2 When initiated by a traveler, the public interface for travelers shall forward a request for assistance to an emergency management function and acknowledge the request.
- Requirement:* 3 The public interface for travelers shall provide the capability to broadcast a message to advise or warn a traveler.
- Requirement:* 4 The public interface for travelers shall accept input and provide information to the traveler in a form suitable for travelers with physical disabilities.

*Element:***PANYNJ PATH Fare Management System***Entity:***Transit Management***Functional Area:* **Transit Center Fare and Load Management**

Management of fare collection at the center - includes setting and distributing fare information, central processing of fares for transit as well as other ITS services, links to financial institutions and enforcement agencies.

- Requirement:* 1 The center shall manage the actual value of transit fares for each segment of each regular transit route, including the transmission of the information to transit vehicles and transit stops or stations.
- Requirement:* 2 The center shall provide the capability for a system operator to manage the transit fares and control the exchange of transit fare information.
- Requirement:* 3 The center shall process the financial requests from the transit vehicles or roadside and manage an interface to a Financial Institution.
- Requirement:* 4 The center shall support the payment of transit fare transactions using data provided by the traveler cards / payment instruments.

Architecture**Northern New Jersey ITS Architecture***Element:***PANYNJ PATH Fare Management System***Entity:***Transit Management***Functional Area:* **Transit Center Fare and Load Management**

Management of fare collection at the center - includes setting and distributing fare information, central processing of fares for transit as well as other ITS services, links to financial institutions and enforcement agencies.

- Requirement:* 5 The center shall collect data on fare payment violations and send the data, including images of the violator, to the appropriate enforcement agency.
- Requirement:* 6 The center shall process requests for transit fares to be paid in advance.
- Requirement:* 7 The center shall process requests for the advanced payment of tolls and parking lot charges as well as other non-transportation services, e.g. yellow-pages services.
- Requirement:* 8 The center shall be capable of establishing emergency fare structures to override all other fares during disasters, states of emergency, or evacuations.
- Requirement:* 9 The center shall maintain a list of invalid traveler credit identities, or bad tag lists that can be forwarded to transit vehicles and transit stops or stations.
- Requirement:* 10 The center shall collect passenger loading and fare statistics data to implement variable and flexible fare structures.
- Requirement:* 11 The center shall exchange fare and load information with other transit management centers, including potential Centralized Payments facilities.
- Requirement:* 12 The center shall provide transit fare information to other centers, including traveler information providers upon request.

*Element:***PANYNJ PATH Fare Point of Sale***Entity:***Remote Traveler Support***Functional Area:* **Remote Transit Fare Management**

Public traveler interface, such as a kiosk, that provides the capability for the traveler to use a common fare medium for transit fares, tolls, and/or parking lot charges, to calculate the amount due and identify payment problems.

- Requirement:* 1 The public interface for travelers shall accept and process current transit passenger fare collection information.
- Requirement:* 2 The public interface for travelers shall calculate a fare based on the origin and destination provided by the traveler, in conjunction with transit routing, transit fare category, and transit user history.
- Requirement:* 3 The public interface for travelers shall provide an interface to a transit user traveler card in support of payment for transit fares, tolls, and/or parking lot charges. The stored credit value data from the card shall be collected and updated based on the fare or other charges, or the credit identity shall be collected.
- Requirement:* 4 The public interface for travelers shall provide information to the center for financial authorization and transaction processing.
- Requirement:* 5 The public interface for travelers shall provide an image of all travelers purchasing rides or services to be used for violation processing.
- Requirement:* 6 The public interface for travelers shall determine the routing based on the traveler's destination and the location of the closest transit stop from which a route request is being made.
- Requirement:* 7 The public interface for travelers shall create passenger loading and fare statistics data based upon data collected at a transit stop.
- Requirement:* 8 The public interface for travelers shall present information to the traveler in a form suitable for travelers with physical disabilities.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ PATH Operations Center****Entity: Emergency Management****Functional Area: Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

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| <i>Requirement:</i> | 1 The center shall support the interface to the Emergency Telecommunications System (e.g. 911 or 7-digit call routing) to receive emergency notification information and provide it to the emergency system operator. |
| <i>Requirement:</i> | 2 The center shall receive emergency call information from 911 services and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 3 The center shall receive emergency call information from motorist call-boxes and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 4 The center shall receive emergency call information from mayday service providers and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 5 The center shall receive emergency notification information from other public safety agencies and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 6 The center shall receive emergency notification information from public transit systems and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 7 The center shall receive emergency notification information from commercial vehicles, commercial vehicle check stations, or commercial fleet operators and present the possible incident information to the emergency system operator. This may include detection of non-permitted transport of security sensitive hazmat, hazardous cargo spills, etc. |
| <i>Requirement:</i> | 8 The center shall receive details of the cargo being carried by commercial vehicles from their commercial fleet manager for incidents involving potential hazardous materials. |
| <i>Requirement:</i> | 9 The center shall coordinate, correlate, and verify all emergency inputs, including those identified based on external calls and internal analysis of security sensor and surveillance data, and assign each a level of confidence. |
| <i>Requirement:</i> | 10 The center shall send a request for remote control of CCTV systems from a traffic management center in order to verify the reported incident. |
| <i>Requirement:</i> | 11 The center shall update the incident information log once the emergency system operator has verified the incident. |
| <i>Requirement:</i> | 12 The center shall provide the capability for digitized map data to act as the background to the emergency information presented to the emergency system operator. |
| <i>Requirement:</i> | 13 The center shall forward the verified emergency information to the responding agency based on the location and nature of the emergency. |

Functional Area: Emergency Dispatch

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

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|---------------------|---|
| <i>Requirement:</i> | 1 The center shall dispatch emergency vehicles to respond to verified emergencies and provide suggested routing under center personnel control. |
| <i>Requirement:</i> | 2 The center shall store the current status of all emergency vehicles available for dispatch and those that have been dispatched. |
| <i>Requirement:</i> | 3 The center shall relay location and incident details to the responding vehicles. |

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ PATH Operations Center****Entity: Emergency Management****Functional Area: Emergency Dispatch**

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

- Requirement:* 4 The center shall provide the capability to request traffic control measures from traffic management centers such as signal preemption, traffic barriers and road closures.
- Requirement:* 5 The center shall track the location and status of emergency vehicles responding to an emergency and update the incident status based on information from the emergency vehicle.
- Requirement:* 6 The center shall receive status information from care facilities to determine the appropriate facility and its location.
- Requirement:* 7 The center shall store and maintain the emergency service responses in an action log.
- Requirement:* 8 The center shall receive asset restriction information from maintenance centers to support the dispatching of appropriate emergency resources.
- Requirement:* 9 The center shall receive traffic information, including closures, traffic conditions, etc. from traffic management centers.
- Requirement:* 10 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.
- Requirement:* 11 The center shall receive road network conditions and traffic images to support dispatch of emergency vehicles.
- Requirement:* 12 The center shall coordinate response to incidents with other Emergency Management centers to ensure appropriate resources are dispatched and utilized.

Functional Area: Emergency Response Management

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

- Requirement:* 1 The center shall provide strategic emergency response capabilities such as that of an Emergency Operations Center for large-scale incidents and disasters.
- Requirement:* 2 The center shall manage coordinated inter-agency responses to and recovery from large-scale emergencies. Such agencies include traffic management, transit, maintenance and construction management, rail operations, and other emergency management agencies.
- Requirement:* 3 The center shall provide the capability to implement response plans and track progress through the incident by exchanging incident information and distributing response status to allied agencies.
- Requirement:* 4 The center shall develop, coordinate with other agencies, and store emergency response plans.
- Requirement:* 5 The center shall track the availability of resources (including vehicles, roadway cleanup?, etc.), request additional resources from traffic, maintenance, or other emergency centers if needed.
- Requirement:* 6 The center shall allocate the appropriate emergency services, resources, and vehicle (s) to respond to incidents, and shall provide the capability to override the current allocation to suit the special needs of a current incident.
- Requirement:* 7 The center shall receive event scheduling information from Event Promoters.
- Requirement:* 8 The center shall receive hazardous materials incident information from commercial fleet operators.
- Requirement:* 9 The center shall provide the capability to request the safe disabling of a commercial vehicle during a hazardous materials incident.
- Requirement:* 10 The center shall provide the capability to request transit resource availability from transit centers for use during disaster and evacuation operations.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ PATH Operations Center****Entity: Emergency Management****Functional Area: Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

Requirement: 11 The center shall assimilate the status of the transit, traffic, rail, maintenance, and other emergency center services and systems to create an overall transportation system status, and disseminate to each of these centers and the traveling public via traveler information providers.

Requirement: 12 The center shall provide information to the media concerning the status of an emergency response.

Requirement: 13 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.

Requirement: 14 The center shall provide the capability for center personnel to provide inputs to the management of incidents, disasters and evacuations.

Functional Area: Emergency Environmental Monitoring

Current and forecast road and weather information assimilated from weather service providers and emergency vehicles equipped with environmental sensors; used by the operator to more effectively manage incidents.

Requirement: 1 The center shall collect current and forecast road and weather information from weather service providers (such as the National Weather Service and value-added sector specific meteorological services).

Requirement: 2 The center shall receive environmental probe information from its fleet of emergency vehicles.

Requirement: 3 The center shall collect current road and weather information from roadway maintenance operations.

Requirement: 4 The center shall assimilate current and forecast road conditions and surface weather information to support incident management.

Requirement: 5 The center shall present the current and forecast road and weather information to the emergency system operator.

Requirement: 6 The center shall provide aggregated or processed environmental probe information from its fleet of emergency vehicles to traffic management and maintenance centers.

Functional Area: Center Secure Area Surveillance

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

Requirement: 1 The center shall remotely monitor video images and audio surveillance data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The data may be raw or pre-processed in the field.

Requirement: 2 The center shall remotely monitor video images and audio surveillance data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The data may be raw or pre-processed in the field.

Requirement: 3 The center shall remotely monitor video images and audio surveillance data collected on-board transit vehicles. The data may be raw or pre-processed in the field.

Requirement: 4 The center shall exchange surveillance data with other emergency centers.

Requirement: 5 The center shall identify potential security threats based on collected security surveillance data.

Requirement: 6 The center shall verify potential security threats by correlating security surveillance data from multiple sources.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ PATH Operations Center****Entity: Emergency Management****Functional Area: Center Secure Area Surveillance**

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 7 The center shall remotely control security surveillance devices in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways).
- Requirement:* 8 The center shall remotely control security surveillance devices in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers).
- Requirement:* 9 The center shall remotely control security surveillance devices on-board transit vehicles.
- Requirement:* 10 The center shall match traveler video images against a database from the Alerting and Advisory Systems of known images that may represent criminals and terrorists.
- Requirement:* 11 The center shall exchange traveler images with other emergency management centers to support traveler image matching.
- Requirement:* 12 The center shall respond to control data from center personnel regarding security surveillance data collection, processing, threat detection, and image matching.

Functional Area: Center Secure Area Sensor Management

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 1 The center shall remotely monitor and control security sensor data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), infrastructure condition and integrity, intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 2 The center shall remotely monitor and control security sensor data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 3 The center shall remotely monitor and control security sensor data collected on-board transit vehicles. The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors) and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 4 The center shall exchange security sensor data with other emergency centers.
- Requirement:* 5 The center shall identify potential security threats based on collected security sensor data.
- Requirement:* 6 The center shall verify potential security threats by correlating security sensor data from multiple sources.
- Requirement:* 7 The center shall perform threat analysis based on correlations of security sensor and surveillance data.
- Requirement:* 8 The center shall exchange threat analysis data with Alerting and Advisory Systems and use that data in local threat analysis processing.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ PATH Operations Center****Entity: Emergency Management****Functional Area: Center Secure Area Sensor Management**

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

Requirement: 9 The center shall disseminate threat information to other agencies, including traffic, transit, maintenance, rail operations, and other emergency management centers.

Requirement: 10 The center shall respond to control data from center personnel regarding security sensor data collection, processing, threat detection, and threat analysis.

Functional Area: Center Secure Area Alarm Support

Collection and response to silent and audible alarms received from travelers in secure areas (such as transit stops, rest areas, park-and-ride lots) and from on-board transit vehicles.

Requirement: 1 The center shall collect silent and audible alarms received from travelers in secure areas (such as transit stops, rest areas, park and ride lots, modal interchange facilities).

Requirement: 2 The center shall collect silent and audible alarms received from transit vehicles, originated by the traveler or the transit vehicle operator.

Requirement: 3 After the alarm message has been received, the center shall generate an alarm acknowledgment to the sender.

Requirement: 4 After the alarm message becomes a verified incident, the center shall determine the appropriate response.

Requirement: 5 The center shall determine whether the alarm message indicates an emergency that requires the attention of public safety agencies, and forward alarm message data to the appropriate agency as necessary.

Requirement: 6 The center shall forward the alarm message to center personnel and respond to the traveler or transit vehicle operator as directed by the personnel.

Functional Area: Emergency Data Collection

Collection and storage of information related to Emergency Management. For use by operations personnel or data archives in the region.

Requirement: 1 The center shall collect emergency service data, emergency vehicle management data, emergency vehicle data, sensor and surveillance data, threat data, and incident data.

Requirement: 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

Requirement: 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the emergency management data or for the data itself.

Requirement: 4 The center shall be able to produce sample products of the data available.

Entity: Maintenance and Construction Management**Functional Area: MCM Environmental Information Processing**

Processes current and forecast weather data, road condition information, local environmental data, and uses internal models to develop specialized detailed forecasts of local weather and surface conditions. Disseminates road weather information to other agencies and centers.

Requirement: 1 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.

Architecture

Northern New Jersey ITS Architecture

Element: **PANYNJ PATH Operations Center**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Environmental Information Processing**

Processes current and forecast weather data, road condition information, local environmental data, and uses internal models to develop specialized detailed forecasts of local weather and surface conditions. Disseminates road weather information to other agencies and centers.

Requirement: 2 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services) and local environmental sensor data.

Requirement: 3 The center shall use the various data inputs of environmental sensors and road weather data to develop a view of current and predicted road weather and road conditions.

Requirement: 4 The center shall disseminate current and forecasted road weather and road condition information to weather service providers (such as the National Weather Service and value-added sector specific meteorological services) as well as other agencies including traffic, emergency, and transit management, traveler information providers, rail operations centers, media, and other maintenance management centers.

Requirement: 5 The center shall provide value-added sector specific meteorological services with information on basic road facility and treatment information that supports forecasts for road conditions.

Functional Area: **MCM Work Activity Coordination**

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

Requirement: 1 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

Requirement: 2 The center shall provide status information about scheduled maintenance and construction activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, multimodal transportation providers, rail operations, and the media.

Requirement: 3 The center shall collect and respond to feedback concerning scheduled maintenance and construction activities with other management centers such as traffic, emergency, transit, and rail operations.

Requirement: 4 The center shall collect and disseminate asset restriction information levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.

Requirement: 5 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance and construction activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.

Requirement: 6 The center shall exchange rail schedules and work plans with rail operations centers.

Functional Area: **MCM Data Collection**

Collection and storage of maintenance and construction information. For use by operations personnel or data archives in the region.

Requirement: 1 The center shall collect maintenance and construction data (such as field equipment status, infrastructure status, maintenance and construction activity data) gathered from roadway, traffic, and other maintenance and construction sources.

Architecture

Northern New Jersey ITS Architecture

Element: **PANYNJ PATH Operations Center**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Data Collection**

Collection and storage of maintenance and construction information. For use by operations personnel or data archives in the region.

- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.
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- Requirement:* 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the maintenance and construction data or for the data itself.
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- Requirement:* 4 The center shall be able to produce sample products of the data available.
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- Requirement:* 5 The center shall provide data to Asset Management to be used in updating the status of assets in the inventory.
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Entity: **Transit Management**

Functional Area: **Transit Center Tracking and Dispatch**

Monitoring transit vehicle locations via interactions with on-board systems and determining vehicle schedule adherence. Furnish users with real-time transit related information and maintain interface with digital map providers.

- Requirement:* 1 The center shall monitor the locations of all transit vehicles within its network.
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- Requirement:* 2 The center shall determine adherence of transit vehicles to their assigned schedule.
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- Requirement:* 3 The center shall collect trip monitoring data from on-board systems including transit vehicle mileage, fuel usage, passenger loading, availability, etc.
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- Requirement:* 4 The center shall provide transit operational data to traveler information service providers.
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- Requirement:* 5 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for transit tracking and dispatch.
-

Functional Area: **Transit Center Fixed-Route Operations**

Planning and scheduling associated with fixed and flexible route transit services, automatically updates customer service operator systems, and provides current vehicle schedule adherence and optimum scenarios for schedule adjustment.

- Requirement:* 1 The center shall generate transit routes and schedules based on such factors as parameters input by the system operator, road network conditions, operational data on current routes and schedules, and digitized map data.
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- Requirement:* 2 The center shall provide the interface to the system operator to control the generation of new routes and schedules (transit services) including the ability to review and update the parameters used by the routes and schedules generation processes and to initiate these processes
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- Requirement:* 3 The center shall be able to generate special routes and schedules to support an incident, disaster, evacuation, or other emergency.
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- Requirement:* 4 The center shall accept requests from traffic management to change routes and schedules as part of the implementation of demand management strategies.
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- Requirement:* 5 The center shall collect transit operational data for use in the generation of routes and schedules.
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- Requirement:* 6 The center shall assign transit vehicle operators based on factors such as eligibility, route preferences, seniority, and transit vehicle availability.
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- Requirement:* 7 The center shall manage large deviations of individual transit vehicles, deviations in rural areas, and deviations of large numbers of vehicles.
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Architecture

Northern New Jersey ITS Architecture

Element: **PANYNJ PATH Operations Center**

Entity: **Transit Management**

Functional Area: **Transit Center Fixed-Route Operations**

Planning and scheduling associated with fixed and flexible route transit services, automatically updates customer service operator systems, and provides current vehicle schedule adherence and optimum scenarios for schedule adjustment.

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- Requirement:* 8 The center shall generate the necessary corrective actions which may involve more than the vehicles concerned and more far reaching action, such as, the introduction of extra vehicles, wide area signal priority by traffic management, the premature termination of some services, etc.
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- Requirement:* 9 The center shall exchange information with Maintenance and Construction Operations concerning work zones, roadway conditions, asset restrictions, work plans, etc.
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- Requirement:* 10 The center shall disseminate up-to-date schedules and route information to other centers for fixed and flexible route services.
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Functional Area: **Transit Center Security**

Monitor transit vehicle operator or traveler activated alarms; authenticate transit vehicle operators; remotely disable a transit vehicle; alert operators, travelers, and police to potential incidents identified by these security features.

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- Requirement:* 1 The center shall monitor transit vehicle operational data to determine if the transit vehicle is off-route and assess whether a security incident is occurring.
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- Requirement:* 2 The center shall receive reports of emergencies on-board transit vehicles entered directly by the transit vehicle operator or from a traveler through interfaces such as panic buttons or alarm switches.
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- Requirement:* 3 The center shall support the back-office portion of functionality to authenticate transit vehicle operators.
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- Requirement:* 4 The center shall exchange transit incident information along with other service data with other transit agencies.
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- Requirement:* 5 The center shall receive information pertaining to a wide-area alert such as weather alerts, disaster situations, or child abductions. This information may come from Emergency Management or from other Alerting and Advisory Systems.
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- Requirement:* 6 The center shall send wide-area alert information to travelers (on-board transit vehicles or at stations/stops) and transit vehicle operators.
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- Requirement:* 7 The center shall coordinate the response to security incidents involving transit with other agencies including Emergency Management, other transit agencies, media, traffic management, and traveler information service providers.
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- Requirement:* 8 The center shall receive threat information and status on the integrity of the transit infrastructure.
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- Requirement:* 9 The center shall provide support to remotely disable (or reset the disabling of) a transit vehicle in service.
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Functional Area: **Transit Garage Operations**

Assignment of transit vehicles and operators to routes or service areas in a fair manner while minimizing labor and overtime services, considering operator preferences, qualifications, accumulated work hours, and other information about each operator.

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- Requirement:* 1 The center shall maintain records of a transit vehicle operator's performance. This may be done utilizing standardized performance evaluation criteria set forth by governmental regulations and transit operating company policies, assessing the transit vehicle operator's driving history, and assessing comments from the transit vehicle operator's supervisor(s) as well as noting any moving violations or accidents, supervisor comments, government regulations, and company policies.
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- Requirement:* 2 The center shall assess the transit vehicle operator's availability based on previous work assignments, accumulated hours, plus health and vacation commitments.
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Architecture

Northern New Jersey ITS Architecture

Element: **PANYNJ PATH Operations Center**

Entity: **Transit Management**

Functional Area: **Transit Garage Operations**

Assignment of transit vehicles and operators to routes or service areas in a fair manner while minimizing labor and overtime services, considering operator preferences, qualifications, accumulated work hours, and other information about each operator.

Requirement: 3 The center shall assign transit vehicle operators to transit schedules based on their eligibility, route preferences, seniority, and transit vehicle availability.

Requirement: 4 The center shall provide an interface through which the transit vehicle operator information can be maintained - either from the transit vehicle operator, a transit system operator (i.e. center personnel), or other functions.

Functional Area: **Transit Center Information Services**

Provide interactive traveler information to travelers (on-board transit vehicles, at stops/stations, using personal devices), traveler information service providers, media, and other transit organizations. Includes routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, yellow pages, and special events.

Requirement: 1 The center shall provide travelers using public transportation with traffic and advisory information upon request. Such information may include transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events.

Requirement: 2 The center shall provide transit information to the media including details of deviations from schedule of regular transit services.

Requirement: 3 The center shall exchange transit schedules, real-time arrival information, fare schedules, and general transit service information with other transit organizations to support transit traveler information systems.

Requirement: 4 The center shall provide transit service information to traveler information service providers including routes, schedules, schedule adherence, and fare information as well as transit service information during evacuation.

Requirement: 5 The center shall enable yellow pages (including non-motorized transportation) information to be output to the traveler.

Requirement: 6 The center shall broadcast transit advisory data, including alerts and advisories pertaining to major emergencies, or man made disasters.

Functional Area: **Transit Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and vehicle probes. The information is monitored and forwarded to other agencies to more effectively manage transit operations.

Requirement: 1 The center shall assimilate current and forecast road conditions and surface weather information to more effectively manage transit operations.

Requirement: 2 The center shall collect current and forecast road and weather information from weather service providers and vehicle probes.

Requirement: 3 The center shall receive road network probe information from its fleet of transit vehicles.

Requirement: 4 The center shall provide road network probe information from its fleet of transit vehicles to traffic management as well as maintenance and construction management.

Functional Area: **Transit Center Multi-Modal Coordination**

Generate requests for transit priority on routes and at certain intersections. Coordinate schedules with other agencies and modes, including transit transfer cluster and transfer point information.

Architecture**Northern New Jersey ITS Architecture***Element:***PANYNJ PATH Operations Center***Entity:***Transit Management***Functional Area:* **Transit Center Multi-Modal Coordination**

Generate requests for transit priority on routes and at certain intersections. Coordinate schedules with other agencies and modes, including transit transfer cluster and transfer point information.

- Requirement:* 1 The center shall analyze transit vehicle schedule performance to determine the need for priority along certain routes or at certain intersections.
- Requirement:* 2 The center shall send requests for priority along routes or at intersections to traffic management.
- Requirement:* 3 The center shall coordinate schedules and services between transit agencies, traffic management, maintenance and construction operations, parking management, and other surface or air transportation modes.
- Requirement:* 4 The center shall share transfer cluster and transfer point information with multimodal transportation service providers, other transit agencies, and traveler information service providers. A transfer cluster is a collection of stops, stations, or terminals where transfers can be made conveniently.

Functional Area: **Transit Data Collection**

Collection and storage of transit management data. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect transit management data such as transit fares and passenger use, transit services, paratransit operations, transit vehicle maintenance data, etc.
- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.
- Requirement:* 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the transit data or for the data itself.
- Requirement:* 4 The center shall be able to produce sample products of the data available.

*Element:***PANYNJ PATH PATHVISION***Entity:***Remote Traveler Support***Functional Area:* **Remote Interactive Information Reception**

Public traveler interface, such as a kiosk, that provides traffic, transit, yellow pages, event, and trip planning information, as well as payment services for tolls, parking, and other personalized traveler information services upon request.

- Requirement:* 1 The public interface for travelers shall receive traffic information from a center and present it to the traveler upon request.
- Requirement:* 2 The public interface for travelers shall receive transit information from a center and present it to the traveler upon request.
- Requirement:* 3 The public interface for travelers shall receive yellow pages information (such as lodging, restaurants, theaters, bicycle facilities, and other tourist activities) from a center and present it to the traveler upon request.
- Requirement:* 4 The public interface for travelers shall receive event information from a center and present it to the traveler upon request.
- Requirement:* 5 The public interface for travelers shall receive evacuation information from a center and present it to the traveler.
- Requirement:* 6 The public interface for travelers shall receive wide-area alerts and present it to the traveler.
- Requirement:* 7 The public interface for travelers shall accept reservations for confirmed trip plans.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ PATH PATHVISION****Entity: Remote Traveler Support****Functional Area: Remote Interactive Information Reception**

Public traveler interface, such as a kiosk, that provides traffic, transit, yellow pages, event, and trip planning information, as well as payment services for tolls, parking, and other personalized traveler information services upon request.

- Requirement:* 8 The public interface for travelers shall support payment for services, such as confirmed trip plans, confirmed yellow pages services, tolls, transit fares, parking lot charges, and advanced payment for tolls.
- Requirement:* 9 The public interface for travelers shall provide an interface through which credit identities and stored credit values may be collected from tags, traveler cards, or payment instruments used by travelers.
- Requirement:* 10 The public interface for travelers shall base requests from the traveler on the traveler's current location or a specific location identified by the traveler, and filter the provided information accordingly.
- Requirement:* 11 The public interface for travelers shall provide digitized map data to act as the background to the information presented to the traveler.
- Requirement:* 12 The public interface for travelers shall support traveler input in audio or manual form.
- Requirement:* 13 The public interface for travelers shall present information to the traveler in audible or visual forms consistent with a kiosk, including those that are suitable for travelers with hearing or vision physical disabilities.
- Requirement:* 14 The public interface for travelers shall be able to store frequently requested data.

Functional Area: Remote Transit Information Services

Public traveler interface that provides real-time travel-related information at transit stops and multi-modal transfer points, including general annunciation, display of imminent arrival information, the latest available information on transit routes, schedules, transfer options, bicycle accessibility, fares, real-time schedule adherence, current incidents, weather conditions, and special events

- Requirement:* 1 The public interface for travelers shall collect and provide real-time travel-related information at transit stops, multi-modal transfer points, and other public transportation areas.
- Requirement:* 2 The public interface for travelers shall collect and present to the transit traveler information on transit routes, schedules, and real-time schedule adherence.
- Requirement:* 3 The public interface for travelers shall provide support for general annunciation and/or display of imminent arrival information and other information of general interest to transit users.
- Requirement:* 4 The public interface for travelers shall present information to the traveler in a form suitable for travelers with physical disabilities.

Element: PANYNJ PATH Transit Vehicles**Entity: Transit Vehicle Subsystem****Functional Area: On-board Transit Trip Monitoring**

Support fleet management with automatic vehicle location (AVL) and automated mileage and fuel reporting and auditing.

- Requirement:* 1 The transit vehicle shall compute the location of the transit vehicle based on inputs from a vehicle location determination function.
- Requirement:* 2 The transit vehicle shall support the computation of the location of a transit vehicle using on-board sensors to augment the location determination function. This may include proximity to the transit stops or other known reference points as well as recording trip length.
- Requirement:* 3 The transit vehicle shall record transit trip monitoring data including vehicle mileage and fuel usage.
- Requirement:* 4 The transit vehicle shall record transit trip monitoring data including operational status information such as doors open/closed, passenger loading, running times, etc.

Architecture**Northern New Jersey ITS Architecture***Element:***PANYNJ PATH Transit Vehicles***Entity:***Transit Vehicle Subsystem***Functional Area:* **On-board Transit Trip Monitoring**

Support fleet management with automatic vehicle location (AVL) and automated mileage and fuel reporting and auditing.

- Requirement:* 5 The transit vehicle shall send the transit vehicle trip monitoring data to center-based trip monitoring functions.

Functional Area: **On-board Fixed Route Schedule Management**

Collecting of data for schedule generation and adjustment on-board a transit vehicle. Supports communication between the vehicle, operator, and center.

- Requirement:* 1 The transit vehicle shall receive transit route information for its assigned route including transit service instructions, traffic information, road conditions, and other information for the operator.
- Requirement:* 2 The transit vehicle shall use the route information and its current location to determine the deviation from the predetermined schedule.
- Requirement:* 3 The transit vehicle shall calculate the estimated times of arrival (ETA) at transit stops.
- Requirement:* 4 The transit vehicle shall determine scenarios to correct the schedule deviation.
- Requirement:* 5 The transit vehicle shall provide the schedule deviations and instructions for schedule corrections to the transit vehicle operator if the deviation is small, or the transit vehicle is operating in an urban area.
- Requirement:* 6 The transit vehicle shall send the schedule deviation and estimated arrival time information to the center.
- Requirement:* 7 The transit vehicle shall support the operations of a flexible route service. This may include requests for route deviations that would then lead to schedule corrective actions.

*Element:***PANYNJ PATH Traveler Information Systems***Entity:***Information Service Provider***Functional Area:* **Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

- Requirement:* 1 The center shall collect, process, store, and disseminate customized traffic and highway condition information to travelers, including incident information, detours and road closures, recommended routes, and current speeds on specific routes upon request.
- Requirement:* 2 The center shall collect, process, store, and disseminate customized maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities upon request.
- Requirement:* 3 The center shall collect, process, store, and disseminate customized transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers upon request.
- Requirement:* 4 The center shall collect, process, store, and disseminate customized parking information to travelers, including location, availability, and fees upon request.
- Requirement:* 5 The center shall collect, process, store, and disseminate customized toll fee information to travelers upon request.
- Requirement:* 6 The center shall collect, process, store, and disseminate customized weather information to travelers upon request.
- Requirement:* 7 The center shall collect, process, store, and disseminate customized multimodal transportation service information (for example, from ferry and airline operators), including transfer points and other information, to travelers upon request.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ PATH Traveler Information Systems****Entity: Information Service Provider****Functional Area: Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

- Requirement:* 8 The center shall collect, process, store, and disseminate customized event information to travelers upon request.
- Requirement:* 9 The center shall collect, process, store, and disseminate customized air quality information to travelers upon request.
- Requirement:* 10 The center shall provide all traveler information based on the traveler's current location or a specific location identified by the traveler, and filter or customize the provided information accordingly.
- Requirement:* 11 The center shall accept traveler profiles for determining the type of personalized data to send to the traveler.
- Requirement:* 12 The center shall manage payment for services, such as tolls, transit fares, parking lot charges, map updates, and advanced payment for tolls, and provide transaction success or failure details.
- Requirement:* 13 The center shall support requests for traveler information and advanced payment for traveler services from commercial fleet operators.
- Requirement:* 14 The center shall provide the capability to exchange information with another traveler information service provider current or predicted data for road links that are outside the area served by the local supplier.
- Requirement:* 15 The center shall manage updates of digitized map data and provide updates to traveler interface systems upon request.
- Requirement:* 16 The center shall provide the capability to support requests from the media for traffic and incident data.
- Requirement:* 17 The center shall provide the capability for a system operator to control the type and update frequency of traveler information.

Functional Area: Traveler Telephone Information

Collection and distribution of traveler information and wide-area alerts to traveler telephone information systems such as 511, based on voice-based traveler requests.

- Requirement:* 1 The center shall provide the capability to process voice-formatted requests for traveler information from a traveler telephone information system, and return the information in the requested format.
- Requirement:* 2 The center shall provide the capability to process dual-tone multifrequency (DTMF)-based requests (touch-tone) for traveler information from a traveler telephone information system.
- Requirement:* 3 The center shall provide the capability to process traveler information requests from a traveler telephone information system.
- Requirement:* 4 The center shall collect and provide information on traffic conditions in the requested voice format and for the requested location.
- Requirement:* 5 The center shall collect and provide work zone and roadway maintenance information in the requested voice format and for the requested location.
- Requirement:* 6 The center shall collect and provide roadway environment conditions information in the requested voice format and for the requested location.
- Requirement:* 7 The center shall collect and provide weather and event information in the requested voice format and for the requested location.
- Requirement:* 8 The center shall collect and provide transit service information in the requested voice format and for the requested location.

Architecture

Northern New Jersey ITS Architecture

*Element:***PANYNJ PATH Traveler Information Systems**

*Entity:***Information Service Provider**

Functional Area: **Traveler Telephone Information**

Collection and distribution of traveler information and wide-area alerts to traveler telephone information systems such as 511, based on voice-based traveler requests.

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| <i>Requirement:</i> | 9 The center shall collect and provide yellow pages services information in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 10 The center shall collect and provide current ferry and rail schedule and airport status information in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 11 The center shall provide the capability to support both specific caller requests as well as bulk upload of regional traveler information. |
| <i>Requirement:</i> | 12 The center shall receive and forward region-specific wide-area alert and advisory information to the traveler telephone information system, including major emergencies such as a natural or man-made disaster, civil emergency, child abductions, severe weather watches and warnings, military activities, and law enforcement warnings. |
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*Element:***PANYNJ PATH Vehicle Detection System**

*Entity:***Transit Management**

Functional Area: **Transit Center Tracking and Dispatch**

Monitoring transit vehicle locations via interactions with on-board systems and determining vehicle schedule adherence. Furnish users with real-time transit related information and maintain interface with digital map providers.

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| <i>Requirement:</i> | 1 The center shall monitor the locations of all transit vehicles within its network. |
| <i>Requirement:</i> | 2 The center shall determine adherence of transit vehicles to their assigned schedule. |
| <i>Requirement:</i> | 3 The center shall collect trip monitoring data from on-board systems including transit vehicle mileage, fuel usage, passenger loading, availability, etc. |
| <i>Requirement:</i> | 4 The center shall provide transit operational data to traveler information service providers. |
| <i>Requirement:</i> | 5 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for transit tracking and dispatch. |
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*Element:***PANYNJ Port Commerce CCTV**

*Entity:***Roadway Subsystem**

Functional Area: **Roadway Basic Surveillance**

Field elements that monitor traffic conditions using loop detectors and CCTV cameras.

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| <i>Requirement:</i> | 1 The field element shall collect, process, digitize, and send traffic sensor data (speed, volume, and occupancy) to the center for further analysis and storage, under center control. |
| <i>Requirement:</i> | 2 The field element shall collect, process, and send traffic images to the center for further analysis and distribution. |
| <i>Requirement:</i> | 3 The field element shall collect, digitize, and send pedestrian sensor data to the center for further analysis and storage. |
| <i>Requirement:</i> | 4 The field element shall collect, process, and send pedestrian images to the center for further analysis and distribution. |
| <i>Requirement:</i> | 5 The field element shall collect, digitize, and send multimodal crossing and high occupancy vehicle (HOV) lane sensor data to the center for further analysis and storage. |
| <i>Requirement:</i> | 6 The field element shall return sensor and CCTV system operational status to the controlling center. |
| <i>Requirement:</i> | 7 The field element shall return sensor and CCTV system fault data to the controlling center for repair. |
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Architecture**Northern New Jersey ITS Architecture***Element:***PANYNJ Port Commerce CCTV***Entity:***Roadway Subsystem***Functional Area:* **Roadway Equipment Coordination**

Field elements that control and send data to other field elements (such as environmental sensors that send data to a DMS or coordination between traffic controllers on adjacent intersections), without center control.

- Requirement:*
- 1 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that provide data and status information to other field element devices (such as dynamic message signs, ramp meters, traffic signals, work zone intrusion alert systems), without center control.
 - 2 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that receive control information from other field element devices, without center control.
 - 3 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that provide data and status information to other field element devices (such as dynamic message signs, traffic controllers on adjacent intersections), without center control.
 - 4 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that receive control information from other field element devices, without center control.

*Element:***PANYNJ Port Commerce Credentialing Back Office (SEALINK)***Entity:***Commercial Vehicle Administration***Functional Area:* **Credentials and Taxes Administration**

Manage electronic filing of credentials and tax filing for commercial vehicle operators. Provides commercial vehicle (including HAZMAT) route restrictions.

- Requirement:*
- 1 The center shall manage electronic credentials filing and processing for commercial vehicles.
 - 2 The center shall manage the filing of appropriate taxes for the operation of commercial vehicles.
 - 3 The center shall process requests for payments of electronic credentials and tax filing and maintain an interface to a Financial Institution.
 - 4 The center shall exchange credentials and tax information with other commercial vehicle administration centers - either in other states or the federal government.
 - 5 The center shall provide route restrictions information, including hazmat restrictions, to other centers and agencies for distribution to commercial vehicle operators. These centers and agencies may include commercial fleet and freight management operators, traveler information centers, digital map update providers, and other commercial vehicle administration centers.
 - 6 The center shall use information on asset restrictions received from maintenance centers to develop the commercial vehicle route restrictions and process credentials applications.
 - 7 The center shall provide an interface with commercial vehicle fleet and freight management centers to exchange audit and compliance review reports.
 - 8 The center shall provide credentials information about commercial vehicle operators and carriers to authorized requestors such as insurance agencies.
 - 9 The center shall receive and store information on commercial vehicle violations from enforcement agencies as part of the processing of credentials applications.

Functional Area: **CV Safety Administration**

Provides commercial vehicle safety criteria to roadside check facilities, collects and reviews safety data from the field and distributes safety information to other centers, carriers, and enforcement agencies.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ Port Commerce Credentialing Back Office (SEALINK)****Entity: Commercial Vehicle Administration****Functional Area: CV Safety Administration**

Provides commercial vehicle safety criteria to roadside check facilities, collects and reviews safety data from the field and distributes safety information to other centers, carriers, and enforcement agencies.

- Requirement:* 1 The center shall provide commercial vehicle safety data to roadside check facilities.
- Requirement:* 2 The center shall collect and review safety inspection reports and violations from the roadside check facilities and pass on appropriate portions to other commercial vehicle administrative centers and commercial vehicle fleet operators.
- Requirement:* 3 The center shall notify enforcement agencies of commercial vehicle safety violations by individual commercial vehicles, drivers, or carriers.

Functional Area: CV Information Exchange

Exchange information concerning safety, credentialing, and operations of commercial vehicles between the center and the roadside check stations, across jurisdictions, with fleet operators, enforcement agencies, and other information requestors.

- Requirement:* 1 The center shall exchange information with roadside check facilities, including credentials and credentials status information, safety status information, daily site activity data, and citations.
- Requirement:* 2 The center shall exchange safety and credentials data among other commercial vehicle administration centers; includes border clearance status, credentials information, credentials status information, and safety status information.
- Requirement:* 3 The center shall package data concerning commercial vehicle safety and credentials into snapshots (top-level summary and critical status information).
- Requirement:* 4 The center shall package data concerning commercial vehicle safety and credentials into profiles (detailed and historical data).
- Requirement:* 5 The center shall provide commercial vehicle accident reports and citations to enforcement agencies.
- Requirement:* 6 The center shall provide commercial vehicle credentials and safety status information to authorized requestors such as insurance agencies.
- Requirement:* 7 The center shall provide reports to the commercial vehicle fleet manager regarding fleet activity through roadside facilities including accident reports, citations, credentials status information, and safety status information.

Element: PANYNJ Port Commerce Field Equipment**Entity: Roadway Subsystem****Functional Area: Roadway Basic Surveillance**

Field elements that monitor traffic conditions using loop detectors and CCTV cameras.

- Requirement:* 1 The field element shall collect, process, digitize, and send traffic sensor data (speed, volume, and occupancy) to the center for further analysis and storage, under center control.
- Requirement:* 2 The field element shall collect, process, and send traffic images to the center for further analysis and distribution.
- Requirement:* 3 The field element shall collect, digitize, and send pedestrian sensor data to the center for further analysis and storage.
- Requirement:* 4 The field element shall collect, process, and send pedestrian images to the center for further analysis and distribution.
- Requirement:* 5 The field element shall collect, digitize, and send multimodal crossing and high occupancy vehicle (HOV) lane sensor data to the center for further analysis and storage.
- Requirement:* 6 The field element shall return sensor and CCTV system operational status to the controlling center.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ Port Commerce Field Equipment****Entity: Roadway Subsystem****Functional Area: Roadway Basic Surveillance**

Field elements that monitor traffic conditions using loop detectors and CCTV cameras.

Requirement: 7 The field element shall return sensor and CCTV system fault data to the controlling center for repair.

Functional Area: Roadway Signal Controls

Field elements including traffic signal controllers for use at major intersections and on main highways for urban areas; also supports pedestrian crossings.

Requirement: 1 The field element shall control traffic signals at intersections and on main highways for urban and rural areas, under center control.

Requirement: 2 The field element shall collect pedestrian images and pedestrian sensor data, and respond to pedestrian crossing requests via display, audio signal, or other manner.

Requirement: 3 The field element shall provide the capability to notify the traffic management center that a pedestrian has requested right-of-way and when the request was or will be granted (request for right-of-way).

Requirement: 4 The field element shall monitor operation of traffic signal controllers and report to the center any instances in which the indicator response does not match that expected from the indicator control information.

Requirement: 5 The field element shall monitor operation of traffic signal controllers and report to the center any instances in which the indicator response does not match that expected from known indicator preemptions.

Requirement: 6 The field element shall return traffic signal controller operational status to the controlling center.

Requirement: 7 The field element shall return traffic signal controller fault data to the maintenance center for repair.

Functional Area: Roadway Equipment Coordination

Field elements that control and send data to other field elements (such as environmental sensors that send data to a DMS or coordination between traffic controllers on adjacent intersections), without center control.

Requirement: 1 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that provide data and status information to other field element devices (such as dynamic message signs, ramp meters, traffic signals, work zone intrusion alert systems), without center control.

Requirement: 2 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that receive control information from other field element devices, without center control.

Requirement: 3 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that provide data and status information to other field element devices (such as dynamic message signs, traffic controllers on adjacent intersections), without center control.

Requirement: 4 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that receive control information from other field element devices, without center control.

Element: PANYNJ Port Commerce FIRST Web Site**Entity: Information Service Provider****Functional Area: Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ Port Commerce FIRST Web Site****Entity: Information Service Provider****Functional Area: Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

- Requirement:* 1 The center shall collect, process, store, and disseminate customized traffic and highway condition information to travelers, including incident information, detours and road closures, recommended routes, and current speeds on specific routes upon request.
- Requirement:* 2 The center shall collect, process, store, and disseminate customized maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities upon request.
- Requirement:* 3 The center shall collect, process, store, and disseminate customized transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers upon request.
- Requirement:* 4 The center shall collect, process, store, and disseminate customized parking information to travelers, including location, availability, and fees upon request.
- Requirement:* 5 The center shall collect, process, store, and disseminate customized toll fee information to travelers upon request.
- Requirement:* 6 The center shall collect, process, store, and disseminate customized weather information to travelers upon request.
- Requirement:* 7 The center shall collect, process, store, and disseminate customized multimodal transportation service information (for example, from ferry and airline operators), including transfer points and other information, to travelers upon request.
- Requirement:* 8 The center shall collect, process, store, and disseminate customized event information to travelers upon request.
- Requirement:* 9 The center shall collect, process, store, and disseminate customized air quality information to travelers upon request.
- Requirement:* 10 The center shall provide all traveler information based on the traveler's current location or a specific location identified by the traveler, and filter or customize the provided information accordingly.
- Requirement:* 11 The center shall accept traveler profiles for determining the type of personalized data to send to the traveler.
- Requirement:* 12 The center shall manage payment for services, such as tolls, transit fares, parking lot charges, map updates, and advanced payment for tolls, and provide transaction success or failure details.
- Requirement:* 13 The center shall support requests for traveler information and advanced payment for traveler services from commercial fleet operators.
- Requirement:* 14 The center shall provide the capability to exchange information with another traveler information service provider current or predicted data for road links that are outside the area served by the local supplier.
- Requirement:* 15 The center shall manage updates of digitized map data and provide updates to traveler interface systems upon request.
- Requirement:* 16 The center shall provide the capability to support requests from the media for traffic and incident data.
- Requirement:* 17 The center shall provide the capability for a system operator to control the type and update frequency of traveler information.

Functional Area: Traveler Telephone Information

Collection and distribution of traveler information and wide-area alerts to traveler telephone information systems such as 511, based on voice-based traveler requests.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ Port Commerce FIRST Web Site****Entity: Information Service Provider****Functional Area: Traveler Telephone Information**

Collection and distribution of traveler information and wide-area alerts to traveler telephone information systems such as 511, based on voice-based traveler requests.

- Requirement:* 1 The center shall provide the capability to process voice-formatted requests for traveler information from a traveler telephone information system, and return the information in the requested format.
- Requirement:* 2 The center shall provide the capability to process dual-tone multifrequency (DTMF)-based requests (touch-tone) for traveler information from a traveler telephone information system.
- Requirement:* 3 The center shall provide the capability to process traveler information requests from a traveler telephone information system.
- Requirement:* 4 The center shall collect and provide information on traffic conditions in the requested voice format and for the requested location.
- Requirement:* 5 The center shall collect and provide work zone and roadway maintenance information in the requested voice format and for the requested location.
- Requirement:* 6 The center shall collect and provide roadway environment conditions information in the requested voice format and for the requested location.
- Requirement:* 7 The center shall collect and provide weather and event information in the requested voice format and for the requested location.
- Requirement:* 8 The center shall collect and provide transit service information in the requested voice format and for the requested location.
- Requirement:* 9 The center shall collect and provide yellow pages services information in the requested voice format and for the requested location.
- Requirement:* 10 The center shall collect and provide current ferry and rail schedule and airport status information in the requested voice format and for the requested location.
- Requirement:* 11 The center shall provide the capability to support both specific caller requests as well as bulk upload of regional traveler information.
- Requirement:* 12 The center shall receive and forward region-specific wide-area alert and advisory information to the traveler telephone information system, including major emergencies such as a natural or man-made disaster, civil emergency, child abductions, severe weather watches and warnings, military activities, and law enforcement warnings.

Functional Area: ISP Probe Information Collection

Collection and aggregation of vehicle probe data, including calculation and dissemination of route travel times and usage. Includes environmental probe data collection, aggregation and dissemination.

- Requirement:* 1 The center shall collect vehicle probe data from various sources, including vehicles under infrastructure-based route guidance and electronic toll collection points.
- Requirement:* 2 The center shall aggregate collected vehicle probe data (route segment identity and the time), calculate route segment travel times, route segment speeds, and route usage, and disseminate to other centers.
- Requirement:* 3 The center shall collect environmental probe data (air temperature, wind speed, surface temperature, etc.) from appropriately equipped vehicles.
- Requirement:* 4 The center shall aggregate collected environmental probe data, and disseminate environmental conditions to other centers.

Element: PANYNJ Port Commerce Operations Centers**Entity: Commercial Vehicle Administration****Functional Area: CV Safety Administration**

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ Port Commerce Operations Centers****Entity: Commercial Vehicle Administration****Functional Area: CV Safety Administration**

Provides commercial vehicle safety criteria to roadside check facilities, collects and reviews safety data from the field and distributes safety information to other centers, carriers, and enforcement agencies.

- Requirement:** 1 The center shall provide commercial vehicle safety data to roadside check facilities.
- Requirement:** 2 The center shall collect and review safety inspection reports and violations from the roadside check facilities and pass on appropriate portions to other commercial vehicle administrative centers and commercial vehicle fleet operators.
- Requirement:** 3 The center shall notify enforcement agencies of commercial vehicle safety violations by individual commercial vehicles, drivers, or carriers.

Functional Area: CV Information Exchange

Exchange information concerning safety, credentialing, and operations of commercial vehicles between the center and the roadside check stations, across jurisdictions, with fleet operators, enforcement agencies, and other information requestors.

- Requirement:** 1 The center shall exchange information with roadside check facilities, including credentials and credentials status information, safety status information, daily site activity data, and citations.
- Requirement:** 2 The center shall exchange safety and credentials data among other commercial vehicle administration centers; includes border clearance status, credentials information, credentials status information, and safety status information.
- Requirement:** 3 The center shall package data concerning commercial vehicle safety and credentials into snapshots (top-level summary and critical status information).
- Requirement:** 4 The center shall package data concerning commercial vehicle safety and credentials into profiles (detailed and historical data).
- Requirement:** 5 The center shall provide commercial vehicle accident reports and citations to enforcement agencies.
- Requirement:** 6 The center shall provide commercial vehicle credentials and safety status information to authorized requestors such as insurance agencies.
- Requirement:** 7 The center shall provide reports to the commercial vehicle fleet manager regarding fleet activity through roadside facilities including accident reports, citations, credentials status information, and safety status information.

Entity: Emergency Management**Functional Area: Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

- Requirement:** 1 The center shall support the interface to the Emergency Telecommunications System (e.g. 911 or 7-digit call routing) to receive emergency notification information and provide it to the emergency system operator.
- Requirement:** 2 The center shall receive emergency call information from 911 services and present the possible incident information to the emergency system operator.
- Requirement:** 3 The center shall receive emergency call information from motorist call-boxes and present the possible incident information to the emergency system operator.
- Requirement:** 4 The center shall receive emergency call information from mayday service providers and present the possible incident information to the emergency system operator.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ Port Commerce Operations Centers****Entity: Emergency Management****Functional Area: Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

- Requirement:* 5 The center shall receive emergency notification information from other public safety agencies and present the possible incident information to the emergency system operator.
- Requirement:* 6 The center shall receive emergency notification information from public transit systems and present the possible incident information to the emergency system operator.
- Requirement:* 7 The center shall receive emergency notification information from commercial vehicles, commercial vehicle check stations, or commercial fleet operators and present the possible incident information to the emergency system operator. This may include detection of non-permitted transport of security sensitive hazmat, hazardous cargo spills, etc.
- Requirement:* 8 The center shall receive details of the cargo being carried by commercial vehicles from their commercial fleet manager for incidents involving potential hazardous materials.
- Requirement:* 9 The center shall coordinate, correlate, and verify all emergency inputs, including those identified based on external calls and internal analysis of security sensor and surveillance data, and assign each a level of confidence.
- Requirement:* 10 The center shall send a request for remote control of CCTV systems from a traffic management center in order to verify the reported incident.
- Requirement:* 11 The center shall update the incident information log once the emergency system operator has verified the incident.
- Requirement:* 12 The center shall provide the capability for digitized map data to act as the background to the emergency information presented to the emergency system operator.
- Requirement:* 13 The center shall forward the verified emergency information to the responding agency based on the location and nature of the emergency.

Functional Area: Emergency Response Management

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

- Requirement:* 1 The center shall provide strategic emergency response capabilities such as that of an Emergency Operations Center for large-scale incidents and disasters.
- Requirement:* 2 The center shall manage coordinated inter-agency responses to and recovery from large-scale emergencies. Such agencies include traffic management, transit, maintenance and construction management, rail operations, and other emergency management agencies.
- Requirement:* 3 The center shall provide the capability to implement response plans and track progress through the incident by exchanging incident information and distributing response status to allied agencies.
- Requirement:* 4 The center shall develop, coordinate with other agencies, and store emergency response plans.
- Requirement:* 5 The center shall track the availability of resources (including vehicles, roadway cleanup?, etc.), request additional resources from traffic, maintenance, or other emergency centers if needed.
- Requirement:* 6 The center shall allocate the appropriate emergency services, resources, and vehicle (s) to respond to incidents, and shall provide the capability to override the current allocation to suit the special needs of a current incident.
- Requirement:* 7 The center shall receive event scheduling information from Event Promoters.
- Requirement:* 8 The center shall receive hazardous materials incident information from commercial fleet operators.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ Port Commerce Operations Centers****Entity: Emergency Management****Functional Area: Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

- Requirement:* 9 The center shall provide the capability to request the safe disabling of a commercial vehicle during a hazardous materials incident.
- Requirement:* 10 The center shall provide the capability to request transit resource availability from transit centers for use during disaster and evacuation operations.
- Requirement:* 11 The center shall assimilate the status of the transit, traffic, rail, maintenance, and other emergency center services and systems to create an overall transportation system status, and disseminate to each of these centers and the traveling public via traveler information providers.
- Requirement:* 12 The center shall provide information to the media concerning the status of an emergency response.
- Requirement:* 13 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.
- Requirement:* 14 The center shall provide the capability for center personnel to provide inputs to the management of incidents, disasters and evacuations.

Functional Area: Incident Command

Tactical decision support, resource coordination, and communications integration among emergency management agencies for Incident Commands that are established by first responders to support local management of an incident.

- Requirement:* 1 The center shall provide tactical decision support, resource coordination, and communications integration for Incident Commands that are established by first responders to support local management of an incident.
- Requirement:* 2 The center shall provide incident command communications with public safety, emergency management, transportation, and other allied response agency centers.
- Requirement:* 3 The center shall track and maintain resource information and action plans pertaining to the incident command.
- Requirement:* 4 The center shall share incident command information with other public safety agencies including resource deployment status, hazardous material information, rail incident information, evacuation advice as well as traffic, road, and weather conditions.
- Requirement:* 5 The center shall assess the status of responding emergency vehicles as part of an incident command.

Functional Area: Mayday Support

Collection and response to Mayday messages received from vehicles and drivers.

- Requirement:* 1 The center shall collect mayday messages from vehicles and drivers.
- Requirement:* 2 The center shall collect mayday messages from travelers via personal handheld devices.
- Requirement:* 3 The center shall acknowledge the request for emergency assistance, whether originated by the driver, automatically by the vehicle's safety systems, or by a traveler via a personal handheld device.
- Requirement:* 4 After the mayday becomes a verified incident, the center shall determine the appropriate response to the mayday message.
- Requirement:* 5 The center shall determine whether the mayday message indicates an emergency that requires the attention of public safety agencies, and forward mayday emergency data to the appropriate agency as necessary.
- Requirement:* 6 The center shall support the activation of remote controlled functions requested by a vehicle, such as requests to unlock doors.

Architecture

Northern New Jersey ITS Architecture

Element: **PANYNJ Port Commerce Operations Centers**

Entity: **Emergency Management**

Functional Area: **Mayday Support**

Collection and response to Mayday messages received from vehicles and drivers.

- Requirement:* 7 The center shall request additional emergency details from or issue commands to the vehicle's security systems or vehicle driver if needed.
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- Requirement:* 8 The center shall maintain a log of all mayday signals received from vehicles.
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- Requirement:* 9 The center shall provide all mayday data to center personnel and respond to the vehicle, driver, or traveler using the portable handheld device as directed by the personnel.
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Entity: **Maintenance and Construction Management**

Functional Area: **MCM Incident Management**

Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.

- Requirement:* 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.
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- Requirement:* 2 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, etc.
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- Requirement:* 3 The center shall exchange incident and threat information with emergency management centers as well as traffic management centers; including notification of existence of incident and expected severity, location, time and nature of incident.
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- Requirement:* 4 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.
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- Requirement:* 5 The center shall respond to requests from emergency management to provide maintenance and construction resources to implement response plans, assist in clean up, verify an incident, etc. This may also involve coordination with traffic management centers and other maintenance centers.
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- Requirement:* 6 The center shall exchange road network status assessment information with emergency management and traffic management centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.
-
- Requirement:* 7 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.
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- Requirement:* 8 The center shall receive information indicating the damage sustained by transportation assets, derived from aerial surveillance, field reports, inspections, tests, and analyses to support incident management.
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Functional Area: **MCM Work Zone Management**

Remotely monitors and supports work zone activities, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).

- Requirement:* 1 The center shall generate new work zone activity schedules for use by maintenance and construction vehicles, maintenance and construction operators, and for information coordination purposes.
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- Requirement:* 2 The center shall control the collection of work zone status information including video images from cameras located in or near the work zone.
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Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ Port Commerce Operations Centers****Entity: Maintenance and Construction Management****Functional Area: MCM Work Zone Management**

Remotely monitors and supports work zone activities, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).

- Requirement:* 3 The center shall disseminate work zone information to other agencies and centers including traffic, transit, emergency management centers, other maintenance centers, traveler information providers, and the media.
- Requirement:* 4 The center shall control traffic in work zones by providing remote control of dynamic message signs and highway advisory radio systems located in or near the work zone.
- Requirement:* 5 The center shall exchange information with administrative systems to support the planning and scheduling of work zone activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.

Functional Area: MCM Work Activity Coordination

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

- Requirement:* 1 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.
- Requirement:* 2 The center shall provide status information about scheduled maintenance and construction activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, multimodal transportation providers, rail operations, and the media.
- Requirement:* 3 The center shall collect and respond to feedback concerning scheduled maintenance and construction activities with other management centers such as traffic, emergency, transit, and rail operations.
- Requirement:* 4 The center shall collect and disseminate asset restriction information levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.
- Requirement:* 5 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance and construction activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
- Requirement:* 6 The center shall exchange rail schedules and work plans with rail operations centers.

Entity: Traffic Management**Functional Area: Collect Traffic Surveillance**

Management of traffic sensors and surveillance (CCTV) equipment, and distribution of the collected information to other centers and operators.

- Requirement:* 1 The center shall monitor, analyze, and store traffic sensor data (speed, volume, occupancy) collected from field elements under remote control of the center.
- Requirement:* 2 The center shall monitor, analyze, and distribute traffic images from CCTV systems under remote control of the center.

Architecture

Northern New Jersey ITS Architecture

Element: **PANYNJ Port Commerce Operations Centers**

Entity: **Traffic Management**

Functional Area: **Collect Traffic Surveillance**

Management of traffic sensors and surveillance (CCTV) equipment, and distribution of the collected information to other centers and operators.

- Requirement:* 3 The center shall monitor, analyze, and store pedestrian sensor data collected from field elements under remote control of the center.
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- Requirement:* 4 The center shall monitor, analyze, and distribute pedestrian images from CCTV systems under remote control of the center.
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- Requirement:* 5 The center shall monitor, analyze, and store multimodal crossing and high occupancy vehicle (HOV) lane sensor data under remote control of the center.
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- Requirement:* 6 The center shall maintain a database of surveillance and sensors and the freeways, surface street and rural roadways, e.g. where they are located, to which part(s) of the network their data applies, the type of data, and the ownership of each link (that is, the agency or entity responsible for collecting and storing surveillance of the link) in the network.
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- Requirement:* 7 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic data.
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- Requirement:* 8 The center shall distribute road network conditions data (raw or processed) based on collected and analyzed traffic sensor and surveillance data to other centers.
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- Requirement:* 9 The center shall respond to control data from center personnel regarding sensor and surveillance data collection, analysis, storage, and distribution.
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Functional Area: **TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

- Requirement:* 1 The center shall remotely control traffic signal controllers.
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- Requirement:* 2 The center shall accept notifications of right-of-way requests from pedestrians.
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- Requirement:* 3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center.
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- Requirement:* 4 The center shall collect traffic signal controller fault data from the field.
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- Requirement:* 5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.
-

Functional Area: **TMC Freeway Management**

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

- Requirement:* 1 The center shall remotely control systems to manage use of the freeways, including ramp meters, mainline metering, and lane controls.
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- Requirement:* 2 The center shall collect operational status from ramp meters, mainline metering, and lane controls and compare against the control information sent by the center.
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- Requirement:* 3 The center shall collect fault data from ramp meters, mainline metering, and lane controls.
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- Requirement:* 4 The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, mainline metering, and lane controls), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the ramps themselves.
-

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ Port Commerce Operations Centers****Entity: Traffic Management****Functional Area: TMC Traffic Information Dissemination**

Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.

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| <i>Requirement:</i> | 1 The center shall remotely control dynamic messages signs for dissemination of traffic and other information to drivers. |
| <i>Requirement:</i> | 2 The center shall remotely control driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers. |
| <i>Requirement:</i> | 3 The center shall collect operational status for the driver information systems equipment (DMS, HAR, etc.). |
| <i>Requirement:</i> | 4 The center shall collect fault data for the driver information systems equipment (DMS, HAR, etc.) for repair. |
| <i>Requirement:</i> | 5 The center shall retrieve locally stored traffic information, including current and forecasted traffic information, road and weather conditions, traffic incident information, information on diversions and alternate routes, closures, and special traffic restrictions (lane/shoulder use, weight restrictions, width restrictions, HOV requirements), etc. |
| <i>Requirement:</i> | 6 The center shall distribute traffic data to maintenance and construction centers, transit centers, emergency management centers, and traveler information providers. |
| <i>Requirement:</i> | 7 The center shall distribute traffic data to the media upon request; the capability to provide the information in both data stream and graphical display shall be supported. |
| <i>Requirement:</i> | 8 The center shall provide the capability for center personnel to control the nature of the data that is available to non-traffic operations centers and the media. |

Functional Area: TMC Regional Traffic Control

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

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| <i>Requirement:</i> | 1 The center shall exchange traffic information with other traffic management centers, includes incident information, congestion data, traffic data, signal timing plans, and real-time signal control information. |
| <i>Requirement:</i> | 2 The center shall exchange traffic control information with other traffic management centers, includes remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.). |

Functional Area: TMC Incident Detection

Remotely controls traffic and video sensors to support incident detection and verification; exchange information with other agencies including emergency management, maintenance and construction, alerting and advisory systems, event promoters, intermodal freight depots, and traveler information systems.

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| <i>Requirement:</i> | 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System. |
| <i>Requirement:</i> | 2 The center shall collect and store traffic flow and image data from the field equipment to detect and verify incidents. |
| <i>Requirement:</i> | 3 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, and intermodal freight depots. |

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ Port Commerce Operations Centers****Entity: Traffic Management****Functional Area: TMC Incident Detection**

Remotely controls traffic and video sensors to support incident detection and verification; exchange information with other agencies including emergency management, maintenance and construction, alerting and advisory systems, event promoters, intermodal freight depots, and traveler information systems.

- Requirement:* 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.
- Requirement:* 5 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field.
- Requirement:* 6 The center shall provide road network conditions and traffic images to emergency management centers to support the detection, verification, and classification of incidents.
- Requirement:* 7 The center shall provide video and traffic sensor control commands to the field equipment to detect and verify incidents.

Functional Area: TMC Incident Dispatch Coordination/Communication

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

- Requirement:* 1 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction for distribution to the public. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, and information and instructions necessary for the public to respond to the alert. This may also identify specific information that should not be released to the public.
- Requirement:* 2 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.
- Requirement:* 3 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field, provide special routing for emergency vehicles, and to provide responding emergency vehicles with signal preemption.
- Requirement:* 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.
- Requirement:* 5 The center shall respond to requests from emergency management to provide traffic management resources to implement special traffic control measures, assist in clean up, verify an incident, etc. This may also involve coordination with maintenance centers.
- Requirement:* 6 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, media, and rail operations centers.
- Requirement:* 7 The center shall provide road network conditions and traffic images to emergency management centers, maintenance and construction centers, and traveler information service providers.
- Requirement:* 8 The center shall exchange road network status assessment information with emergency management and maintenance centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.
- Requirement:* 9 The center shall coordinate information and controls with other traffic management centers.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ Port Commerce Operations Centers****Entity: Traffic Management****Functional Area: TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

Requirement: 10 The center shall receive inputs from emergency management and transit management centers to develop an overall status of the transportation system including emergency transit schedules in effect and current status and condition of the transportation infrastructure.

Requirement: 11 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic incident management.

Functional Area: Traffic Maintenance

Monitoring and remote diagnostics of field equipment - detect failures, issue problem reports, and track the repair or replacement of the failed equipment.

Requirement: 1 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) operational status.

Requirement: 2 The center shall collect and store CCTV surveillance system (traffic, pedestrian) operational status.

Requirement: 3 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) fault data and send to the maintenance center for repair.

Requirement: 4 The center shall collect and store CCTV surveillance system (traffic, pedestrian) fault data send to the maintenance center for repair.

Requirement: 5 The center shall collect environmental sensor operational status.

Requirement: 6 The center shall collect environmental sensor equipment fault data and send to the maintenance center for repair.

Requirement: 7 The center shall exchange data with maintenance centers concerning the reporting of faulty equipment and the schedule/status of their repair. Information exchanged includes details of new equipment faults, and clearances when the faults are cleared.

Requirement: 8 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic maintenance data.

Functional Area: TMC Work Zone Traffic Management

Coordination with maintenance systems using work zone images and traveler information systems (such as DMS), and distribution of work plans so that work zones are established that have minimum traffic impact.

Requirement: 1 The center shall receive work zone images from a maintenance center.

Requirement: 2 The center shall analyze work zone images for indications of a possible incident.

Requirement: 3 The center shall remotely control driver information systems (such as dynamic messages signs, highway advisory radios) to advise drivers of activity around a work zone.

Requirement: 4 The center shall collect operational status for the driver information systems equipment in work zones.

Requirement: 5 The center shall collect fault data for the driver information systems equipment in work zones for repair.

Requirement: 6 The center shall receive proposed maintenance and construction work plans, analyze the activity as a possible incident, and provide work plan feedback to the sending center.

Element: PANYNJ Port Commerce Terminal Access Equipment**Entity: Commercial Vehicle Check**

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ Port Commerce Terminal Access Equipment****Entity: Commercial Vehicle Check****Functional Area: Roadside Electronic Screening**

Roadside check facility equipment to communicate with commercial vehicles at mainline speeds - reading tag data, identification, weight and vehicle characteristics, and credential checking. Determines whether a pull-in message should be generated, allowing for inspectors to override.

- Requirement:* 1 The roadside check facility equipment shall detect the presence of commercial vehicles and freight equipment approaching a facility. Sensors can differentiate between different types of vehicles and determine the number of axles, gross vehicle weight, and the identification of the vehicle and its cargo.
- Requirement:* 2 The roadside check facility equipment shall receive the credential and credentials status information (e.g. snapshots) from the commercial vehicle administration center to maintain an up to date list of which vehicles have been cleared (enrolled) to potentially pass through without stopping.
- Requirement:* 3 The roadside check facility equipment shall receive violation records from appropriate law enforcement agencies pertaining to commercial vehicles.
- Requirement:* 4 The roadside check facility equipment shall provide an interface to inspectors in the field to allow them to monitor and if necessary override the pull-in decisions made by the system.
- Requirement:* 5 The roadside check facility equipment shall request and input electronic screening data from the commercial vehicle's electronic tag data.
- Requirement:* 6 The roadside check facility equipment shall send a pass/pull-in notification to the commercial vehicle and its driver based on the information received from the vehicle, the administration center, enforcement agencies, and the inspector. The message may be sent to the on-board equipment in the commercial vehicle or transmitted to the driver using equipment such as dynamic message signs, red-green lights, flashing signs, etc.
- Requirement:* 7 The roadside check facility equipment shall send a record of daily activities at the facility including summaries of screening events and inspections to the commercial vehicle administration center.

Functional Area: Citation and Accident Electronic Recording

Roadside check facility equipment to records results of roadside inspections and forwards information to the commercial vehicle administration center. Includes accident reports, violations, citations, and the daily site activity data.

- Requirement:* 1 The roadside check facility equipment shall record the results of roadside inspections carried using an inspector's hand held terminal interface.
- Requirement:* 2 The roadside check facility equipment shall provide an interface for an inspector to add comments to the inspection results.
- Requirement:* 3 The roadside check facility equipment shall forward results of the roadside inspections to the commercial vehicle administration center either as needed or on a periodic (e.g. basis). These reports include accident reports, violation notifications, citations, and daily site activity logs.

Element: PANYNJ Port Commerce Traveler Information System**Entity: Information Service Provider****Functional Area: Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

- Requirement:* 1 The center shall collect, process, store, and disseminate customized traffic and highway condition information to travelers, including incident information, detours and road closures, recommended routes, and current speeds on specific routes upon request.
- Requirement:* 2 The center shall collect, process, store, and disseminate customized maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities upon request.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ Port Commerce Traveler Information System****Entity: Information Service Provider****Functional Area: Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

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| <i>Requirement:</i> | 3 | The center shall collect, process, store, and disseminate customized transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers upon request. |
| <i>Requirement:</i> | 4 | The center shall collect, process, store, and disseminate customized parking information to travelers, including location, availability, and fees upon request. |
| <i>Requirement:</i> | 5 | The center shall collect, process, store, and disseminate customized toll fee information to travelers upon request. |
| <i>Requirement:</i> | 6 | The center shall collect, process, store, and disseminate customized weather information to travelers upon request. |
| <i>Requirement:</i> | 7 | The center shall collect, process, store, and disseminate customized multimodal transportation service information (for example, from ferry and airline operators), including transfer points and other information, to travelers upon request. |
| <i>Requirement:</i> | 8 | The center shall collect, process, store, and disseminate customized event information to travelers upon request. |
| <i>Requirement:</i> | 9 | The center shall collect, process, store, and disseminate customized air quality information to travelers upon request. |
| <i>Requirement:</i> | 10 | The center shall provide all traveler information based on the traveler's current location or a specific location identified by the traveler, and filter or customize the provided information accordingly. |
| <i>Requirement:</i> | 11 | The center shall accept traveler profiles for determining the type of personalized data to send to the traveler. |
| <i>Requirement:</i> | 12 | The center shall manage payment for services, such as tolls, transit fares, parking lot charges, map updates, and advanced payment for tolls, and provide transaction success or failure details. |
| <i>Requirement:</i> | 13 | The center shall support requests for traveler information and advanced payment for traveler services from commercial fleet operators. |
| <i>Requirement:</i> | 14 | The center shall provide the capability to exchange information with another traveler information service provider current or predicted data for road links that are outside the area served by the local supplier. |
| <i>Requirement:</i> | 15 | The center shall manage updates of digitized map data and provide updates to traveler interface systems upon request. |
| <i>Requirement:</i> | 16 | The center shall provide the capability to support requests from the media for traffic and incident data. |
| <i>Requirement:</i> | 17 | The center shall provide the capability for a system operator to control the type and update frequency of traveler information. |

Functional Area: Traveler Telephone Information

Collection and distribution of traveler information and wide-area alerts to traveler telephone information systems such as 511, based on voice-based traveler requests.

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| <i>Requirement:</i> | 1 | The center shall provide the capability to process voice-formatted requests for traveler information from a traveler telephone information system, and return the information in the requested format. |
| <i>Requirement:</i> | 2 | The center shall provide the capability to process dual-tone multifrequency (DTMF)-based requests (touch-tone) for traveler information from a traveler telephone information system. |
| <i>Requirement:</i> | 3 | The center shall provide the capability to process traveler information requests from a traveler telephone information system. |

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ Port Commerce Traveler Information System****Entity: Information Service Provider****Functional Area: Traveler Telephone Information**

Collection and distribution of traveler information and wide-area alerts to traveler telephone information systems such as 511, based on voice-based traveler requests.

- Requirement:* 4 The center shall collect and provide information on traffic conditions in the requested voice format and for the requested location.
- Requirement:* 5 The center shall collect and provide work zone and roadway maintenance information in the requested voice format and for the requested location.
- Requirement:* 6 The center shall collect and provide roadway environment conditions information in the requested voice format and for the requested location.
- Requirement:* 7 The center shall collect and provide weather and event information in the requested voice format and for the requested location.
- Requirement:* 8 The center shall collect and provide transit service information in the requested voice format and for the requested location.
- Requirement:* 9 The center shall collect and provide yellow pages services information in the requested voice format and for the requested location.
- Requirement:* 10 The center shall collect and provide current ferry and rail schedule and airport status information in the requested voice format and for the requested location.
- Requirement:* 11 The center shall provide the capability to support both specific caller requests as well as bulk upload of regional traveler information.
- Requirement:* 12 The center shall receive and forward region-specific wide-area alert and advisory information to the traveler telephone information system, including major emergencies such as a natural or man-made disaster, civil emergency, child abductions, severe weather watches and warnings, military activities, and law enforcement warnings.

Element: PANYNJ TB/T Bridges/Tunnels Commercial Vehicle Check**Entity: Commercial Vehicle Check****Functional Area: Roadside WIM**

Roadside check facility equipment to detect and measure the weight commercial vehicles at high speed. Can include an interface to the credential checking or it can be a stand alone package with display.

- Requirement:* 1 The roadside check facility equipment shall detect the presence of commercial vehicles and freight equipment approaching a facility. Sensors can differentiate between different types of vehicles and determine the number of axles, gross vehicle weight, weight per axle, and the identification of the vehicle and its cargo.
- Requirement:* 2 The roadside check facility equipment shall request and input electronic screening data from the commercial vehicle's electronic tag data.
- Requirement:* 3 The roadside check facility equipment shall send a pass/pull-in notification to the commercial vehicle and its driver based on the information received from the vehicle and the measurements taken. The message may be sent to the on-board equipment in the commercial vehicle or transmitted to the driver using equipment such as dynamic message signs, red-green lights, flashing signs, etc.

Element: PANYNJ TB/T Bus Ramp Field Equipment**Entity: Roadway Subsystem****Functional Area: Roadway Basic Surveillance**

Field elements that monitor traffic conditions using loop detectors and CCTV cameras.

- Requirement:* 1 The field element shall collect, process, digitize, and send traffic sensor data (speed, volume, and occupancy) to the center for further analysis and storage, under center control.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ TB/T Bus Ramp Field Equipment****Entity: Roadway Subsystem****Functional Area: Roadway Basic Surveillance**

Field elements that monitor traffic conditions using loop detectors and CCTV cameras.

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| <i>Requirement:</i> | 2 | The field element shall collect, process, and send traffic images to the center for further analysis and distribution. |
| <i>Requirement:</i> | 3 | The field element shall collect, digitize, and send pedestrian sensor data to the center for further analysis and storage. |
| <i>Requirement:</i> | 4 | The field element shall collect, process, and send pedestrian images to the center for further analysis and distribution. |
| <i>Requirement:</i> | 5 | The field element shall collect, digitize, and send multimodal crossing and high occupancy vehicle (HOV) lane sensor data to the center for further analysis and storage. |
| <i>Requirement:</i> | 6 | The field element shall return sensor and CCTV system operational status to the controlling center. |
| <i>Requirement:</i> | 7 | The field element shall return sensor and CCTV system fault data to the controlling center for repair. |

Functional Area: Roadway Freeway Control

Freeway control equipment including ramp meters, mainline metering, and lane control equipment which controls traffic on freeways, including indicators to drivers.

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| <i>Requirement:</i> | 1 | The field element shall include ramp metering controllers, mainline meters, and lane controls for use on freeways, under center control. |
| <i>Requirement:</i> | 2 | The field element shall monitor operation of ramp meter, mainline meters, and lane control indicators and report to the center any instances in which the indicator response does not match that expected from the indicator control information. |
| <i>Requirement:</i> | 3 | The field element shall monitor operation of ramp meter, mainline meters, and lane control indicators and report to the center any instances in which the indicator response does not match that expected from known indicator preemptions. |
| <i>Requirement:</i> | 4 | The field element shall return ramp metering controller, mainline meters, and lane control operational status to the controlling center. |
| <i>Requirement:</i> | 5 | The field element shall return ramp metering controller, mainline meters, and lane control fault data to the maintenance center for repair. |
| <i>Requirement:</i> | 6 | The field element shall provide indications to the driver that a freeway ramp or a lane is available for use, with possible usage data for the freeway lanes they are entering. |

Functional Area: Roadway Equipment Coordination

Field elements that control and send data to other field elements (such as environmental sensors that send data to a DMS or coordination between traffic controllers on adjacent intersections), without center control.

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| <i>Requirement:</i> | 1 | The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that provide data and status information to other field element devices (such as dynamic message signs, ramp meters, traffic signals, work zone intrusion alert systems), without center control. |
| <i>Requirement:</i> | 2 | The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that receive control information from other field element devices, without center control. |
| <i>Requirement:</i> | 3 | The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that provide data and status information to other field element devices (such as dynamic message signs, traffic controllers on adjacent intersections), without center control. |

Architecture

Northern New Jersey ITS Architecture

*Element:***PANYNJ TB/T Bus Ramp Field Equipment**

*Entity:***Roadway Subsystem**

Functional Area: **Roadway Equipment Coordination**

Field elements that control and send data to other field elements (such as environmental sensors that send data to a DMS or coordination between traffic controllers on adjacent intersections), without center control.

- Requirement:* 4 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that receive control information from other field element devices, without center control.
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*Element:***PANYNJ TB/T Bus Terminals/Internal Roads Field Equipment**

*Entity:***Roadway Subsystem**

Functional Area: **Roadway Basic Surveillance**

Field elements that monitor traffic conditions using loop detectors and CCTV cameras.

- Requirement:* 1 The field element shall collect, process, digitize, and send traffic sensor data (speed, volume, and occupancy) to the center for further analysis and storage, under center control.
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- Requirement:* 2 The field element shall collect, process, and send traffic images to the center for further analysis and distribution.
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- Requirement:* 3 The field element shall collect, digitize, and send pedestrian sensor data to the center for further analysis and storage.
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- Requirement:* 4 The field element shall collect, process, and send pedestrian images to the center for further analysis and distribution.
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- Requirement:* 5 The field element shall collect, digitize, and send multimodal crossing and high occupancy vehicle (HOV) lane sensor data to the center for further analysis and storage.
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- Requirement:* 6 The field element shall return sensor and CCTV system operational status to the controlling center.
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- Requirement:* 7 The field element shall return sensor and CCTV system fault data to the controlling center for repair.
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Functional Area: **Roadway Freeway Control**

Freeway control equipment including ramp meters, mainline metering, and lane control equipment which controls traffic on freeways, including indicators to drivers.

- Requirement:* 1 The field element shall include ramp metering controllers, mainline meters, and lane controls for use on freeways, under center control.
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- Requirement:* 2 The field element shall monitor operation of ramp meter, mainline meters, and lane control indicators and report to the center any instances in which the indicator response does not match that expected from the indicator control information.
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- Requirement:* 3 The field element shall monitor operation of ramp meter, mainline meters, and lane control indicators and report to the center any instances in which the indicator response does not match that expected from known indicator preemptions.
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- Requirement:* 4 The field element shall return ramp metering controller, mainline meters, and lane control operational status to the controlling center.
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- Requirement:* 5 The field element shall return ramp metering controller, mainline meters, and lane control fault data to the maintenance center for repair.
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- Requirement:* 6 The field element shall provide indications to the driver that a freeway ramp or a lane is available for use, with possible usage data for the freeway lanes they are entering.
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Functional Area: **Roadway Equipment Coordination**

Field elements that control and send data to other field elements (such as environmental sensors that send data to a DMS or coordination between traffic controllers on adjacent intersections), without center control.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ TB/T Bus Terminals/Internal Roads Field Equipment****Entity: Roadway Subsystem****Functional Area: Roadway Equipment Coordination**

Field elements that control and send data to other field elements (such as environmental sensors that send data to a DMS or coordination between traffic controllers on adjacent intersections), without center control.

- Requirement:* 1 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that provide data and status information to other field element devices (such as dynamic message signs, ramp meters, traffic signals, work zone intrusion alert systems), without center control.
- Requirement:* 2 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that receive control information from other field element devices, without center control.
- Requirement:* 3 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that provide data and status information to other field element devices (such as dynamic message signs, traffic controllers on adjacent intersections), without center control.
- Requirement:* 4 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that receive control information from other field element devices, without center control.

Element: PANYNJ TB/T Bus Terminals/Stations Communications Desk/Operations Center**Entity: Traffic Management****Functional Area: Collect Traffic Surveillance**

Management of traffic sensors and surveillance (CCTV) equipment, and distribution of the collected information to other centers and operators.

- Requirement:* 1 The center shall monitor, analyze, and store traffic sensor data (speed, volume, occupancy) collected from field elements under remote control of the center.
- Requirement:* 2 The center shall monitor, analyze, and distribute traffic images from CCTV systems under remote control of the center.
- Requirement:* 3 The center shall monitor, analyze, and store pedestrian sensor data collected from field elements under remote control of the center.
- Requirement:* 4 The center shall monitor, analyze, and distribute pedestrian images from CCTV systems under remote control of the center.
- Requirement:* 5 The center shall monitor, analyze, and store multimodal crossing and high occupancy vehicle (HOV) lane sensor data under remote control of the center.
- Requirement:* 6 The center shall maintain a database of surveillance and sensors and the freeways, surface street and rural roadways, e.g. where they are located, to which part(s) of the network their data applies, the type of data, and the ownership of each link (that is, the agency or entity responsible for collecting and storing surveillance of the link) in the network.
- Requirement:* 7 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic data.
- Requirement:* 8 The center shall distribute road network conditions data (raw or processed) based on collected and analyzed traffic sensor and surveillance data to other centers.
- Requirement:* 9 The center shall respond to control data from center personnel regarding sensor and surveillance data collection, analysis, storage, and distribution.

Functional Area: TMC Signal Control

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ TB/T Bus Terminals/Stations Communications Desk/Operations Center****Entity: Traffic Management****Functional Area: TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

- Requirement:* 1 The center shall remotely control traffic signal controllers.
- Requirement:* 2 The center shall accept notifications of right-of-way requests from pedestrians.
- Requirement:* 3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center.
- Requirement:* 4 The center shall collect traffic signal controller fault data from the field.
- Requirement:* 5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.

Functional Area: TMC Freeway Management

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

- Requirement:* 1 The center shall remotely control systems to manage use of the freeways, including ramp meters, mainline metering, and lane controls.
- Requirement:* 2 The center shall collect operational status from ramp meters, mainline metering, and lane controls and compare against the control information sent by the center.
- Requirement:* 3 The center shall collect fault data from ramp meters, mainline metering, and lane controls.
- Requirement:* 4 The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, mainline metering, and lane controls), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the ramps themselves.

Functional Area: TMC Traffic Information Dissemination

Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.

- Requirement:* 1 The center shall remotely control dynamic messages signs for dissemination of traffic and other information to drivers.
- Requirement:* 2 The center shall remotely control driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers.
- Requirement:* 3 The center shall collect operational status for the driver information systems equipment (DMS, HAR, etc.).
- Requirement:* 4 The center shall collect fault data for the driver information systems equipment (DMS, HAR, etc.) for repair.
- Requirement:* 5 The center shall retrieve locally stored traffic information, including current and forecasted traffic information, road and weather conditions, traffic incident information, information on diversions and alternate routes, closures, and special traffic restrictions (lane/shoulder use, weight restrictions, width restrictions, HOV requirements), etc.
- Requirement:* 6 The center shall distribute traffic data to maintenance and construction centers, transit centers, emergency management centers, and traveler information providers.
- Requirement:* 7 The center shall distribute traffic data to the media upon request; the capability to provide the information in both data stream and graphical display shall be supported.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ TB/T Bus Terminals/Stations Communications Desk/Operations Center****Entity: Traffic Management****Functional Area: TMC Traffic Information Dissemination**

Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.

- Requirement:* 8 The center shall provide the capability for center personnel to control the nature of the data that is available to non-traffic operations centers and the media.

Functional Area: TMC Regional Traffic Control

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

- Requirement:* 1 The center shall exchange traffic information with other traffic management centers, includes incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.

- Requirement:* 2 The center shall exchange traffic control information with other traffic management centers, includes remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).

Functional Area: TMC Incident Dispatch Coordination/Communication

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

- Requirement:* 1 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction for distribution to the public. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, and information and instructions necessary for the public to respond to the alert. This may also identify specific information that should not be released to the public.

- Requirement:* 2 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.

- Requirement:* 3 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field, provide special routing for emergency vehicles, and to provide responding emergency vehicles with signal preemption.

- Requirement:* 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.

- Requirement:* 5 The center shall respond to requests from emergency management to provide traffic management resources to implement special traffic control measures, assist in clean up, verify an incident, etc. This may also involve coordination with maintenance centers.

- Requirement:* 6 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, media, and rail operations centers.

- Requirement:* 7 The center shall provide road network conditions and traffic images to emergency management centers, maintenance and construction centers, and traveler information service providers.

- Requirement:* 8 The center shall exchange road network status assessment information with emergency management and maintenance centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.

- Requirement:* 9 The center shall coordinate information and controls with other traffic management centers.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ TB/T Bus Terminals/Stations Communications Desk/Operations Center****Entity: Traffic Management****Functional Area: TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

Requirement: 10 The center shall receive inputs from emergency management and transit management centers to develop an overall status of the transportation system including emergency transit schedules in effect and current status and condition of the transportation infrastructure.

Requirement: 11 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic incident management.

Functional Area: TMC Reversible Lane Management

Remotely controls traffic sensors, surveillance, and automated reversible lane equipment and lane control signals to control traffic in reversible lanes.

Requirement: 1 The center shall remotely control devices to detect traffic in reversible lanes, including wrong-way vehicles.

Requirement: 2 The center shall monitor the use of reversible lanes and detect wrong-way vehicles in reversible lanes using sensor and surveillance information, and the current lane control status (which direction the lane is currently operating). This may include identification of wrong-way violators.

Requirement: 3 The center shall remotely control automated reversible lane equipment and driver information systems (such as lane control signals) that control traffic in reversible lanes on surface streets.

Requirement: 4 The center shall remotely control automated reversible lane equipment and driver information systems (such as lane control signals) that control traffic in reversible lanes on freeways.

Requirement: 5 The center shall collect operational status for the reversible lane field equipment.

Requirement: 6 The center shall collect fault data for the reversible lane field equipment and send to the maintenance center for repair.

Requirement: 7 The center shall provide the capability for center personnel to control access and management of reversible lane facilities, including the direction of traffic flow changes during the day, especially between the peak hours and dedication of more lanes to the congestion direction during special events.

Functional Area: Traffic Maintenance

Monitoring and remote diagnostics of field equipment - detect failures, issue problem reports, and track the repair or replacement of the failed equipment.

Requirement: 1 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) operational status.

Requirement: 2 The center shall collect and store CCTV surveillance system (traffic, pedestrian) operational status.

Requirement: 3 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) fault data and send to the maintenance center for repair.

Requirement: 4 The center shall collect and store CCTV surveillance system (traffic, pedestrian) fault data send to the maintenance center for repair.

Requirement: 5 The center shall collect environmental sensor operational status.

Requirement: 6 The center shall collect environmental sensor equipment fault data and send to the maintenance center for repair.

Requirement: 7 The center shall exchange data with maintenance centers concerning the reporting of faulty equipment and the schedule/status of their repair. Information exchanged includes details of new equipment faults, and clearances when the faults are cleared.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ TB/T Bus Terminals/Stations Communications Desk/Operations Center****Entity: Traffic Management****Functional Area: Traffic Maintenance**

Monitoring and remote diagnostics of field equipment - detect failures, issue problem reports, and track the repair or replacement of the failed equipment.

- Requirement:** 8 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic maintenance data.

Functional Area: TMC Multimodal Coordination

Provides traffic signal priority for transit vehicles based on center-to-center communications with the transit management center; also exchange traffic and transit information.

- Requirement:** 1 The center shall respond to requests from transit management centers for signal priority at one or more intersections along a particular transit route.
- Requirement:** 2 The center shall exchange information with transit management centers including details current transit routes, the level of service on each route, and the progress of individual vehicles along their routes.

Entity: Transit Management**Functional Area: Transit Center Multi-Modal Coordination**

Generate requests for transit priority on routes and at certain intersections. Coordinate schedules with other agencies and modes, including transit transfer cluster and transfer point information.

- Requirement:** 1 The center shall analyze transit vehicle schedule performance to determine the need for priority along certain routes or at certain intersections.
- Requirement:** 2 The center shall send requests for priority along routes or at intersections to traffic management.
- Requirement:** 3 The center shall coordinate schedules and services between transit agencies, traffic management, maintenance and construction operations, parking management, and other surface or air transportation modes.
- Requirement:** 4 The center shall share transfer cluster and transfer point information with multimodal transportation service providers, other transit agencies, and traveler information service providers. A transfer cluster is a collection of stops, stations, or terminals where transfers can be made conveniently.

Element: PANYNJ TB/T Bus Terminals/Stations Field Equipment**Entity: Roadway Subsystem****Functional Area: Roadway Basic Surveillance**

Field elements that monitor traffic conditions using loop detectors and CCTV cameras.

- Requirement:** 1 The field element shall collect, process, digitize, and send traffic sensor data (speed, volume, and occupancy) to the center for further analysis and storage, under center control.
- Requirement:** 2 The field element shall collect, process, and send traffic images to the center for further analysis and distribution.
- Requirement:** 3 The field element shall collect, digitize, and send pedestrian sensor data to the center for further analysis and storage.
- Requirement:** 4 The field element shall collect, process, and send pedestrian images to the center for further analysis and distribution.
- Requirement:** 5 The field element shall collect, digitize, and send multimodal crossing and high occupancy vehicle (HOV) lane sensor data to the center for further analysis and storage.
- Requirement:** 6 The field element shall return sensor and CCTV system operational status to the controlling center.
- Requirement:** 7 The field element shall return sensor and CCTV system fault data to the controlling center for repair.

Architecture

Northern New Jersey ITS Architecture

*Element:***PANYNJ TB/T Bus Terminals/Stations Field Equipment**

*Entity:***Roadway Subsystem**

Functional Area: **Roadway Freeway Control**

Freeway control equipment including ramp meters, mainline metering, and lane control equipment which controls traffic on freeways, including indicators to drivers.

- Requirement:* 1 The field element shall include ramp metering controllers, mainline meters, and lane controls for use on freeways, under center control.
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- Requirement:* 2 The field element shall monitor operation of ramp meter, mainline meters, and lane control indicators and report to the center any instances in which the indicator response does not match that expected from the indicator control information.
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- Requirement:* 3 The field element shall monitor operation of ramp meter, mainline meters, and lane control indicators and report to the center any instances in which the indicator response does not match that expected from known indicator preemptions.
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- Requirement:* 4 The field element shall return ramp metering controller, mainline meters, and lane control operational status to the controlling center.
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- Requirement:* 5 The field element shall return ramp metering controller, mainline meters, and lane control fault data to the maintenance center for repair.
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- Requirement:* 6 The field element shall provide indications to the driver that a freeway ramp or a lane is available for use, with possible usage data for the freeway lanes they are entering.
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Functional Area: **Roadway Equipment Coordination**

Field elements that control and send data to other field elements (such as environmental sensors that send data to a DMS or coordination between traffic controllers on adjacent intersections), without center control.

- Requirement:* 1 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that provide data and status information to other field element devices (such as dynamic message signs, ramp meters, traffic signals, work zone intrusion alert systems), without center control.
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- Requirement:* 2 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that receive control information from other field element devices, without center control.
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- Requirement:* 3 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that provide data and status information to other field element devices (such as dynamic message signs, traffic controllers on adjacent intersections), without center control.
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- Requirement:* 4 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that receive control information from other field element devices, without center control.
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*Element:***PANYNJ TB/T Bus Terminals/Stations In-Terminal Customer Information Systems**

*Entity:***Remote Traveler Support**

Functional Area: **Remote Interactive Information Reception**

Public traveler interface, such as a kiosk, that provides traffic, transit, yellow pages, event, and trip planning information, as well as payment services for tolls, parking, and other personalized traveler information services upon request.

- Requirement:* 1 The public interface for travelers shall receive traffic information from a center and present it to the traveler upon request.
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Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ TB/T Bus Terminals/Stations In-Terminal Customer Information Systems****Entity: Remote Traveler Support****Functional Area: Remote Interactive Information Reception**

Public traveler interface, such as a kiosk, that provides traffic, transit, yellow pages, event, and trip planning information, as well as payment services for tolls, parking, and other personalized traveler information services upon request.

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| <i>Requirement:</i> | 2 The public interface for travelers shall receive transit information from a center and present it to the traveler upon request. |
| <i>Requirement:</i> | 3 The public interface for travelers shall receive yellow pages information (such as lodging, restaurants, theaters, bicycle facilities, and other tourist activities) from a center and present it to the traveler upon request. |
| <i>Requirement:</i> | 4 The public interface for travelers shall receive event information from a center and present it to the traveler upon request. |
| <i>Requirement:</i> | 5 The public interface for travelers shall receive evacuation information from a center and present it to the traveler. |
| <i>Requirement:</i> | 6 The public interface for travelers shall receive wide-area alerts and present it to the traveler. |
| <i>Requirement:</i> | 7 The public interface for travelers shall accept reservations for confirmed trip plans. |
| <i>Requirement:</i> | 8 The public interface for travelers shall support payment for services, such as confirmed trip plans, confirmed yellow pages services, tolls, transit fares, parking lot charges, and advanced payment for tolls. |
| <i>Requirement:</i> | 9 The public interface for travelers shall provide an interface through which credit identities and stored credit values may be collected from tags, traveler cards, or payment instruments used by travelers. |
| <i>Requirement:</i> | 10 The public interface for travelers shall base requests from the traveler on the traveler's current location or a specific location identified by the traveler, and filter the provided information accordingly. |
| <i>Requirement:</i> | 11 The public interface for travelers shall provide digitized map data to act as the background to the information presented to the traveler. |
| <i>Requirement:</i> | 12 The public interface for travelers shall support traveler input in audio or manual form. |
| <i>Requirement:</i> | 13 The public interface for travelers shall present information to the traveler in audible or visual forms consistent with a kiosk, including those that are suitable for travelers with hearing or vision physical disabilities. |
| <i>Requirement:</i> | 14 The public interface for travelers shall be able to store frequently requested data. |

Element: PANYNJ TB/T Bus Terminals/Stations Traveler Information System**Entity: Information Service Provider****Functional Area: Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

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| <i>Requirement:</i> | 1 The center shall collect, process, store, and disseminate customized traffic and highway condition information to travelers, including incident information, detours and road closures, recommended routes, and current speeds on specific routes upon request. |
| <i>Requirement:</i> | 2 The center shall collect, process, store, and disseminate customized maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities upon request. |
| <i>Requirement:</i> | 3 The center shall collect, process, store, and disseminate customized transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers upon request. |

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ TB/T Bus Terminals/Stations Traveler Information System****Entity: Information Service Provider****Functional Area: Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

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| <i>Requirement:</i> | 4 The center shall collect, process, store, and disseminate customized parking information to travelers, including location, availability, and fees upon request. |
| <i>Requirement:</i> | 5 The center shall collect, process, store, and disseminate customized toll fee information to travelers upon request. |
| <i>Requirement:</i> | 6 The center shall collect, process, store, and disseminate customized weather information to travelers upon request. |
| <i>Requirement:</i> | 7 The center shall collect, process, store, and disseminate customized multimodal transportation service information (for example, from ferry and airline operators), including transfer points and other information, to travelers upon request. |
| <i>Requirement:</i> | 8 The center shall collect, process, store, and disseminate customized event information to travelers upon request. |
| <i>Requirement:</i> | 9 The center shall collect, process, store, and disseminate customized air quality information to travelers upon request. |
| <i>Requirement:</i> | 10 The center shall provide all traveler information based on the traveler's current location or a specific location identified by the traveler, and filter or customize the provided information accordingly. |
| <i>Requirement:</i> | 11 The center shall accept traveler profiles for determining the type of personalized data to send to the traveler. |
| <i>Requirement:</i> | 12 The center shall manage payment for services, such as tolls, transit fares, parking lot charges, map updates, and advanced payment for tolls, and provide transaction success or failure details. |
| <i>Requirement:</i> | 13 The center shall support requests for traveler information and advanced payment for traveler services from commercial fleet operators. |
| <i>Requirement:</i> | 14 The center shall provide the capability to exchange information with another traveler information service provider current or predicted data for road links that are outside the area served by the local supplier. |
| <i>Requirement:</i> | 15 The center shall manage updates of digitized map data and provide updates to traveler interface systems upon request. |
| <i>Requirement:</i> | 16 The center shall provide the capability to support requests from the media for traffic and incident data. |
| <i>Requirement:</i> | 17 The center shall provide the capability for a system operator to control the type and update frequency of traveler information. |

Functional Area: Traveler Telephone Information

Collection and distribution of traveler information and wide-area alerts to traveler telephone information systems such as 511, based on voice-based traveler requests.

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| <i>Requirement:</i> | 1 The center shall provide the capability to process voice-formatted requests for traveler information from a traveler telephone information system, and return the information in the requested format. |
| <i>Requirement:</i> | 2 The center shall provide the capability to process dual-tone multifrequency (DTMF)-based requests (touch-tone) for traveler information from a traveler telephone information system. |
| <i>Requirement:</i> | 3 The center shall provide the capability to process traveler information requests from a traveler telephone information system. |
| <i>Requirement:</i> | 4 The center shall collect and provide information on traffic conditions in the requested voice format and for the requested location. |

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ TB/T Bus Terminals/Stations Traveler Information System****Entity: Information Service Provider****Functional Area: Traveler Telephone Information**

Collection and distribution of traveler information and wide-area alerts to traveler telephone information systems such as 511, based on voice-based traveler requests.

- Requirement:* 5 The center shall collect and provide work zone and roadway maintenance information in the requested voice format and for the requested location.
- Requirement:* 6 The center shall collect and provide roadway environment conditions information in the requested voice format and for the requested location.
- Requirement:* 7 The center shall collect and provide weather and event information in the requested voice format and for the requested location.
- Requirement:* 8 The center shall collect and provide transit service information in the requested voice format and for the requested location.
- Requirement:* 9 The center shall collect and provide yellow pages services information in the requested voice format and for the requested location.
- Requirement:* 10 The center shall collect and provide current ferry and rail schedule and airport status information in the requested voice format and for the requested location.
- Requirement:* 11 The center shall provide the capability to support both specific caller requests as well as bulk upload of regional traveler information.
- Requirement:* 12 The center shall receive and forward region-specific wide-area alert and advisory information to the traveler telephone information system, including major emergencies such as a natural or man-made disaster, civil emergency, child abductions, severe weather watches and warnings, military activities, and law enforcement warnings.

Element: PANYNJ TB/T Infrastructure Security Equipment**Entity: Security Monitoring Subsystem****Functional Area: Field Secure Area Surveillance**

Security surveillance devices (audio/video) that monitor facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, and transit railways or guideways).

- Requirement:* 1 The field element shall include video and/or audio surveillance of secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways).

Functional Area: Field Secure Area Sensor Monitoring

Security sensors monitoring facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, and transit railways or guideways) for environmental threats, intrusion and motion, object detection, and infrastructure integrity.

- Requirement:* 1 The field element shall include security sensors that monitor conditions of secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways).

Functional Area: Field Secure Area Surveillance

Security surveillance devices (audio/video) that monitor facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, and transit railways or guideways).

- Requirement:* 2 The field element shall be remotely controlled by a center.

Functional Area: Field Secure Area Sensor Monitoring

Security sensors monitoring facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, and transit railways or guideways) for environmental threats, intrusion and motion, object detection, and infrastructure integrity.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ TB/T Infrastructure Security Equipment****Entity: Security Monitoring Subsystem****Functional Area: Field Secure Area Sensor Monitoring**

Security sensors monitoring facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, and transit railways or guideways) for environmental threats, intrusion and motion, object detection, and infrastructure integrity.

Requirement: 2 The field element shall be remotely controlled by a center.

Functional Area: Field Secure Area Surveillance

Security surveillance devices (audio/video) that monitor facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, and transit railways or guideways).

Requirement: 3 The field element shall provide equipment status and fault indication of surveillance equipment to a center.

Functional Area: Field Secure Area Sensor Monitoring

Security sensors monitoring facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, and transit railways or guideways) for environmental threats, intrusion and motion, object detection, and infrastructure integrity.

Requirement: 3 The field element shall provide equipment status and fault indication of security sensor equipment to a center.

Functional Area: Field Secure Area Surveillance

Security surveillance devices (audio/video) that monitor facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, and transit railways or guideways).

Requirement: 4 The field element shall provide raw video or audio data.

Functional Area: Field Secure Area Sensor Monitoring

Security sensors monitoring facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, and transit railways or guideways) for environmental threats, intrusion and motion, object detection, and infrastructure integrity.

Requirement: 4 The field element shall include environmental threat sensors (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological).

Functional Area: Field Secure Area Surveillance

Security surveillance devices (audio/video) that monitor facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, and transit railways or guideways).

Requirement: 5 The field element shall remotely process video and audio data and provide an indication of potential incidents or threats to a center.

Functional Area: Field Secure Area Sensor Monitoring

Security sensors monitoring facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, and transit railways or guideways) for environmental threats, intrusion and motion, object detection, and infrastructure integrity.

Requirement: 5 The field element shall include infrastructure condition and integrity monitoring sensors.

Requirement: 6 The field element shall include motion and intrusion detection sensors.

Requirement: 7 The field element shall include object detection sensors (such as metal detectors).

Requirement: 8 The field element shall provide raw security sensor data.

Requirement: 9 The field element shall remotely process security sensor data and provide an indication of potential incidents or threats to a center.

Element: PANYNJ TB/T Maintenance Unit

Architecture**Northern New Jersey ITS Architecture***Element:***PANYNJ TB/T Maintenance Unit***Entity:***Maintenance and Construction Management***Functional Area:* **MCM Vehicle Tracking**

Remotely tracks the location of maintenance and construction vehicles and other equipment; presented to the center personnel.

Requirement: 1 The center shall monitor the locations of all maintenance and construction vehicles and other equipment under its jurisdiction.

Requirement: 2 The center shall present location data to center personnel for the fleet of maintenance and construction vehicles and other equipment.

Requirement: 3 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for maintenance and construction vehicle tracking.

Functional Area: **MCM Incident Management**

Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.

Requirement: 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.

Requirement: 2 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, etc.

Requirement: 3 The center shall exchange incident and threat information with emergency management centers as well as traffic management centers; including notification of existence of incident and expected severity, location, time and nature of incident.

Requirement: 4 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.

Requirement: 5 The center shall respond to requests from emergency management to provide maintenance and construction resources to implement response plans, assist in clean up, verify an incident, etc. This may also involve coordination with traffic management centers and other maintenance centers.

Requirement: 6 The center shall exchange road network status assessment information with emergency management and traffic management centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.

Requirement: 7 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

Requirement: 8 The center shall receive information indicating the damage sustained by transportation assets, derived from aerial surveillance, field reports, inspections, tests, and analyses to support incident management.

Functional Area: **MCM Maintenance Decision Support**

Maintenance Decision Support Systems recommend courses of action based on current and forecast environmental and road conditions (filtered and fused for specific time horizons) and additional application specific information. Recommendations and dispatch instructions are generated based on this integrated information.

Architecture**Northern New Jersey ITS Architecture***Element:***PANYNJ TB/T Maintenance Unit***Entity:***Maintenance and Construction Management***Functional Area:* **MCM Maintenance Decision Support**

Maintenance Decision Support Systems recommend courses of action based on current and forecast environmental and road conditions (filtered and fused for specific time horizons) and additional application specific information. Recommendations and dispatch instructions are generated based on this integrated information.

- Requirement:* 1 The center shall provide the center personnel with tailored external information, including weather or road condition observations, forecasted weather information or road conditions, current usage of treatments and materials, available resources, equipment and vehicle availability, road network information, and source reliability information.
- Requirement:* 2 The center shall tailor the decision support information to include filtering (selection from a large amount of external information), error reduction ('smoothing' the information), fusion (combination of disparate information to match the decision needs), and analysis (creating the decision).
- Requirement:* 3 The center shall provide an interface to the center personnel to input control parameters for the decision support process and receive decisions or information presentation.
- Requirement:* 4 The center shall provide dispatch information to maintenance and construction vehicles based on the outputs of the decision support system, including recommended roadway treatment actions.

Functional Area: **MCM Winter Maintenance Management**

Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.

- Requirement:* 1 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other winter roadway maintenance.
- Requirement:* 2 The center shall exchange information with administrative systems to support the planning and scheduling of winter maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
- Requirement:* 3 The center shall provide status information about scheduled winter maintenance activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, and the media.
- Requirement:* 4 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of winter maintenance activities.
- Requirement:* 5 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of winter maintenance activities.
- Requirement:* 6 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
- Requirement:* 7 The center shall dispatch and route winter maintenance vehicle drivers and support them with route-specific environmental, incident, advisory, threat, alert, and traffic congestion information.
- Requirement:* 8 The center shall determine the need for roadway treatment based on current and forecasted weather information, current usage of treatments and materials, available resources, requests for action from other agencies, and recommendations from the Maintenance Decision Support system, specifically under winter conditions. This supports winter maintenance such as plowing, treating, anti-icing, etc.

Architecture**Northern New Jersey ITS Architecture***Element:***PANYNJ TB/T Maintenance Unit***Entity:***Maintenance and Construction Management***Functional Area:* **MCM Winter Maintenance Management**

Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.

- Requirement:* 9 The center shall provide dispatch instructions for vehicle operators based on input parameters from center personnel, specifically for winter conditions. This could include a treatment route, treatment application rates, start and end times, and other treatment instructions.
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- Requirement:* 10 The center shall support remote control of on-board maintenance and construction vehicle systems and field equipment that is remotely controlled by the vehicle such as adjusting material application rates and spread patterns.
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- Requirement:* 11 The center shall assess the current status of all winter maintenance activities, including actual work activities performed, current locations and operational conditions of vehicles, materials and equipment inventories, field equipment status, environmental information, etc.

Functional Area: **MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

- Requirement:* 1 The center shall maintain an interface with asset management systems to track the inventory, restrictions, repair needs and status updates of transportation assets (pavement, bridges, signs, etc.) including location, installation and materials information, vendor/contractor, current maintenance status, standard height, width, and weight restrictions.
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- Requirement:* 2 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other roadway maintenance.
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- Requirement:* 3 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
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- Requirement:* 4 The center shall provide emergency management and traffic management centers with information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.
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- Requirement:* 5 The center shall collect the status and fault data from roadside equipment, such as traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
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- Requirement:* 6 The center shall collect the status and fault data from traffic management centers, including data for traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
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- Requirement:* 7 The center shall remotely control and collect data from infrastructure monitoring sensors located along the roadway infrastructure or on maintenance and construction vehicles.
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- Requirement:* 8 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of roadway maintenance and construction activities.
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- Requirement:* 9 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of roadway maintenance and construction activities.

Architecture

Northern New Jersey ITS Architecture

*Element:***PANYNJ TB/T Maintenance Unit**

*Entity:***Maintenance and Construction Management**

Functional Area: **MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

- Requirement:* 10 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
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- Requirement:* 11 The center shall dispatch and route maintenance and construction vehicle drivers and support them with route- specific environmental, incident, advisory, threat, alert, and traffic congestion information.
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- Requirement:* 12 The center shall manage an interface with center personnel to accept vehicle systems control information and remotely control maintenance and construction vehicle on-board equipment.
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- Requirement:* 13 The center shall track the status of roadway maintenance and construction activities by monitoring collected data from the dispatched vehicles and equipment.
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Functional Area: **MCM Work Zone Management**

Remotely monitors and supports work zone activities, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).

- Requirement:* 1 The center shall generate new work zone activity schedules for use by maintenance and construction vehicles, maintenance and construction operators, and for information coordination purposes.
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- Requirement:* 2 The center shall control the collection of work zone status information including video images from cameras located in or near the work zone.
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- Requirement:* 3 The center shall disseminate work zone information to other agencies and centers including traffic, transit, emergency management centers, other maintenance centers, traveler information providers, and the media.
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- Requirement:* 4 The center shall control traffic in work zones by providing remote control of dynamic message signs and highway advisory radio systems located in or near the work zone.
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- Requirement:* 5 The center shall exchange information with administrative systems to support the planning and scheduling of work zone activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
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*Element:***PANYNJ TB/T Maintenance Vehicles**

*Entity:***Maintenance and Construction Vehicle**

Functional Area: **MCV Vehicle Location Tracking**

On-board systems to track vehicle location and reports the position and timestamp information to the dispatch center.

- Requirement:* 1 The maintenance and construction vehicle shall compute the location of the vehicle based on inputs from a vehicle location determination function.
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- Requirement:* 2 The maintenance and construction vehicle shall send the timestamped vehicle location to the controlling center.
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*Element:***PANYNJ TB/T Tunnels/Bridges Communications Desk/Operations Center**

*Entity:***Emergency Management**

Functional Area: **Emergency Call-Taking**

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ TB/T Tunnels/Bridges Communications Desk/Operations Center****Entity: Emergency Management****Functional Area: Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

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| <i>Requirement:</i> | 1 The center shall support the interface to the Emergency Telecommunications System (e.g. 911 or 7-digit call routing) to receive emergency notification information and provide it to the emergency system operator. |
| <i>Requirement:</i> | 2 The center shall receive emergency call information from 911 services and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 3 The center shall receive emergency call information from motorist call-boxes and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 4 The center shall receive emergency call information from mayday service providers and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 5 The center shall receive emergency notification information from other public safety agencies and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 6 The center shall receive emergency notification information from public transit systems and present the possible incident information to the emergency system operator. |
| <i>Requirement:</i> | 7 The center shall receive emergency notification information from commercial vehicles, commercial vehicle check stations, or commercial fleet operators and present the possible incident information to the emergency system operator. This may include detection of non-permitted transport of security sensitive hazmat, hazardous cargo spills, etc. |
| <i>Requirement:</i> | 8 The center shall receive details of the cargo being carried by commercial vehicles from their commercial fleet manager for incidents involving potential hazardous materials. |
| <i>Requirement:</i> | 9 The center shall coordinate, correlate, and verify all emergency inputs, including those identified based on external calls and internal analysis of security sensor and surveillance data, and assign each a level of confidence. |
| <i>Requirement:</i> | 10 The center shall send a request for remote control of CCTV systems from a traffic management center in order to verify the reported incident. |
| <i>Requirement:</i> | 11 The center shall update the incident information log once the emergency system operator has verified the incident. |
| <i>Requirement:</i> | 12 The center shall provide the capability for digitized map data to act as the background to the emergency information presented to the emergency system operator. |
| <i>Requirement:</i> | 13 The center shall forward the verified emergency information to the responding agency based on the location and nature of the emergency. |

Functional Area: Emergency Response Management

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

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| <i>Requirement:</i> | 1 The center shall provide strategic emergency response capabilities such as that of an Emergency Operations Center for large-scale incidents and disasters. |
| <i>Requirement:</i> | 2 The center shall manage coordinated inter-agency responses to and recovery from large-scale emergencies. Such agencies include traffic management, transit, maintenance and construction management, rail operations, and other emergency management agencies. |
| <i>Requirement:</i> | 3 The center shall provide the capability to implement response plans and track progress through the incident by exchanging incident information and distributing response status to allied agencies. |

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ TB/T Tunnels/Bridges Communications Desk/Operations Center****Entity: Emergency Management****Functional Area: Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

- Requirement:* 4 The center shall develop, coordinate with other agencies, and store emergency response plans.
- Requirement:* 5 The center shall track the availability of resources (including vehicles, roadway cleanup?, etc.), request additional resources from traffic, maintenance, or other emergency centers if needed.
- Requirement:* 6 The center shall allocate the appropriate emergency services, resources, and vehicle (s) to respond to incidents, and shall provide the capability to override the current allocation to suit the special needs of a current incident.
- Requirement:* 7 The center shall receive event scheduling information from Event Promoters.
- Requirement:* 8 The center shall receive hazardous materials incident information from commercial fleet operators.
- Requirement:* 9 The center shall provide the capability to request the safe disabling of a commercial vehicle during a hazardous materials incident.
- Requirement:* 10 The center shall provide the capability to request transit resource availability from transit centers for use during disaster and evacuation operations.
- Requirement:* 11 The center shall assimilate the status of the transit, traffic, rail, maintenance, and other emergency center services and systems to create an overall transportation system status, and disseminate to each of these centers and the traveling public via traveler information providers.
- Requirement:* 12 The center shall provide information to the media concerning the status of an emergency response.
- Requirement:* 13 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.
- Requirement:* 14 The center shall provide the capability for center personnel to provide inputs to the management of incidents, disasters and evacuations.

Functional Area: Incident Command

Tactical decision support, resource coordination, and communications integration among emergency management agencies for Incident Commands that are established by first responders to support local management of an incident.

- Requirement:* 1 The center shall provide tactical decision support, resource coordination, and communications integration for Incident Commands that are established by first responders to support local management of an incident.
- Requirement:* 2 The center shall provide incident command communications with public safety, emergency management, transportation, and other allied response agency centers.
- Requirement:* 3 The center shall track and maintain resource information and action plans pertaining to the incident command.
- Requirement:* 4 The center shall share incident command information with other public safety agencies including resource deployment status, hazardous material information, rail incident information, evacuation advice as well as traffic, road, and weather conditions.
- Requirement:* 5 The center shall assess the status of responding emergency vehicles as part of an incident command.

Functional Area: Emergency Environmental Monitoring

Current and forecast road and weather information assimilated from weather service providers and emergency vehicles equipped with environmental sensors; used by the operator to more effectively manage incidents.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ TB/T Tunnels/Bridges Communications Desk/Operations Center****Entity: Emergency Management****Functional Area: Emergency Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and emergency vehicles equipped with environmental sensors; used by the operator to more effectively manage incidents.

- Requirement:* 1 The center shall collect current and forecast road and weather information from weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
- Requirement:* 2 The center shall receive environmental probe information from its fleet of emergency vehicles.
- Requirement:* 3 The center shall collect current road and weather information from roadway maintenance operations.
- Requirement:* 4 The center shall assimilate current and forecast road conditions and surface weather information to support incident management.
- Requirement:* 5 The center shall present the current and forecast road and weather information to the emergency system operator.
- Requirement:* 6 The center shall provide aggregated or processed environmental probe information from its fleet of emergency vehicles to traffic management and maintenance centers.

Functional Area: Center Secure Area Surveillance

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 1 The center shall remotely monitor video images and audio surveillance data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The data may be raw or pre-processed in the field.
- Requirement:* 2 The center shall remotely monitor video images and audio surveillance data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The data may be raw or pre-processed in the field.
- Requirement:* 3 The center shall remotely monitor video images and audio surveillance data collected on-board transit vehicles. The data may be raw or pre-processed in the field.
- Requirement:* 4 The center shall exchange surveillance data with other emergency centers.
- Requirement:* 5 The center shall identify potential security threats based on collected security surveillance data.
- Requirement:* 6 The center shall verify potential security threats by correlating security surveillance data from multiple sources.
- Requirement:* 7 The center shall remotely control security surveillance devices in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways).
- Requirement:* 8 The center shall remotely control security surveillance devices in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers).
- Requirement:* 9 The center shall remotely control security surveillance devices on-board transit vehicles.
- Requirement:* 10 The center shall match traveler video images against a database from the Alerting and Advisory Systems of known images that may represent criminals and terrorists.
- Requirement:* 11 The center shall exchange traveler images with other emergency management centers to support traveler image matching.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ TB/T Tunnels/Bridges Communications Desk/Operations Center****Entity: Emergency Management****Functional Area: Center Secure Area Surveillance**

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:** 12 The center shall respond to control data from center personnel regarding security surveillance data collection, processing, threat detection, and image matching.

Functional Area: Center Secure Area Sensor Management

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:** 1 The center shall remotely monitor and control security sensor data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), infrastructure condition and integrity, intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.

- Requirement:** 2 The center shall remotely monitor and control security sensor data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.

- Requirement:** 3 The center shall remotely monitor and control security sensor data collected on-board transit vehicles. The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors) and object detection sensors. The data may be raw or pre-processed in the field.

- Requirement:** 4 The center shall exchange security sensor data with other emergency centers.

- Requirement:** 5 The center shall identify potential security threats based on collected security sensor data.

- Requirement:** 6 The center shall verify potential security threats by correlating security sensor data from multiple sources.

- Requirement:** 7 The center shall perform threat analysis based on correlations of security sensor and surveillance data.

- Requirement:** 8 The center shall exchange threat analysis data with Alerting and Advisory Systems and use that data in local threat analysis processing.

- Requirement:** 9 The center shall disseminate threat information to other agencies, including traffic, transit, maintenance, rail operations, and other emergency management centers.

- Requirement:** 10 The center shall respond to control data from center personnel regarding security sensor data collection, processing, threat detection, and threat analysis.

Functional Area: Mayday Support

Collection and response to Mayday messages received from vehicles and drivers.

- Requirement:** 1 The center shall collect mayday messages from vehicles and drivers.

- Requirement:** 2 The center shall collect mayday messages from travelers via personal handheld devices.

- Requirement:** 3 The center shall acknowledge the request for emergency assistance, whether originated by the driver, automatically by the vehicle's safety systems, or by a traveler via a personal handheld device.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ TB/T Tunnels/Bridges Communications Desk/Operations Center****Entity: Emergency Management****Functional Area: Mayday Support**

Collection and response to Mayday messages received from vehicles and drivers.

- Requirement:* 4 After the mayday becomes a verified incident, the center shall determine the appropriate response to the mayday message.
- Requirement:* 5 The center shall determine whether the mayday message indicates an emergency that requires the attention of public safety agencies, and forward mayday emergency data to the appropriate agency as necessary.
- Requirement:* 6 The center shall support the activation of remote controlled functions requested by a vehicle, such as requests to unlock doors.
- Requirement:* 7 The center shall request additional emergency details from or issue commands to the vehicle's security systems or vehicle driver if needed.
- Requirement:* 8 The center shall maintain a log of all mayday signals received from vehicles.
- Requirement:* 9 The center shall provide all mayday data to center personnel and respond to the vehicle, driver, or traveler using the portable handheld device as directed by the personnel.

Entity: Maintenance and Construction Management**Functional Area: MCM Environmental Information Processing**

Processes current and forecast weather data, road condition information, local environmental data, and uses internal models to develop specialized detailed forecasts of local weather and surface conditions. Disseminates road weather information to other agencies and centers.

- Requirement:* 1 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.
- Requirement:* 2 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services) and local environmental sensor data.
- Requirement:* 3 The center shall use the various data inputs of environmental sensors and road weather data to develop a view of current and predicted road weather and road conditions.
- Requirement:* 4 The center shall disseminate current and forecasted road weather and road condition information to weather service providers (such as the National Weather Service and value-added sector specific meteorological services) as well as other agencies including traffic, emergency, and transit management, traveler information providers, rail operations centers, media, and other maintenance management centers.
- Requirement:* 5 The center shall provide value-added sector specific meteorological services with information on basic road facility and treatment information that supports forecasts for road conditions.

Functional Area: MCM Incident Management

Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.

- Requirement:* 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.
- Requirement:* 2 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, etc.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ TB/T Tunnels/Bridges Communications Desk/Operations Center****Entity: Maintenance and Construction Management****Functional Area: MCM Incident Management**

Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.

- Requirement:* 3 The center shall exchange incident and threat information with emergency management centers as well as traffic management centers; including notification of existence of incident and expected severity, location, time and nature of incident.
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- Requirement:* 4 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.
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- Requirement:* 5 The center shall respond to requests from emergency management to provide maintenance and construction resources to implement response plans, assist in clean up, verify an incident, etc. This may also involve coordination with traffic management centers and other maintenance centers.
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- Requirement:* 6 The center shall exchange road network status assessment information with emergency management and traffic management centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.
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- Requirement:* 7 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.
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- Requirement:* 8 The center shall receive information indicating the damage sustained by transportation assets, derived from aerial surveillance, field reports, inspections, tests, and analyses to support incident management.

Functional Area: MCM Maintenance Decision Support

Maintenance Decision Support Systems recommend courses of action based on current and forecast environmental and road conditions (filtered and fused for specific time horizons) and additional application specific information. Recommendations and dispatch instructions are generated based on this integrated information.

- Requirement:* 1 The center shall provide the center personnel with tailored external information, including weather or road condition observations, forecasted weather information or road conditions, current usage of treatments and materials, available resources, equipment and vehicle availability, road network information, and source reliability information.
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- Requirement:* 2 The center shall tailor the decision support information to include filtering (selection from a large amount of external information), error reduction ('smoothing' the information), fusion (combination of disparate information to match the decision needs), and analysis (creating the decision).
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- Requirement:* 3 The center shall provide an interface to the center personnel to input control parameters for the decision support process and receive decisions or information presentation.
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- Requirement:* 4 The center shall provide dispatch information to maintenance and construction vehicles based on the outputs of the decision support system, including recommended roadway treatment actions.

Functional Area: MCM Winter Maintenance Management

Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.

- Requirement:* 1 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other winter roadway maintenance.

Architecture

Northern New Jersey ITS Architecture

Element: **PANYNJ TB/T Tunnels/Bridges Communications Desk/Operations Center**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Winter Maintenance Management**

Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.

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| <i>Requirement:</i> | 2 The center shall exchange information with administrative systems to support the planning and scheduling of winter maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration. |
| <i>Requirement:</i> | 3 The center shall provide status information about scheduled winter maintenance activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, and the media. |
| <i>Requirement:</i> | 4 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of winter maintenance activities. |
| <i>Requirement:</i> | 5 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of winter maintenance activities. |
| <i>Requirement:</i> | 6 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services). |
| <i>Requirement:</i> | 7 The center shall dispatch and route winter maintenance vehicle drivers and support them with route-specific environmental, incident, advisory, threat, alert, and traffic congestion information. |
| <i>Requirement:</i> | 8 The center shall determine the need for roadway treatment based on current and forecasted weather information, current usage of treatments and materials, available resources, requests for action from other agencies, and recommendations from the Maintenance Decision Support system, specifically under winter conditions. This supports winter maintenance such as plowing, treating, anti-icing, etc. |
| <i>Requirement:</i> | 9 The center shall provide dispatch instructions for vehicle operators based on input parameters from center personnel, specifically for winter conditions. This could include a treatment route, treatment application rates, start and end times, and other treatment instructions. |
| <i>Requirement:</i> | 10 The center shall support remote control of on-board maintenance and construction vehicle systems and field equipment that is remotely controlled by the vehicle such as adjusting material application rates and spread patterns. |
| <i>Requirement:</i> | 11 The center shall assess the current status of all winter maintenance activities, including actual work activities performed, current locations and operational conditions of vehicles, materials and equipment inventories, field equipment status, environmental information, etc. |
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Functional Area: **MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

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| <i>Requirement:</i> | 1 The center shall maintain an interface with asset management systems to track the inventory, restrictions, repair needs and status updates of transportation assets (pavement, bridges, signs, etc.) including location, installation and materials information, vendor/contractor, current maintenance status, standard height, width, and weight restrictions. |
| <i>Requirement:</i> | 2 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other roadway maintenance. |
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Architecture

Northern New Jersey ITS Architecture

Element: **PANYNJ TB/T Tunnels/Bridges Communications Desk/Operations Center**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

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| <i>Requirement:</i> | 3 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration. |
| <i>Requirement:</i> | 4 The center shall provide emergency management and traffic management centers with information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. |
| <i>Requirement:</i> | 5 The center shall collect the status and fault data from roadside equipment, such as traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs. |
| <i>Requirement:</i> | 6 The center shall collect the status and fault data from traffic management centers, including data for traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs. |
| <i>Requirement:</i> | 7 The center shall remotely control and collect data from infrastructure monitoring sensors located along the roadway infrastructure or on maintenance and construction vehicles. |
| <i>Requirement:</i> | 8 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of roadway maintenance and construction activities. |
| <i>Requirement:</i> | 9 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of roadway maintenance and construction activities. |
| <i>Requirement:</i> | 10 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services). |
| <i>Requirement:</i> | 11 The center shall dispatch and route maintenance and construction vehicle drivers and support them with route- specific environmental, incident, advisory, threat, alert, and traffic congestion information. |
| <i>Requirement:</i> | 12 The center shall manage an interface with center personnel to accept vehicle systems control information and remotely control maintenance and construction vehicle on-board equipment. |
| <i>Requirement:</i> | 13 The center shall track the status of roadway maintenance and construction activities by monitoring collected data from the dispatched vehicles and equipment. |
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Functional Area: **MCM Work Zone Management**

Remotely monitors and supports work zone activities, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).

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| <i>Requirement:</i> | 1 The center shall generate new work zone activity schedules for use by maintenance and construction vehicles, maintenance and construction operators, and for information coordination purposes. |
| <i>Requirement:</i> | 2 The center shall control the collection of work zone status information including video images from cameras located in or near the work zone. |
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Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ TB/T Tunnels/Bridges Communications Desk/Operations Center****Entity: Maintenance and Construction Management****Functional Area: MCM Work Zone Management**

Remotely monitors and supports work zone activities, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).

Requirement: 3 The center shall disseminate work zone information to other agencies and centers including traffic, transit, emergency management centers, other maintenance centers, traveler information providers, and the media.

Requirement: 4 The center shall control traffic in work zones by providing remote control of dynamic message signs and highway advisory radio systems located in or near the work zone.

Requirement: 5 The center shall exchange information with administrative systems to support the planning and scheduling of work zone activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.

Functional Area: MCM Work Activity Coordination

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

Requirement: 1 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

Requirement: 2 The center shall provide status information about scheduled maintenance and construction activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, multimodal transportation providers, rail operations, and the media.

Requirement: 3 The center shall collect and respond to feedback concerning scheduled maintenance and construction activities with other management centers such as traffic, emergency, transit, and rail operations.

Requirement: 4 The center shall collect and disseminate asset restriction information levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.

Requirement: 5 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance and construction activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.

Requirement: 6 The center shall exchange rail schedules and work plans with rail operations centers.

Entity: Traffic Management**Functional Area: Collect Traffic Surveillance**

Management of traffic sensors and surveillance (CCTV) equipment, and distribution of the collected information to other centers and operators.

Requirement: 1 The center shall monitor, analyze, and store traffic sensor data (speed, volume, occupancy) collected from field elements under remote control of the center.

Requirement: 2 The center shall monitor, analyze, and distribute traffic images from CCTV systems under remote control of the center.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ TB/T Tunnels/Bridges Communications Desk/Operations Center****Entity: Traffic Management****Functional Area: Collect Traffic Surveillance**

Management of traffic sensors and surveillance (CCTV) equipment, and distribution of the collected information to other centers and operators.

- Requirement:* 3 The center shall monitor, analyze, and store pedestrian sensor data collected from field elements under remote control of the center.
- Requirement:* 4 The center shall monitor, analyze, and distribute pedestrian images from CCTV systems under remote control of the center.
- Requirement:* 5 The center shall monitor, analyze, and store multimodal crossing and high occupancy vehicle (HOV) lane sensor data under remote control of the center.
- Requirement:* 6 The center shall maintain a database of surveillance and sensors and the freeways, surface street and rural roadways, e.g. where they are located, to which part(s) of the network their data applies, the type of data, and the ownership of each link (that is, the agency or entity responsible for collecting and storing surveillance of the link) in the network.
- Requirement:* 7 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic data.
- Requirement:* 8 The center shall distribute road network conditions data (raw or processed) based on collected and analyzed traffic sensor and surveillance data to other centers.
- Requirement:* 9 The center shall respond to control data from center personnel regarding sensor and surveillance data collection, analysis, storage, and distribution.

Functional Area: TMC Signal Control

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

- Requirement:* 1 The center shall remotely control traffic signal controllers.
- Requirement:* 2 The center shall accept notifications of right-of-way requests from pedestrians.
- Requirement:* 3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center.
- Requirement:* 4 The center shall collect traffic signal controller fault data from the field.
- Requirement:* 5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.

Functional Area: TMC Freeway Management

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

- Requirement:* 1 The center shall remotely control systems to manage use of the freeways, including ramp meters, mainline metering, and lane controls.
- Requirement:* 2 The center shall collect operational status from ramp meters, mainline metering, and lane controls and compare against the control information sent by the center.
- Requirement:* 3 The center shall collect fault data from ramp meters, mainline metering, and lane controls.
- Requirement:* 4 The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, mainline metering, and lane controls), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the ramps themselves.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ TB/T Tunnels/Bridges Communications Desk/Operations Center****Entity: Traffic Management****Functional Area: TMC HOV Lane Management**

Remotely controls high-occupancy vehicle (HOV) lane sensors, driver information systems, and ramp meters to manage use of HOV or High Occupancy Toll (HOT) lanes; also detects HOV violators and notifies enforcement agencies.

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| <i>Requirement:</i> | 1 The center shall remotely control sensors to detect high-occupancy vehicle (HOV) lane usage. |
| <i>Requirement:</i> | 2 The center shall remotely control driver information systems to notify users of lane status for lanes that become HOV or High Occupancy Toll (HOT) lanes during certain times of the day on freeways. |
| <i>Requirement:</i> | 3 The center shall remotely control freeway control devices, such as ramp signals and mainline metering and other systems associated with freeway operations that control use of HOV lanes. |
| <i>Requirement:</i> | 4 The center shall collect traffic flow measures and information regarding vehicle occupancy (i.e., lane usage) in HOV lanes. |
| <i>Requirement:</i> | 5 The center shall monitor the use of HOV lanes and detect vehicles that do not have the required number of occupants. |
| <i>Requirement:</i> | 6 The center shall collect operational status for the freeway control devices associated with HOV lane control. |
| <i>Requirement:</i> | 7 The center shall collect fault data for the freeway control devices associated with HOV lane control for repair. |
| <i>Requirement:</i> | 8 The center shall store violation parameters, detect HOV lane violators, obtain the vehicle registration data from the appropriate State Department of Motor Vehicles (DMV) office, and then provide the capability to send violation information to a law enforcement agency. |

Functional Area: TMC Traffic Information Dissemination

Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.

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| <i>Requirement:</i> | 1 The center shall remotely control dynamic messages signs for dissemination of traffic and other information to drivers. |
| <i>Requirement:</i> | 2 The center shall remotely control driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers. |
| <i>Requirement:</i> | 3 The center shall collect operational status for the driver information systems equipment (DMS, HAR, etc.). |
| <i>Requirement:</i> | 4 The center shall collect fault data for the driver information systems equipment (DMS, HAR, etc.) for repair. |
| <i>Requirement:</i> | 5 The center shall retrieve locally stored traffic information, including current and forecasted traffic information, road and weather conditions, traffic incident information, information on diversions and alternate routes, closures, and special traffic restrictions (lane/shoulder use, weight restrictions, width restrictions, HOV requirements), etc. |
| <i>Requirement:</i> | 6 The center shall distribute traffic data to maintenance and construction centers, transit centers, emergency management centers, and traveler information providers. |
| <i>Requirement:</i> | 7 The center shall distribute traffic data to the media upon request; the capability to provide the information in both data stream and graphical display shall be supported. |
| <i>Requirement:</i> | 8 The center shall provide the capability for center personnel to control the nature of the data that is available to non-traffic operations centers and the media. |

Functional Area: TMC Regional Traffic Control

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ TB/T Tunnels/Bridges Communications Desk/Operations Center****Entity: Traffic Management****Functional Area: TMC Regional Traffic Control**

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

- Requirement:* 1 The center shall exchange traffic information with other traffic management centers, includes incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.
- Requirement:* 2 The center shall exchange traffic control information with other traffic management centers, includes remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).

Functional Area: TMC Incident Detection

Remotely controls traffic and video sensors to support incident detection and verification; exchange information with other agencies including emergency management, maintenance and construction, alerting and advisory systems, event promoters, intermodal freight depots, and traveler information systems.

- Requirement:* 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.
- Requirement:* 2 The center shall collect and store traffic flow and image data from the field equipment to detect and verify incidents.
- Requirement:* 3 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, and intermodal freight depots.
- Requirement:* 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.
- Requirement:* 5 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field.
- Requirement:* 6 The center shall provide road network conditions and traffic images to emergency management centers to support the detection, verification, and classification of incidents.
- Requirement:* 7 The center shall provide video and traffic sensor control commands to the field equipment to detect and verify incidents.

Functional Area: TMC Incident Dispatch Coordination/Communication

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

- Requirement:* 1 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction for distribution to the public. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, and information and instructions necessary for the public to respond to the alert. This may also identify specific information that should not be released to the public.
- Requirement:* 2 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.
- Requirement:* 3 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field, provide special routing for emergency vehicles, and to provide responding emergency vehicles with signal preemption.

Architecture

Northern New Jersey ITS Architecture

Element: **PANYNJ TB/T Tunnels/Bridges Communications Desk/Operations Center**

Entity: **Traffic Management**

Functional Area: **TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

- Requirement:* 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.
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- Requirement:* 5 The center shall respond to requests from emergency management to provide traffic management resources to implement special traffic control measures, assist in clean up, verify an incident, etc. This may also involve coordination with maintenance centers.
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- Requirement:* 6 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, media, and rail operations centers.
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- Requirement:* 7 The center shall provide road network conditions and traffic images to emergency management centers, maintenance and construction centers, and traveler information service providers.
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- Requirement:* 8 The center shall exchange road network status assessment information with emergency management and maintenance centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.
-
- Requirement:* 9 The center shall coordinate information and controls with other traffic management centers.
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- Requirement:* 10 The center shall receive inputs from emergency management and transit management centers to develop an overall status of the transportation system including emergency transit schedules in effect and current status and condition of the transportation infrastructure.
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- Requirement:* 11 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic incident management.
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Functional Area: **TMC Environmental Monitoring**

Management of environmental sensors and assimilation of collected data with other current and forecast road conditions and surface weather information from weather service providers and roadway maintenance operations.

- Requirement:* 1 The center shall remotely control environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures.
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- Requirement:* 2 The center shall remotely control environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.
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- Requirement:* 3 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services), data from roadway maintenance operations, and environmental data collected from sensors deployed on and about the roadway.
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- Requirement:* 4 The center shall provide weather and road condition information to weather service providers and center personnel.
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- Requirement:* 5 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.
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Functional Area: **TMC Reversible Lane Management**

Remotely controls traffic sensors, surveillance, and automated reversible lane equipment and lane control signals to control traffic in reversible lanes.

Architecture

Northern New Jersey ITS Architecture

Element: **PANYNJ TB/T Tunnels/Bridges Communications Desk/Operations Center**

Entity: **Traffic Management**

Functional Area: **TMC Reversible Lane Management**

 Remotely controls traffic sensors, surveillance, and automated reversible lane equipment and lane control signals to control traffic in reversible lanes.

Requirement: 1 The center shall remotely control devices to detect traffic in reversible lanes, including wrong-way vehicles.

Requirement: 2 The center shall monitor the use of reversible lanes and detect wrong-way vehicles in reversible lanes using sensor and surveillance information, and the current lane control status (which direction the lane is currently operating). This may include identification of wrong-way violators.

Requirement: 3 The center shall remotely control automated reversible lane equipment and driver information systems (such as lane control signals) that control traffic in reversible lanes on surface streets.

Requirement: 4 The center shall remotely control automated reversible lane equipment and driver information systems (such as lane control signals) that control traffic in reversible lanes on freeways.

Requirement: 5 The center shall collect operational status for the reversible lane field equipment.

Requirement: 6 The center shall collect fault data for the reversible lane field equipment and send to the maintenance center for repair.

Requirement: 7 The center shall provide the capability for center personnel to control access and management of reversible lane facilities, including the direction of traffic flow changes during the day, especially between the peak hours and dedication of more lanes to the congestion direction during special events.

Functional Area: **Barrier System Management**

 Remotely controls barrier systems such as gates and other systems that manage entry to roadways, transportation facilities and infrastructure.

Requirement: 1 The center shall remotely control barrier systems for transportation facilities and infrastructure. Barrier systems include automated or remotely controlled gates, barriers and other systems that manage entry to roadways.

Requirement: 2 The center shall collect barrier system operational status.

Requirement: 3 The center shall collect barrier system fault data and send to the maintenance center for repair.

Requirement: 4 The center shall accept requests for barrier system activation from other centers and from center personnel to support emergency response and detours.

Functional Area: **Safeguard System Management**

 Remotely controls safeguard systems such as blast shields and tunnel exhaust systems that are used to mitigate the impact of incidents on transportation infrastructure.

Requirement: 1 The center shall remotely control safeguard systems, equipment used to mitigate the impact of incidents on transportation infrastructure (e.g., blast shields, tunnel exhaust systems, etc.)

Requirement: 2 The center shall collect safeguard system operational status.

Requirement: 3 The center shall collect safeguard system fault data and send to the maintenance center for repair.

Requirement: 4 The center shall accept requests for safeguard system activation from other centers and from center personnel to support emergency response.

Functional Area: **Traffic Maintenance**

 Monitoring and remote diagnostics of field equipment - detect failures, issue problem reports, and track the repair or replacement of the failed equipment.

Requirement: 1 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) operational status.

Requirement: 2 The center shall collect and store CCTV surveillance system (traffic, pedestrian) operational status.

Architecture

Northern New Jersey ITS Architecture

*Element:***PANYNJ TB/T Tunnels/Bridges Communications Desk/Operations Center**

*Entity:***Traffic Management**

Functional Area: **Traffic Maintenance**

Monitoring and remote diagnostics of field equipment - detect failures, issue problem reports, and track the repair or replacement of the failed equipment.

- Requirement:* 3 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) fault data and send to the maintenance center for repair.
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- Requirement:* 4 The center shall collect and store CCTV surveillance system (traffic, pedestrian) fault data send to the maintenance center for repair.
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- Requirement:* 5 The center shall collect environmental sensor operational status.
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- Requirement:* 6 The center shall collect environmental sensor equipment fault data and send to the maintenance center for repair.
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- Requirement:* 7 The center shall exchange data with maintenance centers concerning the reporting of faulty equipment and the schedule/status of their repair. Information exchanged includes details of new equipment faults, and clearances when the faults are cleared.
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- Requirement:* 8 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic maintenance data.
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Functional Area: **TMC Work Zone Traffic Management**

Coordination with maintenance systems using work zone images and traveler information systems (such as DMS), and distribution of work plans so that work zones are established that have minimum traffic impact.

- Requirement:* 1 The center shall receive work zone images from a maintenance center.
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- Requirement:* 2 The center shall analyze work zone images for indications of a possible incident.
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- Requirement:* 3 The center shall remotely control driver information systems (such as dynamic messages signs, highway advisory radios) to advise drivers of activity around a work zone.
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- Requirement:* 4 The center shall collect operational status for the driver information systems equipment in work zones.
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- Requirement:* 5 The center shall collect fault data for the driver information systems equipment in work zones for repair.
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- Requirement:* 6 The center shall receive proposed maintenance and construction work plans, analyze the activity as a possible incident, and provide work plan feedback to the sending center.
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*Element:***PANYNJ TB/T Tunnels/Bridges Emergency Response Vehicles**

*Entity:***Emergency Vehicle Subsystem**

Functional Area: **On-board EV Incident Management Communication**

On-board systems providing the direct interface between the emergency vehicle and incident management personnel at the incident site.

- Requirement:* 1 The emergency vehicle shall receive dispatch instructions sufficient to enable emergency personnel in the field to implement an effective incident response. It includes local traffic, road, and weather conditions, hazardous material information, and the current status of resources that have been allocated to an incident.
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- Requirement:* 2 The emergency vehicle shall provide an interface to the center for emergency personnel to transmit information about the incident site such as the extent of injuries, identification of vehicles and people involved, hazardous material, etc.
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- Requirement:* 3 The emergency vehicle shall provide an interface to the center for emergency personnel to transmit information about the current incident response status such as the identification of the resources on site, site management strategies in effect, and current clearance status.
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Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ TB/T Tunnels/Bridges Field Equipment****Entity: Roadway Subsystem****Functional Area: Roadway Basic Surveillance**

Field elements that monitor traffic conditions using loop detectors and CCTV cameras.

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| <i>Requirement:</i> | 1 The field element shall collect, process, digitize, and send traffic sensor data (speed, volume, and occupancy) to the center for further analysis and storage, under center control. |
| <i>Requirement:</i> | 2 The field element shall collect, process, and send traffic images to the center for further analysis and distribution. |
| <i>Requirement:</i> | 3 The field element shall collect, digitize, and send pedestrian sensor data to the center for further analysis and storage. |
| <i>Requirement:</i> | 4 The field element shall collect, process, and send pedestrian images to the center for further analysis and distribution. |
| <i>Requirement:</i> | 5 The field element shall collect, digitize, and send multimodal crossing and high occupancy vehicle (HOV) lane sensor data to the center for further analysis and storage. |
| <i>Requirement:</i> | 6 The field element shall return sensor and CCTV system operational status to the controlling center. |
| <i>Requirement:</i> | 7 The field element shall return sensor and CCTV system fault data to the controlling center for repair. |

Functional Area: Roadway Freeway Control

Freeway control equipment including ramp meters, mainline metering, and lane control equipment which controls traffic on freeways, including indicators to drivers.

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| <i>Requirement:</i> | 1 The field element shall include ramp metering controllers, mainline meters, and lane controls for use on freeways, under center control. |
| <i>Requirement:</i> | 2 The field element shall monitor operation of ramp meter, mainline meters, and lane control indicators and report to the center any instances in which the indicator response does not match that expected from the indicator control information. |
| <i>Requirement:</i> | 3 The field element shall monitor operation of ramp meter, mainline meters, and lane control indicators and report to the center any instances in which the indicator response does not match that expected from known indicator preemptions. |
| <i>Requirement:</i> | 4 The field element shall return ramp metering controller, mainline meters, and lane control operational status to the controlling center. |
| <i>Requirement:</i> | 5 The field element shall return ramp metering controller, mainline meters, and lane control fault data to the maintenance center for repair. |
| <i>Requirement:</i> | 6 The field element shall provide indications to the driver that a freeway ramp or a lane is available for use, with possible usage data for the freeway lanes they are entering. |

Functional Area: Roadway HOV Control

HOV lane usage traffic sensors and display equipment to notify users of HOV lane status for control of traffic in HOV lanes on freeways.

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| <i>Requirement:</i> | 1 The field element shall include sensors to detect high-occupancy vehicle (HOV) lane usage, under center control. |
| <i>Requirement:</i> | 2 The field element shall include driver information systems to notify users of lane status for lanes that become HOV or High Occupancy Toll (HOT) lanes during certain times of the day on freeways, under center control. |
| <i>Requirement:</i> | 3 The field element shall include freeway control devices, such as ramp signals and mainline metering and other systems associated with freeway operations that control use of HOV lanes, under center control. |

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ TB/T Tunnels/Bridges Field Equipment****Entity: Roadway Subsystem****Functional Area: Roadway HOV Control**

HOV lane usage traffic sensors and display equipment to notify users of HOV lane status for control of traffic in HOV lanes on freeways.

Requirement: 4 The field element shall provide traffic flow measures and information regarding vehicle occupancy (i.e., lane usage) in HOV lanes to the center.

Requirement: 5 The field element shall return operational status for the HOV lane sensors to the controlling center.

Requirement: 6 The field element shall return fault data for the HOV lane sensors to the center for repair.

Functional Area: Roadway Traffic Information Dissemination

Driver information systems, such as dynamic message signs and Highway Advisory Radio (HAR).

Requirement: 1 The field element shall include dynamic messages signs for dissemination of traffic and other information to drivers, under center control; the DMS may be either those that display variable text messages, or those that have fixed format display(s) (e.g. vehicle restrictions, or lane open/close).

Requirement: 2 The field element shall include driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers, under center control.

Requirement: 3 The field element shall include pedestrian information systems under center control (e.g. warning pedestrians of a potential hazard, or providing mandatory instructions as to the availability of pedestrian access).

Requirement: 4 The field element shall provide operational status for the driver information systems equipment (DMS, HAR, etc.) to the center.

Requirement: 5 The field element shall provide fault data for the driver information systems equipment (DMS, HAR, etc.) to the center for repair.

Functional Area: Roadway Equipment Coordination

Field elements that control and send data to other field elements (such as environmental sensors that send data to a DMS or coordination between traffic controllers on adjacent intersections), without center control.

Requirement: 1 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that provide data and status information to other field element devices (such as dynamic message signs, ramp meters, traffic signals, work zone intrusion alert systems), without center control.

Requirement: 2 The field element shall include sensors (such as traffic, environmental, and work zone intrusion detection sensors) that receive control information from other field element devices, without center control.

Requirement: 3 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that provide data and status information to other field element devices (such as dynamic message signs, traffic controllers on adjacent intersections), without center control.

Requirement: 4 The field element shall include devices (such as arterial or freeway controllers, roadway automated treatment systems, barrier and safeguard systems, emissions or pollution systems, and work zone intrusion alert systems) that receive control information from other field element devices, without center control.

Functional Area: Roadway Reversible Lanes

Traffic sensors, surveillance, and automated reversible lane equipment and lane control signals to control traffic in reversible lanes.

Requirement: 1 The field element shall monitor traffic in reversible lanes, including wrong-way vehicles, using sensors and surveillance equipment under center control.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ TB/T Tunnels/Bridges Field Equipment****Entity: Roadway Subsystem****Functional Area: Roadway Reversible Lanes**

Traffic sensors, surveillance, and automated reversible lane equipment and lane control signals to control traffic in reversible lanes.

- Requirement:* 2 The field element shall include automated reversible lane equipment and driver information systems (such as lane control signals) that control traffic in reversible lanes on surface streets, under center control.
- Requirement:* 3 The field element shall include automated reversible lane equipment and driver information systems (such as lane control signals) that control traffic in reversible lanes on freeways, under center control.
- Requirement:* 4 The field element shall provide operational status for the reversible lane field equipment to the center.
- Requirement:* 5 The field element shall provide fault data for the reversible lane field equipment to the center.

Element: PANYNJ TB/T Tunnels/Bridges Traveler Information System**Entity: Information Service Provider****Functional Area: Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

- Requirement:* 1 The center shall collect, process, store, and disseminate customized traffic and highway condition information to travelers, including incident information, detours and road closures, recommended routes, and current speeds on specific routes upon request.
- Requirement:* 2 The center shall collect, process, store, and disseminate customized maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities upon request.
- Requirement:* 3 The center shall collect, process, store, and disseminate customized transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers upon request.
- Requirement:* 4 The center shall collect, process, store, and disseminate customized parking information to travelers, including location, availability, and fees upon request.
- Requirement:* 5 The center shall collect, process, store, and disseminate customized toll fee information to travelers upon request.
- Requirement:* 6 The center shall collect, process, store, and disseminate customized weather information to travelers upon request.
- Requirement:* 7 The center shall collect, process, store, and disseminate customized multimodal transportation service information (for example, from ferry and airline operators), including transfer points and other information, to travelers upon request.
- Requirement:* 8 The center shall collect, process, store, and disseminate customized event information to travelers upon request.
- Requirement:* 9 The center shall collect, process, store, and disseminate customized air quality information to travelers upon request.
- Requirement:* 10 The center shall provide all traveler information based on the traveler's current location or a specific location identified by the traveler, and filter or customize the provided information accordingly.
- Requirement:* 11 The center shall accept traveler profiles for determining the type of personalized data to send to the traveler.
- Requirement:* 12 The center shall manage payment for services, such as tolls, transit fares, parking lot charges, map updates, and advanced payment for tolls, and provide transaction success or failure details.

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ TB/T Tunnels/Bridges Traveler Information System****Entity: Information Service Provider****Functional Area: Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

- Requirement:* 13 The center shall support requests for traveler information and advanced payment for traveler services from commercial fleet operators.
- Requirement:* 14 The center shall provide the capability to exchange information with another traveler information service provider current or predicted data for road links that are outside the area served by the local supplier.
- Requirement:* 15 The center shall manage updates of digitized map data and provide updates to traveler interface systems upon request.
- Requirement:* 16 The center shall provide the capability to support requests from the media for traffic and incident data.
- Requirement:* 17 The center shall provide the capability for a system operator to control the type and update frequency of traveler information.

Functional Area: Traveler Telephone Information

Collection and distribution of traveler information and wide-area alerts to traveler telephone information systems such as 511, based on voice-based traveler requests.

- Requirement:* 1 The center shall provide the capability to process voice-formatted requests for traveler information from a traveler telephone information system, and return the information in the requested format.
- Requirement:* 2 The center shall provide the capability to process dual-tone multifrequency (DTMF)-based requests (touch-tone) for traveler information from a traveler telephone information system.
- Requirement:* 3 The center shall provide the capability to process traveler information requests from a traveler telephone information system.
- Requirement:* 4 The center shall collect and provide information on traffic conditions in the requested voice format and for the requested location.
- Requirement:* 5 The center shall collect and provide work zone and roadway maintenance information in the requested voice format and for the requested location.
- Requirement:* 6 The center shall collect and provide roadway environment conditions information in the requested voice format and for the requested location.
- Requirement:* 7 The center shall collect and provide weather and event information in the requested voice format and for the requested location.
- Requirement:* 8 The center shall collect and provide transit service information in the requested voice format and for the requested location.
- Requirement:* 9 The center shall collect and provide yellow pages services information in the requested voice format and for the requested location.
- Requirement:* 10 The center shall collect and provide current ferry and rail schedule and airport status information in the requested voice format and for the requested location.
- Requirement:* 11 The center shall provide the capability to support both specific caller requests as well as bulk upload of regional traveler information.
- Requirement:* 12 The center shall receive and forward region-specific wide-area alert and advisory information to the traveler telephone information system, including major emergencies such as a natural or man-made disaster, civil emergency, child abductions, severe weather watches and warnings, military activities, and law enforcement warnings.

Element: PANYNJ Traveler Information Systems

Architecture**Northern New Jersey ITS Architecture****Element: PANYNJ Traveler Information Systems****Entity: Information Service Provider****Functional Area: Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

- Requirement:* 1 The center shall collect, process, store, and disseminate customized traffic and highway condition information to travelers, including incident information, detours and road closures, recommended routes, and current speeds on specific routes upon request.
- Requirement:* 2 The center shall collect, process, store, and disseminate customized maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities upon request.
- Requirement:* 3 The center shall collect, process, store, and disseminate customized transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers upon request.
- Requirement:* 4 The center shall collect, process, store, and disseminate customized parking information to travelers, including location, availability, and fees upon request.
- Requirement:* 5 The center shall collect, process, store, and disseminate customized toll fee information to travelers upon request.
- Requirement:* 6 The center shall collect, process, store, and disseminate customized weather information to travelers upon request.
- Requirement:* 7 The center shall collect, process, store, and disseminate customized multimodal transportation service information (for example, from ferry and airline operators), including transfer points and other information, to travelers upon request.
- Requirement:* 8 The center shall collect, process, store, and disseminate customized event information to travelers upon request.
- Requirement:* 9 The center shall collect, process, store, and disseminate customized air quality information to travelers upon request.
- Requirement:* 10 The center shall provide all traveler information based on the traveler's current location or a specific location identified by the traveler, and filter or customize the provided information accordingly.
- Requirement:* 11 The center shall accept traveler profiles for determining the type of personalized data to send to the traveler.
- Requirement:* 12 The center shall manage payment for services, such as tolls, transit fares, parking lot charges, map updates, and advanced payment for tolls, and provide transaction success or failure details.
- Requirement:* 13 The center shall support requests for traveler information and advanced payment for traveler services from commercial fleet operators.
- Requirement:* 14 The center shall provide the capability to exchange information with another traveler information service provider current or predicted data for road links that are outside the area served by the local supplier.
- Requirement:* 15 The center shall manage updates of digitized map data and provide updates to traveler interface systems upon request.
- Requirement:* 16 The center shall provide the capability to support requests from the media for traffic and incident data.
- Requirement:* 17 The center shall provide the capability for a system operator to control the type and update frequency of traveler information.

Functional Area: Traveler Telephone Information

Collection and distribution of traveler information and wide-area alerts to traveler telephone information systems such as 511, based on voice-based traveler requests.

Architecture

Northern New Jersey ITS Architecture

*Element:***PANYNJ Traveler Information Systems**

*Entity:***Information Service Provider**

Functional Area: **Traveler Telephone Information**

Collection and distribution of traveler information and wide-area alerts to traveler telephone information systems such as 511, based on voice-based traveler requests.

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| <i>Requirement:</i> | 1 The center shall provide the capability to process voice-formatted requests for traveler information from a traveler telephone information system, and return the information in the requested format. |
| <i>Requirement:</i> | 2 The center shall provide the capability to process dual-tone multifrequency (DTMF)-based requests (touch-tone) for traveler information from a traveler telephone information system. |
| <i>Requirement:</i> | 3 The center shall provide the capability to process traveler information requests from a traveler telephone information system. |
| <i>Requirement:</i> | 4 The center shall collect and provide information on traffic conditions in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 5 The center shall collect and provide work zone and roadway maintenance information in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 6 The center shall collect and provide roadway environment conditions information in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 7 The center shall collect and provide weather and event information in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 8 The center shall collect and provide transit service information in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 9 The center shall collect and provide yellow pages services information in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 10 The center shall collect and provide current ferry and rail schedule and airport status information in the requested voice format and for the requested location. |
| <i>Requirement:</i> | 11 The center shall provide the capability to support both specific caller requests as well as bulk upload of regional traveler information. |
| <i>Requirement:</i> | 12 The center shall receive and forward region-specific wide-area alert and advisory information to the traveler telephone information system, including major emergencies such as a natural or man-made disaster, civil emergency, child abductions, severe weather watches and warnings, military activities, and law enforcement warnings. |
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*Element:***Parking Facility Operators**

*Entity:***Parking Management**

Functional Area: **Parking Surveillance**

Field elements that detect and classify vehicles entering and exiting a parking facility.

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| <i>Requirement:</i> | 1 The parking element shall provide the capability to detect and classify vehicles entering and exiting a parking facility (vehicle size, type, identifiable features, etc.). |
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Functional Area: **Parking Management**

Maintain and distribute parking lot information including static (spaces, hours, charges, etc.) and dynamic (availability, open/closed, etc.) data. Interface to traffic, transit, and traveler information providers.

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| <i>Requirement:</i> | 1 The parking element shall maintain parking lot information including static information such as hours of operation, rates, location, entrance locations, capacity, type, and constraints; as well as dynamic information such as current state of the lot, occupancy, arrival rates, and departure rates. |
| <i>Requirement:</i> | 2 The parking element shall distribute parking lot information upon request to traffic management centers, transit management centers for park and ride facilities, and to traveler information providers. |
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Architecture**Northern New Jersey ITS Architecture****Element: Parking Facility Operators****Entity: Parking Management****Functional Area: Parking Management**

Maintain and distribute parking lot information including static (spaces, hours, charges, etc.) and dynamic (availability, open/closed, etc.) data. Interface to traffic, transit, and traveler information providers.

Requirement: 3 The parking element manage local dynamic message signs that display messages to travelers such as the parking lot state, number of spaces available, location of entrances, and current charges.

Requirement: 4 The parking element shall support requests for parking reservations.

Functional Area: Parking Electronic Payment

Parking payment collection using in-vehicle equipment (tags) or contact or proximity traveler cards used for electronic payment. Includes field elements and back-office functionality.

Requirement: 1 The parking element shall detect and classify vehicles entering and exiting a parking facility (vehicle size, type, identifiable features, etc.).

Requirement: 2 The parking element shall read data from the traveler card / payment instrument carried on-board the vehicle (tag) or by the traveler.

Requirement: 3 The parking element shall provide an interface to the driver informing them of the success or failure of the financial transaction. This may involve a request for the driver to pull aside so the operator can resolve an issue.

Requirement: 4 The parking element shall collect data on payment violations and send the data, including images of the violator and the vehicle registration data obtained from the Department of Motor Vehicles (DMV) office, to the appropriate enforcement agency.

Requirement: 5 The parking element shall manage the parking lot charges, considering such factors as location, vehicle types, and times of day.

Requirement: 6 The parking element shall process the financial requests and manage an interface to a Financial Institution.

Requirement: 7 The parking element shall support the payment of parking lot transactions using data provided by the traveler cards / payment instruments.

Requirement: 8 The parking element shall process requests for parking lot charges to be paid in advance.

Requirement: 9 The parking element shall process requests for the advanced payment of tolls and transit fares as well as other non-transportation services, e.g. yellow-pages services.

Requirement: 10 The parking element shall maintain a list of invalid traveler credit identities, or bad tag lists.

Functional Area: Parking Data Collection

Collection and storage of parking management information. For use by operations personnel or data archives in the region.

Requirement: 1 The parking element shall collect parking management data including lot usage and charging information.

Requirement: 2 The parking element shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

Requirement: 3 The parking element shall receive and respond to requests from ITS Archives for either a catalog of the parking management data or for the data itself.

Requirement: 4 The parking element shall be able to produce sample products of the data available.

Element: PennDOT District 4 TOC**Entity: Traffic Management**

Architecture

Northern New Jersey ITS Architecture

*Element:***PennDOT District 4 TOC**

*Entity:***Traffic Management**

Functional Area: **TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

Requirement: 1 The center shall remotely control traffic signal controllers.

Requirement: 2 The center shall accept notifications of right-of-way requests from pedestrians.

Requirement: 3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center.

Requirement: 4 The center shall collect traffic signal controller fault data from the field.

Requirement: 5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.

Functional Area: **TMC Freeway Management**

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

Requirement: 1 The center shall remotely control systems to manage use of the freeways, including ramp meters, mainline metering, and lane controls.

Requirement: 2 The center shall collect operational status from ramp meters, mainline metering, and lane controls and compare against the control information sent by the center.

Requirement: 3 The center shall collect fault data from ramp meters, mainline metering, and lane controls.

Requirement: 4 The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, mainline metering, and lane controls), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the ramps themselves.

Functional Area: **TMC Regional Traffic Control**

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

Requirement: 1 The center shall exchange traffic information with other traffic management centers, includes incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.

Requirement: 2 The center shall exchange traffic control information with other traffic management centers, includes remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).

*Element:***PennDOT District 5 TOC**

*Entity:***Traffic Management**

Functional Area: **TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

Requirement: 1 The center shall remotely control traffic signal controllers.

Requirement: 2 The center shall accept notifications of right-of-way requests from pedestrians.

Architecture

Northern New Jersey ITS Architecture

*Element:***PennDOT District 5 TOC**

*Entity:***Traffic Management**

Functional Area: **TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

Requirement: 3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center.

Requirement: 4 The center shall collect traffic signal controller fault data from the field.

Requirement: 5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.

Functional Area: **TMC Freeway Management**

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

Requirement: 1 The center shall remotely control systems to manage use of the freeways, including ramp meters, mainline metering, and lane controls.

Requirement: 2 The center shall collect operational status from ramp meters, mainline metering, and lane controls and compare against the control information sent by the center.

Requirement: 3 The center shall collect fault data from ramp meters, mainline metering, and lane controls.

Requirement: 4 The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, mainline metering, and lane controls), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the ramps themselves.

Functional Area: **TMC Regional Traffic Control**

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

Requirement: 1 The center shall exchange traffic information with other traffic management centers, includes incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.

Requirement: 2 The center shall exchange traffic control information with other traffic management centers, includes remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).

*Element:***Private Commercial and Fleet Vehicles**

*Entity:***Commercial Vehicle Subsystem**

Functional Area: **On-board Trip Monitoring**

On-board systems to provide automatic vehicle location and automated mileage and fuel reporting and auditing. In addition, monitors the planned route and notifies the fleet and freight management center of any deviations.

Requirement: 1 The commercial vehicle shall compute the location of the commercial vehicle and its freight equipment based on inputs from commercial vehicle measures (e.g. identity, distance traveled, etc.) and a vehicle location determination function.

Requirement: 2 The commercial vehicle shall provide details of the route input from the commercial vehicle fleet management center.

Requirement: 3 The commercial vehicle shall provide warnings to the driver and the commercial vehicle fleet management center when the vehicle's location has deviated from its planned route.

Architecture**Northern New Jersey ITS Architecture****Element: Private Commercial and Fleet Vehicles****Entity: Commercial Vehicle Subsystem****Functional Area: On-board Trip Monitoring**

On-board systems to provide automatic vehicle location and automated mileage and fuel reporting and auditing. In addition, monitors the planned route and notifies the fleet and freight management center of any deviations.

- Requirement:* 4 The commercial vehicle shall maintain the driver's daily log, vehicle location, mileage, and trip activity (includes screening, inspection and border clearance event data as well as fare payments) and distribute it to the driver and to the commercial vehicle fleet management center upon request.
- Requirement:* 5 The commercial vehicle shall provide on-board vehicle data to the commercial vehicle fleet management center upon request - includes location, credentials, driver license citations, fuel purchase data, identity details, inspection data, log data, service records, safety systems diagnostics, and freight equipment data.
- Requirement:* 6 The commercial vehicle shall maintain the interface between the vehicle, its driver, and the commercial vehicle fleet management center for dispatch, routing, and special instructions as well as payment, and enrollment information.

Functional Area: On-board Cargo Monitoring

On-board systems monitoring the location and status of the commercial vehicle and its cargo. Sends the data on to appropriate centers and roadside facilities, including emergency management in the case of HAZMAT incidents.

- Requirement:* 1 The commercial vehicle shall compute the location of the commercial vehicle and its freight equipment based on inputs from a vehicle location determination function.
- Requirement:* 2 The commercial vehicle shall monitor on-board systems and record measures such as weight, vehicle security status, vehicle safety status, vehicle identity, driver status, driver safety status, distance traveled, and brake condition.
- Requirement:* 3 The commercial vehicle shall monitor information concerning the freight equipment including cargo type, HAZMAT designation (if any) for the cargo, cargo weight, the type of container in which the cargo is held, safety condition of the cargo, etc.
- Requirement:* 4 The commercial vehicle shall forward information concerning the freight equipment on to its fleet and freight management center as well as the roadside check facility.
- Requirement:* 5 The commercial vehicle shall send notification of a hazmat spill to appropriate emergency management center in case of an incident including the information from cargo sensors, vehicle location, and the carrier identification.

Functional Area: On-board CV Electronic Data

On-board systems exchanging information between the vehicle and the roadside facility with the information such as status of driver, vehicle, carrier IDs and cargo information identified via an electronic tag. Actual weight from roadside mainline weigh-in-motion may be checked.

- Requirement:* 1 The commercial vehicle shall receive pass/pull-in messages from the roadside check facilities and present them to the driver in either audible or visual forms.
- Requirement:* 2 The commercial vehicle shall respond to requests to provide data accumulated on-board the vehicle to roadside check facilities for inspection including driver logs, electronic identifiers, credentials, border clearance data, and other screening data such as cargo status, hazmat identifiers, out of service status, vehicle axle weight, vehicle weight, and time.
- Requirement:* 3 The commercial vehicle shall respond to requests to provide the identity, status and other information from the electronic cargo lock tag, if so equipped, to roadside check facilities, including border crossings.
- Requirement:* 4 The commercial vehicle shall support an interface to a commercial vehicle driver that is also acting in the role of a commercial vehicle fleet manager to set up routes, pay necessary taxes, obtain proper credentials, and write the identifiers to the electronic tag for the driver, vehicle, and carrier.

Architecture**Northern New Jersey ITS Architecture***Element:* **Private Commercial and Fleet Vehicles***Entity:* **Commercial Vehicle Subsystem***Functional Area:* **On-board Driver Authentication**

On-board systems to identify and authenticate commercial vehicle drivers based on inputs from the controlling center. Supports ability to safely disable the vehicle if an unauthorized access is detected.

- Requirement:* 1 The commercial vehicle shall receive and store driver assignments and associated driver identity characteristic keys from the commercial vehicle fleet management center.
- Requirement:* 2 The commercial vehicle shall detect when an unauthorized commercial vehicle driver attempts to drive their vehicle based on stored driver identity information; passing the information on to the commercial vehicle fleet management center.
- Requirement:* 3 The commercial vehicle shall activate commands to safely disable the commercial vehicle when an unauthorized driver is detected; either in a stand-alone fashion or in response to inputs from the commercial vehicle fleet management center.

Entity: **Vehicle***Functional Area:* **Basic Vehicle Reception**

Provides drivers basic transportation information including formatted traffic advisories, event, and other traveler information as well as broadcast alerts.

- Requirement:* 1 The vehicle shall receive formatted traffic information from a center and present it to the driver.
- Requirement:* 2 The vehicle shall receive transit information from a center and present it to the driver.
- Requirement:* 3 The vehicle shall receive event information from a center and present it to the driver.
- Requirement:* 4 The vehicle shall receive evacuation information from a center and present it to the driver.
- Requirement:* 5 The vehicle shall receive wide-area alerts and present it to the driver.
- Requirement:* 6 The vehicle shall provide data from the vehicle itself to the driver. This vehicle data may include vehicle conditions, environmental conditions, safety or position warnings.
- Requirement:* 7 The vehicle shall prioritize safety and warning messages to supersede advisory and broadcast messages.
- Requirement:* 8 The vehicle shall support driver input in audio or manual form.
- Requirement:* 9 The vehicle shall present information to the driver in audible or visual forms without impairing the driver's ability to control the vehicle in a safe manner.

Functional Area: **Vehicle Provider-Based Route Guidance**

In-vehicle system that coordinates with a traveler information center to provide a suggested route plan that is tailored to the driver's preferences. During the trip the route plan can be modified to account for new information.

- Requirement:* 1 The vehicle shall provide the capability for a driver to request and confirm multi-modal route guidance from a specified source to a destination.
- Requirement:* 2 The vehicle shall forward the request for route guidance to a traveler information center for route calculation.
- Requirement:* 3 The vehicle shall forward user preferences, background information, constraints, and payment information to the supplying traveler information center.
- Requirement:* 4 The vehicle shall present information to the driver in audible or visual forms without impairing the driver's ability to control the vehicle in a safe manner.
- Requirement:* 5 The vehicle shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used for route guidance.

Functional Area: **Vehicle Location Determination**

Architecture**Northern New Jersey ITS Architecture****Element: Private Commercial and Fleet Vehicles****Entity: Vehicle****Functional Area: Vehicle Location Determination**

Determines current location of the vehicle using GPS or similar location referencing and provides this information to other in-vehicle functions.

- Requirement:* 1 The vehicle shall provide the vehicle's current location to other in-vehicle functions.
- Requirement:* 2 The vehicle shall calculate the location from one or more sources of position data. These location referencing systems include position systems such as GPS, DGPS, odometer and differential odometers.
- Requirement:* 3 The vehicle shall refine its calculations as required by other in-vehicle functions.

Functional Area: Vehicle Probe Support

On-board systems that identify location, measure traffic conditions such as link travel time and speed and transmit data to a center or roadside beacons.

- Requirement:* 1 The vehicle shall collect and process traffic conditions data, including location, speed, and link travel times.
- Requirement:* 2 The vehicle shall transmit data to the center upon request including speed, link travel times, location and timestamp information.
- Requirement:* 3 The vehicle shall transmit data to field equipment located along the roadway upon request including speed, link travel times, location and timestamp information.

Functional Area: In-Vehicle Signage System

Provides drivers with road condition, environmental, advisory, and other special information via in-vehicle signage equipment.

- Requirement:* 1 The vehicle shall receive road condition and environmental information and present it to the driver via on-board signage equipment.
- Requirement:* 2 The vehicle shall receive advisory information, such as evacuation information, proximity to a maintenance and construction vehicle, wide-area alerts, incident information, work zone intrusion information, and other special information and present it to the driver via on-board signage equipment.
- Requirement:* 3 The vehicle shall receive indicator and fixed sign information, such as actual intersection traffic signal states, stop, or yield signs and present it to the driver via on-board signage equipment.
- Requirement:* 4 The vehicle shall store a translation table for road sign and message templates used for in-vehicle display.
- Requirement:* 5 The vehicle shall present information to the driver in audible or visual forms without impairing the driver's ability to control the vehicle in a safe manner.

Functional Area: Vehicle Mayday I/F

In-vehicle capability for drivers or collision detection sensors onboard a vehicle to report an emergency and summon assistance.

- Requirement:* 1 The vehicle shall provide the capability for a driver to report an emergency and summon assistance.
- Requirement:* 2 The vehicle shall provide the capability to accept input from a driver via a panic button or some other functionally similar form of input device provided as part of the in-vehicle equipment.
- Requirement:* 3 The vehicle shall provide the capability to automatically identify that a collision has occurred using equipment such as collision detection sensors with an interface to mayday type equipment that would automatically detect vehicle problems and send appropriate distress signals to a center.
- Requirement:* 4 The vehicle shall forward a request for assistance to a center containing the driver's current location, its identity and basic vehicle data relevant to its current condition, as well as any other data, such as personal medical history, vehicle orientation, etc., that may be developed in-vehicle by other systems.
- Requirement:* 5 The vehicle shall acknowledge the driver's request for emergency assistance.

Architecture

Northern New Jersey ITS Architecture

*Element:***Private Commercial and Fleet Vehicles**

*Entity:***Vehicle**

Functional Area: **Vehicle Mayday I/F**

In-vehicle capability for drivers or collision detection sensors onboard a vehicle to report an emergency and summon assistance.

- Requirement:* 6 The vehicle shall provide further details about the emergency to the center upon request from that function.
-

*Element:***Private Commercial Vehicle and Fleet Dispatch**

*Entity:***Fleet and Freight Management**

Functional Area: **Fleet Administration**

Commercial vehicle fleet tracking, dispatch, and reporting - includes interfaces to state/federal commercial vehicle administration, toll administration, emergency management, map update providers, and traveler information service providers.

- Requirement:* 1 The center shall send data concerning enrollment of commercial vehicles for electronic clearance and tax filing to the appropriate commercial vehicle administration center. The data may include driver and vehicle identification, safety inspections/status, carrier credentials, related citations, and accident information.
-

- Requirement:* 2 The center shall obtain and manage commercial vehicle routes for its fleet of vehicles, taking into account route restrictions, advance payment of tolls, HAZMAT restrictions, and current traffic and road conditions provided by traveler information systems.
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- Requirement:* 3 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as the background for commercial vehicle fleet administration - includes commercial vehicle specific data such as route or HAZMAT restrictions.
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- Requirement:* 4 The center shall monitor the locations and progress of commercial vehicles against their planned routes and raise appropriate warnings based on route monitoring parameters.
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- Requirement:* 5 The center shall coordinate the response to security incidents and the sharing of security threat information involving commercial vehicles with other agencies including emergency management centers and alerting/advisory systems.
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Functional Area: **Fleet Credentials and Taxes Management and Reporting**

Commercial vehicle fleet support systems for the purchase and filing of electronic credentials, status reporting, tax audit data, and compliance reviews. Electronic interfaces with the appropriate state or federal commercial vehicle administration centers.

- Requirement:* 1 The center shall send data concerning enrollment and purchase of commercial vehicles credentials and tax filing to the appropriate commercial vehicle administration center.
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- Requirement:* 2 The center shall receive compliance review reports from the appropriate commercial vehicle administration centers concerning the operations of the commercial vehicle fleet, including concomitant out-of-service notifications, and carrier warnings/notifications.
-

- Requirement:* 3 The center shall provide audit data to the appropriate commercial vehicle administration center to support tax audits.
-

- Requirement:* 4 The center shall support an interface with a commercial vehicle driver that is acting in the role of a commercial vehicle fleet manager for the purposes of obtaining credentials, filing taxes and audit data, and receiving compliance reports and status information.
-

Functional Area: **Fleet HAZMAT Management**

Notification of hazardous materials (HAZMAT) shipments to emergency management centers for commercial vehicles managed by the center - includes information on the nature of the cargo, the vehicle, and its expected route.

Architecture

Northern New Jersey ITS Architecture

*Element:***Private Commercial Vehicle and Fleet Dispatch**

*Entity:***Fleet and Freight Management**

Functional Area: **Fleet HAZMAT Management**

Notification of hazardous materials (HAZMAT) shipments to emergency management centers for commercial vehicles managed by the center - includes information on the nature of the cargo, the vehicle, and its expected route.

Requirement: 1 The center shall track the routing and cargo information, including the manifest data plus the chemical characteristics of a hazardous materials (HAZMAT) load being carried by its fleet of commercial vehicles.

Requirement: 2 The center shall provide information concerning commercial vehicles carrying hazardous materials (HAZMAT) upon request from an emergency management center. The information includes the nature of the cargo being carried, identity of the vehicle and unloading instructions.

Functional Area: **Manage CV Driver Identification**

Commercial vehicle fleet support systems to collect and store driver identification records, including PINs and biometrics. Remote authentication of the drivers and supports remote disabling of the vehicle if an unauthorized access is detected.

Requirement: 1 The center shall send driver assignment data to the fleet of commercial vehicles including unique identification information that is used to authenticate a driver. This may include biometric parameters for a driver or an encoded Personal Identification Number (PIN) used to identify a driver.

Requirement: 2 The center shall receive the identities of the commercial vehicle drivers as they attempt to access a commercial vehicle.

Requirement: 3 The center shall send an alarm to the appropriate emergency management center when an unauthorized access has been attempted on a commercial vehicle.

Requirement: 4 The center shall send a command to the commercial vehicle to disable the vehicle when an unauthorized access has been attempted - this may be initiated within the center or based on inputs from the emergency management center.

*Element:***Private Contractors**

*Entity:***Maintenance and Construction Management**

Functional Area: **MCM Maintenance Decision Support**

Maintenance Decision Support Systems recommend courses of action based on current and forecast environmental and road conditions (filtered and fused for specific time horizons) and additional application specific information. Recommendations and dispatch instructions are generated based on this integrated information.

Requirement: 1 The center shall provide the center personnel with tailored external information, including weather or road condition observations, forecasted weather information or road conditions, current usage of treatments and materials, available resources, equipment and vehicle availability, road network information, and source reliability information.

Requirement: 2 The center shall tailor the decision support information to include filtering (selection from a large amount of external information), error reduction ('smoothing' the information), fusion (combination of disparate information to match the decision needs), and analysis (creating the decision).

Requirement: 3 The center shall provide an interface to the center personnel to input control parameters for the decision support process and receive decisions or information presentation.

Requirement: 4 The center shall provide dispatch information to maintenance and construction vehicles based on the outputs of the decision support system, including recommended roadway treatment actions.

Functional Area: **MCM Roadway Maintenance and Construction**

Architecture**Northern New Jersey ITS Architecture***Element:Private Contractors**Entity:Maintenance and Construction Management**Functional Area: MCM Roadway Maintenance and Construction*

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

- Requirement:* 1 The center shall maintain an interface with asset management systems to track the inventory, restrictions, repair needs and status updates of transportation assets (pavement, bridges, signs, etc.) including location, installation and materials information, vendor/contractor, current maintenance status, standard height, width, and weight restrictions.
- Requirement:* 2 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other roadway maintenance.
- Requirement:* 3 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
- Requirement:* 4 The center shall provide emergency management and traffic management centers with information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.
- Requirement:* 5 The center shall collect the status and fault data from roadside equipment, such as traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
- Requirement:* 6 The center shall collect the status and fault data from traffic management centers, including data for traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
- Requirement:* 7 The center shall remotely control and collect data from infrastructure monitoring sensors located along the roadway infrastructure or on maintenance and construction vehicles.
- Requirement:* 8 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of roadway maintenance and construction activities.
- Requirement:* 9 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of roadway maintenance and construction activities.
- Requirement:* 10 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
- Requirement:* 11 The center shall dispatch and route maintenance and construction vehicle drivers and support them with route- specific environmental, incident, advisory, threat, alert, and traffic congestion information.
- Requirement:* 12 The center shall manage an interface with center personnel to accept vehicle systems control information and remotely control maintenance and construction vehicle on-board equipment.
- Requirement:* 13 The center shall track the status of roadway maintenance and construction activities by monitoring collected data from the dispatched vehicles and equipment.

*Element:Private Demand Response Operators Central Systems**Entity:Transit Management*

Architecture**Northern New Jersey ITS Architecture****Element: Private Demand Response Operators Central Systems****Entity: Transit Management****Functional Area: Transit Center Tracking and Dispatch**

Monitoring transit vehicle locations via interactions with on-board systems and determining vehicle schedule adherence. Furnish users with real-time transit related information and maintain interface with digital map providers.

- Requirement:* 1 The center shall monitor the locations of all transit vehicles within its network.
- Requirement:* 2 The center shall determine adherence of transit vehicles to their assigned schedule.
- Requirement:* 3 The center shall collect trip monitoring data from on-board systems including transit vehicle mileage, fuel usage, passenger loading, availability, etc.
- Requirement:* 4 The center shall provide transit operational data to traveler information service providers.
- Requirement:* 5 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for transit tracking and dispatch.

Functional Area: Transit Center Paratransit Operations

Planning and scheduling of demand responsive transit (i.e. paratransit) services, includes automatic operator assignment and monitoring.

- Requirement:* 1 The center shall process trip requests for demand responsive transit services, i.e. paratransit. Sources of the requests may include traveler information service providers.
- Requirement:* 2 The center shall track the location and availability of transit vehicles for use in demand responsive transit (paratransit) operations.
- Requirement:* 3 The center shall generate demand responsive transit (paratransit) routes and schedules based on such factors as parameters input by the system operator, what other demand responsive transit schedules have been planned, the availability and location of vehicles, the relevance of any fixed transit routes and schedules, and road network information.
- Requirement:* 4 The center shall assign transit vehicle operators for confirmed demand responsive transit (paratransit) trips based on factors such as eligibility, route preferences, seniority, and transit vehicle availability.
- Requirement:* 5 The center shall exchange information with Maintenance and Construction Operations concerning work zones, roadway conditions, asset restrictions, work plans, etc.
- Requirement:* 6 The center shall disseminate up-to-date schedules and route information to other centers for demand responsive transit services (paratransit).

Functional Area: Transit Center Fare and Load Management

Management of fare collection at the center - includes setting and distributing fare information, central processing of fares for transit as well as other ITS services, links to financial institutions and enforcement agencies.

- Requirement:* 1 The center shall manage the actual value of transit fares for each segment of each regular transit route, including the transmission of the information to transit vehicles and transit stops or stations.
- Requirement:* 2 The center shall provide the capability for a system operator to manage the transit fares and control the exchange of transit fare information.
- Requirement:* 3 The center shall process the financial requests from the transit vehicles or roadside and manage an interface to a Financial Institution.
- Requirement:* 4 The center shall support the payment of transit fare transactions using data provided by the traveler cards / payment instruments.
- Requirement:* 5 The center shall collect data on fare payment violations and send the data, including images of the violator, to the appropriate enforcement agency.

Architecture**Northern New Jersey ITS Architecture****Element: Private Demand Response Operators Central Systems****Entity: Transit Management****Functional Area: Transit Center Fare and Load Management**

Management of fare collection at the center - includes setting and distributing fare information, central processing of fares for transit as well as other ITS services, links to financial institutions and enforcement agencies.

- Requirement:* 6 The center shall process requests for transit fares to be paid in advance.
- Requirement:* 7 The center shall process requests for the advanced payment of tolls and parking lot charges as well as other non-transportation services, e.g. yellow-pages services.
- Requirement:* 8 The center shall be capable of establishing emergency fare structures to override all other fares during disasters, states of emergency, or evacuations.
- Requirement:* 9 The center shall maintain a list of invalid traveler credit identities, or bad tag lists that can be forwarded to transit vehicles and transit stops or stations.
- Requirement:* 10 The center shall collect passenger loading and fare statistics data to implement variable and flexible fare structures.
- Requirement:* 11 The center shall exchange fare and load information with other transit management centers, including potential Centralized Payments facilities.
- Requirement:* 12 The center shall provide transit fare information to other centers, including traveler information providers upon request.

Functional Area: Transit Garage Operations

Assignment of transit vehicles and operators to routes or service areas in a fair manner while minimizing labor and overtime services, considering operator preferences, qualifications, accumulated work hours, and other information about each operator.

- Requirement:* 1 The center shall maintain records of a transit vehicle operator's performance. This may be done utilizing standardized performance evaluation criteria set forth by governmental regulations and transit operating company policies, assessing the transit vehicle operator's driving history, and assessing comments from the transit vehicle operator's supervisor(s) as well as noting any moving violations or accidents, supervisor comments, government regulations, and company policies.
- Requirement:* 2 The center shall assess the transit vehicle operator's availability based on previous work assignments, accumulated hours, plus health and vacation commitments.
- Requirement:* 3 The center shall assign transit vehicle operators to transit schedules based on their eligibility, route preferences, seniority, and transit vehicle availability.
- Requirement:* 4 The center shall provide an interface through which the transit vehicle operator information can be maintained - either from the transit vehicle operator, a transit system operator (i.e. center personnel), or other functions.

Functional Area: Transit Center Multi-Modal Coordination

Generate requests for transit priority on routes and at certain intersections. Coordinate schedules with other agencies and modes, including transit transfer cluster and transfer point information.

- Requirement:* 1 The center shall analyze transit vehicle schedule performance to determine the need for priority along certain routes or at certain intersections.
- Requirement:* 2 The center shall send requests for priority along routes or at intersections to traffic management.
- Requirement:* 3 The center shall coordinate schedules and services between transit agencies, traffic management, maintenance and construction operations, parking management, and other surface or air transportation modes.

Architecture**Northern New Jersey ITS Architecture****Element: Private Demand Response Operators Central Systems****Entity: Transit Management****Functional Area: Transit Center Multi-Modal Coordination**

Generate requests for transit priority on routes and at certain intersections. Coordinate schedules with other agencies and modes, including transit transfer cluster and transfer point information.

- Requirement:* 4 The center shall share transfer cluster and transfer point information with multimodal transportation service providers, other transit agencies, and traveler information service providers. A transfer cluster is a collection of stops, stations, or terminals where transfers can be made conveniently.

Functional Area: Transit Data Collection

Collection and storage of transit management data. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect transit management data such as transit fares and passenger use, transit services, paratransit operations, transit vehicle maintenance data, etc.
- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.
- Requirement:* 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the transit data or for the data itself.
- Requirement:* 4 The center shall be able to produce sample products of the data available.

Element: Private Demand Response Operators Fare Management Systems**Entity: Transit Management****Functional Area: Transit Center Fare and Load Management**

Management of fare collection at the center - includes setting and distributing fare information, central processing of fares for transit as well as other ITS services, links to financial institutions and enforcement agencies.

- Requirement:* 1 The center shall manage the actual value of transit fares for each segment of each regular transit route, including the transmission of the information to transit vehicles and transit stops or stations.
- Requirement:* 2 The center shall provide the capability for a system operator to manage the transit fares and control the exchange of transit fare information.
- Requirement:* 3 The center shall process the financial requests from the transit vehicles or roadside and manage an interface to a Financial Institution.
- Requirement:* 4 The center shall support the payment of transit fare transactions using data provided by the traveler cards / payment instruments.
- Requirement:* 5 The center shall collect data on fare payment violations and send the data, including images of the violator, to the appropriate enforcement agency.
- Requirement:* 6 The center shall process requests for transit fares to be paid in advance.
- Requirement:* 7 The center shall process requests for the advanced payment of tolls and parking lot charges as well as other non-transportation services, e.g. yellow-pages services.
- Requirement:* 8 The center shall be capable of establishing emergency fare structures to override all other fares during disasters, states of emergency, or evacuations.
- Requirement:* 9 The center shall maintain a list of invalid traveler credit identities, or bad tag lists that can be forwarded to transit vehicles and transit stops or stations.
- Requirement:* 10 The center shall collect passenger loading and fare statistics data to implement variable and flexible fare structures.

Architecture**Northern New Jersey ITS Architecture****Element:Private Demand Response Operators Fare Management Systems****Entity:Transit Management****Functional Area: Transit Center Fare and Load Management**

Management of fare collection at the center - includes setting and distributing fare information, central processing of fares for transit as well as other ITS services, links to financial institutions and enforcement agencies.

Requirement: 11 The center shall exchange fare and load information with other transit management centers, including potential Centralized Payments facilities.

Requirement: 12 The center shall provide transit fare information to other centers, including traveler information providers upon request.

Functional Area: Transit Center Multi-Modal Coordination

Generate requests for transit priority on routes and at certain intersections. Coordinate schedules with other agencies and modes, including transit transfer cluster and transfer point information.

Requirement: 1 The center shall analyze transit vehicle schedule performance to determine the need for priority along certain routes or at certain intersections.

Requirement: 2 The center shall send requests for priority along routes or at intersections to traffic management.

Requirement: 3 The center shall coordinate schedules and services between transit agencies, traffic management, maintenance and construction operations, parking management, and other surface or air transportation modes.

Requirement: 4 The center shall share transfer cluster and transfer point information with multimodal transportation service providers, other transit agencies, and traveler information service providers. A transfer cluster is a collection of stops, stations, or terminals where transfers can be made conveniently.

Element:Private Demand Response Operators Vehicles**Entity:Transit Vehicle Subsystem****Functional Area: On-board Transit Trip Monitoring**

Support fleet management with automatic vehicle location (AVL) and automated mileage and fuel reporting and auditing.

Requirement: 1 The transit vehicle shall compute the location of the transit vehicle based on inputs from a vehicle location determination function.

Requirement: 2 The transit vehicle shall support the computation of the location of a transit vehicle using on-board sensors to augment the location determination function. This may include proximity to the transit stops or other known reference points as well as recording trip length.

Requirement: 3 The transit vehicle shall record transit trip monitoring data including vehicle mileage and fuel usage.

Requirement: 4 The transit vehicle shall record transit trip monitoring data including operational status information such as doors open/closed, passenger loading, running times, etc.

Requirement: 5 The transit vehicle shall send the transit vehicle trip monitoring data to center-based trip monitoring functions.

Functional Area: On-board Paratransit Operations

On-board systems to manage paratransit and flexible-route dispatch requests, including multi-stop runs. Inputs based on the transit vehicle's type and passenger capacity.

Requirement: 1 The transit vehicle shall manage data input to sensor(s) on-board a transit vehicle to determine the vehicle's availability for use in demand responsive and flexible-route transit services based on identity, type, and passenger capacity.

Requirement: 2 The transit vehicle shall receive the status of demand responsive or flexible-route transit schedules and passenger loading from the transit vehicle operator.

Architecture

Northern New Jersey ITS Architecture

*Element:***Private Demand Response Operators Vehicles**

*Entity:***Transit Vehicle Subsystem**

Functional Area: **On-board Paratransit Operations**

On-board systems to manage paratransit and flexible-route dispatch requests, including multi-stop runs. Inputs based on the transit vehicle's type and passenger capacity.

- Requirement:* 3 The transit vehicle shall provide the transit vehicle operator instructions about the demand responsive or flexible-route transit schedule that has been confirmed from the center.
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*Element:***Private Ferry Operators Fare Management Systems**

*Entity:***Transit Management**

Functional Area: **Transit Center Fare and Load Management**

Management of fare collection at the center - includes setting and distributing fare information, central processing of fares for transit as well as other ITS services, links to financial institutions and enforcement agencies.

- Requirement:* 1 The center shall manage the actual value of transit fares for each segment of each regular transit route, including the transmission of the information to transit vehicles and transit stops or stations.
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- Requirement:* 2 The center shall provide the capability for a system operator to manage the transit fares and control the exchange of transit fare information.
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- Requirement:* 3 The center shall process the financial requests from the transit vehicles or roadside and manage an interface to a Financial Institution.
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- Requirement:* 4 The center shall support the payment of transit fare transactions using data provided by the traveler cards / payment instruments.
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- Requirement:* 5 The center shall collect data on fare payment violations and send the data, including images of the violator, to the appropriate enforcement agency.
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- Requirement:* 6 The center shall process requests for transit fares to be paid in advance.
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- Requirement:* 7 The center shall process requests for the advanced payment of tolls and parking lot charges as well as other non-transportation services, e.g. yellow-pages services.
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- Requirement:* 8 The center shall be capable of establishing emergency fare structures to override all other fares during disasters, states of emergency, or evacuations.
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- Requirement:* 9 The center shall maintain a list of invalid traveler credit identities, or bad tag lists that can be forwarded to transit vehicles and transit stops or stations.
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- Requirement:* 10 The center shall collect passenger loading and fare statistics data to implement variable and flexible fare structures.
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- Requirement:* 11 The center shall exchange fare and load information with other transit management centers, including potential Centralized Payments facilities.
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- Requirement:* 12 The center shall provide transit fare information to other centers, including traveler information providers upon request.
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*Element:***Private Ferry Operators Ferries**

*Entity:***Transit Vehicle Subsystem**

Functional Area: **On-board Transit Trip Monitoring**

Support fleet management with automatic vehicle location (AVL) and automated mileage and fuel reporting and auditing.

- Requirement:* 1 The transit vehicle shall compute the location of the transit vehicle based on inputs from a vehicle location determination function.
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Architecture**Northern New Jersey ITS Architecture****Element:Private Ferry Operators Ferries****Entity:Transit Vehicle Subsystem****Functional Area: On-board Transit Trip Monitoring**

Support fleet management with automatic vehicle location (AVL) and automated mileage and fuel reporting and auditing.

- Requirement:* 2 The transit vehicle shall support the computation of the location of a transit vehicle using on-board sensors to augment the location determination function. This may include proximity to the transit stops or other known reference points as well as recording trip length.
- Requirement:* 3 The transit vehicle shall record transit trip monitoring data including vehicle mileage and fuel usage.
- Requirement:* 4 The transit vehicle shall record transit trip monitoring data including operational status information such as doors open/closed, passenger loading, running times, etc.
- Requirement:* 5 The transit vehicle shall send the transit vehicle trip monitoring data to center-based trip monitoring functions.

Functional Area: On-board Fixed Route Schedule Management

Collecting of data for schedule generation and adjustment on-board a transit vehicle. Supports communication between the vehicle, operator, and center.

- Requirement:* 1 The transit vehicle shall receive transit route information for its assigned route including transit service instructions, traffic information, road conditions, and other information for the operator.
- Requirement:* 2 The transit vehicle shall use the route information and its current location to determine the deviation from the predetermined schedule.
- Requirement:* 3 The transit vehicle shall calculate the estimated times of arrival (ETA) at transit stops.
- Requirement:* 4 The transit vehicle shall determine scenarios to correct the schedule deviation.
- Requirement:* 5 The transit vehicle shall provide the schedule deviations and instructions for schedule corrections to the transit vehicle operator if the deviation is small, or the transit vehicle is operating in an urban area.
- Requirement:* 6 The transit vehicle shall send the schedule deviation and estimated arrival time information to the center.
- Requirement:* 7 The transit vehicle shall support the operations of a flexible route service. This may include requests for route deviations that would then lead to schedule corrective actions.

Element:Private Ferry Operators Landside Shuttles**Entity:Transit Vehicle Subsystem****Functional Area: On-board Transit Trip Monitoring**

Support fleet management with automatic vehicle location (AVL) and automated mileage and fuel reporting and auditing.

- Requirement:* 1 The transit vehicle shall compute the location of the transit vehicle based on inputs from a vehicle location determination function.
- Requirement:* 2 The transit vehicle shall support the computation of the location of a transit vehicle using on-board sensors to augment the location determination function. This may include proximity to the transit stops or other known reference points as well as recording trip length.
- Requirement:* 3 The transit vehicle shall record transit trip monitoring data including vehicle mileage and fuel usage.
- Requirement:* 4 The transit vehicle shall record transit trip monitoring data including operational status information such as doors open/closed, passenger loading, running times, etc.
- Requirement:* 5 The transit vehicle shall send the transit vehicle trip monitoring data to center-based trip monitoring functions.

Functional Area: On-board Fixed Route Schedule Management

Architecture

Northern New Jersey ITS Architecture

*Element:***Private Ferry Operators Landside Shuttles**

*Entity:***Transit Vehicle Subsystem**

Functional Area: **On-board Fixed Route Schedule Management**

Collecting of data for schedule generation and adjustment on-board a transit vehicle. Supports communication between the vehicle, operator, and center.

- Requirement:* 1 The transit vehicle shall receive transit route information for its assigned route including transit service instructions, traffic information, road conditions, and other information for the operator.
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- Requirement:* 2 The transit vehicle shall use the route information and its current location to determine the deviation from the predetermined schedule.
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- Requirement:* 3 The transit vehicle shall calculate the estimated times of arrival (ETA) at transit stops.
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- Requirement:* 4 The transit vehicle shall determine scenarios to correct the schedule deviation.
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- Requirement:* 5 The transit vehicle shall provide the schedule deviations and instructions for schedule corrections to the transit vehicle operator if the deviation is small, or the transit vehicle is operating in an urban area.
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- Requirement:* 6 The transit vehicle shall send the schedule deviation and estimated arrival time information to the center.
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- Requirement:* 7 The transit vehicle shall support the operations of a flexible route service. This may include requests for route deviations that would then lead to schedule corrective actions.
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*Element:***Private Ferry Operators Systems**

*Entity:***Transit Management**

Functional Area: **Transit Center Tracking and Dispatch**

Monitoring transit vehicle locations via interactions with on-board systems and determining vehicle schedule adherence. Furnish users with real-time transit related information and maintain interface with digital map providers.

- Requirement:* 1 The center shall monitor the locations of all transit vehicles within its network.
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- Requirement:* 2 The center shall determine adherence of transit vehicles to their assigned schedule.
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- Requirement:* 3 The center shall collect trip monitoring data from on-board systems including transit vehicle mileage, fuel usage, passenger loading, availability, etc.
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- Requirement:* 4 The center shall provide transit operational data to traveler information service providers.
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- Requirement:* 5 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for transit tracking and dispatch.
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Functional Area: **Transit Center Fixed-Route Operations**

Planning and scheduling associated with fixed and flexible route transit services, automatically updates customer service operator systems, and provides current vehicle schedule adherence and optimum scenarios for schedule adjustment.

- Requirement:* 1 The center shall generate transit routes and schedules based on such factors as parameters input by the system operator, road network conditions, operational data on current routes and schedules, and digitized map data.
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- Requirement:* 2 The center shall provide the interface to the system operator to control the generation of new routes and schedules (transit services) including the ability to review and update the parameters used by the routes and schedules generation processes and to initiate these processes
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- Requirement:* 3 The center shall be able to generate special routes and schedules to support an incident, disaster, evacuation, or other emergency.
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- Requirement:* 4 The center shall accept requests from traffic management to change routes and schedules as part of the implementation of demand management strategies.
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Architecture**Northern New Jersey ITS Architecture***Element:***Private Ferry Operators Systems***Entity:***Transit Management***Functional Area:* **Transit Center Fixed-Route Operations**

Planning and scheduling associated with fixed and flexible route transit services, automatically updates customer service operator systems, and provides current vehicle schedule adherence and optimum scenarios for schedule adjustment.

- Requirement:* 5 The center shall collect transit operational data for use in the generation of routes and schedules.
- Requirement:* 6 The center shall assign transit vehicle operators based on factors such as eligibility, route preferences, seniority, and transit vehicle availability.
- Requirement:* 7 The center shall manage large deviations of individual transit vehicles, deviations in rural areas, and deviations of large numbers of vehicles.
- Requirement:* 8 The center shall generate the necessary corrective actions which may involve more than the vehicles concerned and more far reaching action, such as, the introduction of extra vehicles, wide area signal priority by traffic management, the premature termination of some services, etc.
- Requirement:* 9 The center shall exchange information with Maintenance and Construction Operations concerning work zones, roadway conditions, asset restrictions, work plans, etc.
- Requirement:* 10 The center shall disseminate up-to-date schedules and route information to other centers for fixed and flexible route services.

Functional Area: **Transit Center Security**

Monitor transit vehicle operator or traveler activated alarms; authenticate transit vehicle operators; remotely disable a transit vehicle; alert operators, travelers, and police to potential incidents identified by these security features.

- Requirement:* 1 The center shall monitor transit vehicle operational data to determine if the transit vehicle is off-route and assess whether a security incident is occurring.
- Requirement:* 2 The center shall receive reports of emergencies on-board transit vehicles entered directly by the transit vehicle operator or from a traveler through interfaces such as panic buttons or alarm switches.
- Requirement:* 3 The center shall support the back-office portion of functionality to authenticate transit vehicle operators.
- Requirement:* 4 The center shall exchange transit incident information along with other service data with other transit agencies.
- Requirement:* 5 The center shall receive information pertaining to a wide-area alert such as weather alerts, disaster situations, or child abductions. This information may come from Emergency Management or from other Alerting and Advisory Systems.
- Requirement:* 6 The center shall send wide-area alert information to travelers (on-board transit vehicles or at stations/stops) and transit vehicle operators.
- Requirement:* 7 The center shall coordinate the response to security incidents involving transit with other agencies including Emergency Management, other transit agencies, media, traffic management, and traveler information service providers.
- Requirement:* 8 The center shall receive threat information and status on the integrity of the transit infrastructure.
- Requirement:* 9 The center shall provide support to remotely disable (or reset the disabling of) a transit vehicle in service.

Functional Area: **Transit Garage Operations**

Assignment of transit vehicles and operators to routes or service areas in a fair manner while minimizing labor and overtime services, considering operator preferences, qualifications, accumulated work hours, and other information about each operator.

Architecture

Northern New Jersey ITS Architecture

Element: **Private Ferry Operators Systems**

Entity: **Transit Management**

Functional Area: **Transit Garage Operations**

Assignment of transit vehicles and operators to routes or service areas in a fair manner while minimizing labor and overtime services, considering operator preferences, qualifications, accumulated work hours, and other information about each operator.

- Requirement:*
- 1 The center shall maintain records of a transit vehicle operator's performance. This may be done utilizing standardized performance evaluation criteria set forth by governmental regulations and transit operating company policies, assessing the transit vehicle operator's driving history, and assessing comments from the transit vehicle operator's supervisor(s) as well as noting any moving violations or accidents, supervisor comments, government regulations, and company policies.
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- Requirement:*
- 2 The center shall assess the transit vehicle operator's availability based on previous work assignments, accumulated hours, plus health and vacation commitments.
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- Requirement:*
- 3 The center shall assign transit vehicle operators to transit schedules based on their eligibility, route preferences, seniority, and transit vehicle availability.
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- Requirement:*
- 4 The center shall provide an interface through which the transit vehicle operator information can be maintained - either from the transit vehicle operator, a transit system operator (i.e. center personnel), or other functions.
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Functional Area: **Transit Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and vehicle probes. The information is monitored and forwarded to other agencies to more effectively manage transit operations.

- Requirement:*
- 1 The center shall assimilate current and forecast road conditions and surface weather information to more effectively manage transit operations.
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- Requirement:*
- 2 The center shall collect current and forecast road and weather information from weather service providers and vehicle probes.
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- Requirement:*
- 3 The center shall receive road network probe information from its fleet of transit vehicles.
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- Requirement:*
- 4 The center shall provide road network probe information from its fleet of transit vehicles to traffic management as well as maintenance and construction management.
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Functional Area: **Transit Center Multi-Modal Coordination**

Generate requests for transit priority on routes and at certain intersections. Coordinate schedules with other agencies and modes, including transit transfer cluster and transfer point information.

- Requirement:*
- 1 The center shall analyze transit vehicle schedule performance to determine the need for priority along certain routes or at certain intersections.
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- Requirement:*
- 2 The center shall send requests for priority along routes or at intersections to traffic management.
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- Requirement:*
- 3 The center shall coordinate schedules and services between transit agencies, traffic management, maintenance and construction operations, parking management, and other surface or air transportation modes.
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- Requirement:*
- 4 The center shall share transfer cluster and transfer point information with multimodal transportation service providers, other transit agencies, and traveler information service providers. A transfer cluster is a collection of stops, stations, or terminals where transfers can be made conveniently.
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Functional Area: **Transit Evacuation Support**

Support evacuation and subsequent reentry of a population in the vicinity of a disaster or other emergency. Coordinate regional evacuation plans and resources including transit and school bus fleets.

- Requirement:*
- 1 The center shall manage the use of transit resources to support evacuation and subsequent reentry of a population in the vicinity of a disaster or other emergency.
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Architecture**Northern New Jersey ITS Architecture****Element:Private Ferry Operators Systems****Entity:Transit Management****Functional Area: Transit Evacuation Support**

Support evacuation and subsequent reentry of a population in the vicinity of a disaster or other emergency.
Coordinate regional evacuation plans and resources including transit and school bus fleets.

- Requirement:* 2 The center shall coordinate regional evacuation plans with Emergency Management - identifying the transit role in an evacuation and the transit resources that would be used.
- Requirement:* 3 The center shall coordinate the use of transit and school bus fleets during an evacuation, supporting evacuation of those with special needs and the general population.
- Requirement:* 4 The center shall adjust and update transit service and fare schedules and provide that information to other agencies as they coordinate evacuations.

Functional Area: Transit Data Collection

Collection and storage of transit management data. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect transit management data such as transit fares and passenger use, transit services, paratransit operations, transit vehicle maintenance data, etc.
- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.
- Requirement:* 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the transit data or for the data itself.
- Requirement:* 4 The center shall be able to produce sample products of the data available.

Element:Private Fixed-Route Bus/Shuttle Operators Fare Management Systems**Entity:Transit Management****Functional Area: Transit Center Fare and Load Management**

Management of fare collection at the center - includes setting and distributing fare information, central processing of fares for transit as well as other ITS services, links to financial institutions and enforcement agencies.

- Requirement:* 1 The center shall manage the actual value of transit fares for each segment of each regular transit route, including the transmission of the information to transit vehicles and transit stops or stations.
- Requirement:* 2 The center shall provide the capability for a system operator to manage the transit fares and control the exchange of transit fare information.
- Requirement:* 3 The center shall process the financial requests from the transit vehicles or roadside and manage an interface to a Financial Institution.
- Requirement:* 4 The center shall support the payment of transit fare transactions using data provided by the traveler cards / payment instruments.
- Requirement:* 5 The center shall collect data on fare payment violations and send the data, including images of the violator, to the appropriate enforcement agency.
- Requirement:* 6 The center shall process requests for transit fares to be paid in advance.
- Requirement:* 7 The center shall process requests for the advanced payment of tolls and parking lot charges as well as other non-transportation services, e.g. yellow-pages services.
- Requirement:* 8 The center shall be capable of establishing emergency fare structures to override all other fares during disasters, states of emergency, or evacuations.
- Requirement:* 9 The center shall maintain a list of invalid traveler credit identities, or bad tag lists that can be forwarded to transit vehicles and transit stops or stations.

Architecture

Northern New Jersey ITS Architecture

*Element:***Private Fixed-Route Bus/Shuttle Operators Fare Management Systems**

*Entity:***Transit Management**

Functional Area: **Transit Center Fare and Load Management**

Management of fare collection at the center - includes setting and distributing fare information, central processing of fares for transit as well as other ITS services, links to financial institutions and enforcement agencies.

Requirement: 10 The center shall collect passenger loading and fare statistics data to implement variable and flexible fare structures.

Requirement: 11 The center shall exchange fare and load information with other transit management centers, including potential Centralized Payments facilities.

Requirement: 12 The center shall provide transit fare information to other centers, including traveler information providers upon request.

*Element:***Private Fixed-Route Transit Bus/Shuttle Operators**

*Entity:***Transit Management**

Functional Area: **Transit Center Tracking and Dispatch**

Monitoring transit vehicle locations via interactions with on-board systems and determining vehicle schedule adherence. Furnish users with real-time transit related information and maintain interface with digital map providers.

Requirement: 1 The center shall monitor the locations of all transit vehicles within its network.

Requirement: 2 The center shall determine adherence of transit vehicles to their assigned schedule.

Requirement: 3 The center shall collect trip monitoring data from on-board systems including transit vehicle mileage, fuel usage, passenger loading, availability, etc.

Requirement: 4 The center shall provide transit operational data to traveler information service providers.

Requirement: 5 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for transit tracking and dispatch.

Functional Area: **Transit Center Fixed-Route Operations**

Planning and scheduling associated with fixed and flexible route transit services, automatically updates customer service operator systems, and provides current vehicle schedule adherence and optimum scenarios for schedule adjustment.

Requirement: 1 The center shall generate transit routes and schedules based on such factors as parameters input by the system operator, road network conditions, operational data on current routes and schedules, and digitized map data.

Requirement: 2 The center shall provide the interface to the system operator to control the generation of new routes and schedules (transit services) including the ability to review and update the parameters used by the routes and schedules generation processes and to initiate these processes

Requirement: 3 The center shall be able to generate special routes and schedules to support an incident, disaster, evacuation, or other emergency.

Requirement: 4 The center shall accept requests from traffic management to change routes and schedules as part of the implementation of demand management strategies.

Requirement: 5 The center shall collect transit operational data for use in the generation of routes and schedules.

Requirement: 6 The center shall assign transit vehicle operators based on factors such as eligibility, route preferences, seniority, and transit vehicle availability.

Requirement: 7 The center shall manage large deviations of individual transit vehicles, deviations in rural areas, and deviations of large numbers of vehicles.

Architecture

Northern New Jersey ITS Architecture

Element: **Private Fixed-Route Transit Bus/Shuttle Operators**

Entity: **Transit Management**

Functional Area: **Transit Center Fixed-Route Operations**

Planning and scheduling associated with fixed and flexible route transit services, automatically updates customer service operator systems, and provides current vehicle schedule adherence and optimum scenarios for schedule adjustment.

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| <i>Requirement:</i> | 8 The center shall generate the necessary corrective actions which may involve more than the vehicles concerned and more far reaching action, such as, the introduction of extra vehicles, wide area signal priority by traffic management, the premature termination of some services, etc. |
| <i>Requirement:</i> | 9 The center shall exchange information with Maintenance and Construction Operations concerning work zones, roadway conditions, asset restrictions, work plans, etc. |
| <i>Requirement:</i> | 10 The center shall disseminate up-to-date schedules and route information to other centers for fixed and flexible route services. |
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Functional Area: **Transit Center Security**

Monitor transit vehicle operator or traveler activated alarms; authenticate transit vehicle operators; remotely disable a transit vehicle; alert operators, travelers, and police to potential incidents identified by these security features.

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| <i>Requirement:</i> | 1 The center shall monitor transit vehicle operational data to determine if the transit vehicle is off-route and assess whether a security incident is occurring. |
| <i>Requirement:</i> | 2 The center shall receive reports of emergencies on-board transit vehicles entered directly by the transit vehicle operator or from a traveler through interfaces such as panic buttons or alarm switches. |
| <i>Requirement:</i> | 3 The center shall support the back-office portion of functionality to authenticate transit vehicle operators. |
| <i>Requirement:</i> | 4 The center shall exchange transit incident information along with other service data with other transit agencies. |
| <i>Requirement:</i> | 5 The center shall receive information pertaining to a wide-area alert such as weather alerts, disaster situations, or child abductions. This information may come from Emergency Management or from other Alerting and Advisory Systems. |
| <i>Requirement:</i> | 6 The center shall send wide-area alert information to travelers (on-board transit vehicles or at stations/stops) and transit vehicle operators. |
| <i>Requirement:</i> | 7 The center shall coordinate the response to security incidents involving transit with other agencies including Emergency Management, other transit agencies, media, traffic management, and traveler information service providers. |
| <i>Requirement:</i> | 8 The center shall receive threat information and status on the integrity of the transit infrastructure. |
| <i>Requirement:</i> | 9 The center shall provide support to remotely disable (or reset the disabling of) a transit vehicle in service. |
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Functional Area: **Transit Garage Operations**

Assignment of transit vehicles and operators to routes or service areas in a fair manner while minimizing labor and overtime services, considering operator preferences, qualifications, accumulated work hours, and other information about each operator.

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| <i>Requirement:</i> | 1 The center shall maintain records of a transit vehicle operator's performance. This may be done utilizing standardized performance evaluation criteria set forth by governmental regulations and transit operating company policies, assessing the transit vehicle operator's driving history, and assessing comments from the transit vehicle operator's supervisor(s) as well as noting any moving violations or accidents, supervisor comments, government regulations, and company policies. |
| <i>Requirement:</i> | 2 The center shall assess the transit vehicle operator's availability based on previous work assignments, accumulated hours, plus health and vacation commitments. |
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Architecture

Northern New Jersey ITS Architecture

Element: **Private Fixed-Route Transit Bus/Shuttle Operators**

Entity: **Transit Management**

Functional Area: **Transit Garage Operations**

Assignment of transit vehicles and operators to routes or service areas in a fair manner while minimizing labor and overtime services, considering operator preferences, qualifications, accumulated work hours, and other information about each operator.

Requirement: 3 The center shall assign transit vehicle operators to transit schedules based on their eligibility, route preferences, seniority, and transit vehicle availability.

Requirement: 4 The center shall provide an interface through which the transit vehicle operator information can be maintained - either from the transit vehicle operator, a transit system operator (i.e. center personnel), or other functions.

Functional Area: **Transit Center Multi-Modal Coordination**

Generate requests for transit priority on routes and at certain intersections. Coordinate schedules with other agencies and modes, including transit transfer cluster and transfer point information.

Requirement: 1 The center shall analyze transit vehicle schedule performance to determine the need for priority along certain routes or at certain intersections.

Requirement: 2 The center shall send requests for priority along routes or at intersections to traffic management.

Requirement: 3 The center shall coordinate schedules and services between transit agencies, traffic management, maintenance and construction operations, parking management, and other surface or air transportation modes.

Requirement: 4 The center shall share transfer cluster and transfer point information with multimodal transportation service providers, other transit agencies, and traveler information service providers. A transfer cluster is a collection of stops, stations, or terminals where transfers can be made conveniently.

Functional Area: **Transit Evacuation Support**

Support evacuation and subsequent reentry of a population in the vicinity of a disaster or other emergency. Coordinate regional evacuation plans and resources including transit and school bus fleets.

Requirement: 1 The center shall manage the use of transit resources to support evacuation and subsequent reentry of a population in the vicinity of a disaster or other emergency.

Requirement: 2 The center shall coordinate regional evacuation plans with Emergency Management - identifying the transit role in an evacuation and the transit resources that would be used.

Requirement: 3 The center shall coordinate the use of transit and school bus fleets during an evacuation, supporting evacuation of those with special needs and the general population.

Requirement: 4 The center shall adjust and update transit service and fare schedules and provide that information to other agencies as they coordinate evacuations.

Functional Area: **Transit Data Collection**

Collection and storage of transit management data. For use by operations personnel or data archives in the region.

Requirement: 1 The center shall collect transit management data such as transit fares and passenger use, transit services, paratransit operations, transit vehicle maintenance data, etc.

Requirement: 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

Requirement: 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the transit data or for the data itself.

Requirement: 4 The center shall be able to produce sample products of the data available.

Architecture**Northern New Jersey ITS Architecture****Element: Private Fixed-Route Transit Bus/Shuttle Operators Vehicles****Entity: Transit Vehicle Subsystem****Functional Area: On-board Transit Trip Monitoring**

Support fleet management with automatic vehicle location (AVL) and automated mileage and fuel reporting and auditing.

- Requirement:* 1 The transit vehicle shall compute the location of the transit vehicle based on inputs from a vehicle location determination function.
- Requirement:* 2 The transit vehicle shall support the computation of the location of a transit vehicle using on-board sensors to augment the location determination function. This may include proximity to the transit stops or other known reference points as well as recording trip length.
- Requirement:* 3 The transit vehicle shall record transit trip monitoring data including vehicle mileage and fuel usage.
- Requirement:* 4 The transit vehicle shall record transit trip monitoring data including operational status information such as doors open/closed, passenger loading, running times, etc.
- Requirement:* 5 The transit vehicle shall send the transit vehicle trip monitoring data to center-based trip monitoring functions.

Functional Area: On-board Fixed Route Schedule Management

Collecting of data for schedule generation and adjustment on-board a transit vehicle. Supports communication between the vehicle, operator, and center.

- Requirement:* 1 The transit vehicle shall receive transit route information for its assigned route including transit service instructions, traffic information, road conditions, and other information for the operator.
- Requirement:* 2 The transit vehicle shall use the route information and its current location to determine the deviation from the predetermined schedule.
- Requirement:* 3 The transit vehicle shall calculate the estimated times of arrival (ETA) at transit stops.
- Requirement:* 4 The transit vehicle shall determine scenarios to correct the schedule deviation.
- Requirement:* 5 The transit vehicle shall provide the schedule deviations and instructions for schedule corrections to the transit vehicle operator if the deviation is small, or the transit vehicle is operating in an urban area.
- Requirement:* 6 The transit vehicle shall send the schedule deviation and estimated arrival time information to the center.
- Requirement:* 7 The transit vehicle shall support the operations of a flexible route service. This may include requests for route deviations that would then lead to schedule corrective actions.

Element: Private ISPs**Entity: Information Service Provider****Functional Area: Basic Information Broadcast**

Collection, processing, storage, and broadcast dissemination of traffic, transit, maintenance and construction, event, and weather information to traveler interface systems and vehicles.

- Requirement:* 1 The center shall collect, process, store, and disseminate traffic and highway condition information to travelers, including incident information, detours and road closures, event information, recommended routes, and current speeds on specific routes.
- Requirement:* 2 The center shall collect, process, store, and disseminate maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities.
- Requirement:* 3 The center shall collect, process, store, and disseminate transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers.
- Requirement:* 4 The center shall collect, process, store, and disseminate parking information to travelers, including location, availability, and fees.
- Requirement:* 5 The center shall collect, process, store, and disseminate toll fee information to travelers.

Architecture**Northern New Jersey ITS Architecture***Element:Private ISPs**Entity:Information Service Provider**Functional Area: Basic Information Broadcast*

Collection, processing, storage, and broadcast dissemination of traffic, transit, maintenance and construction, event, and weather information to traveler interface systems and vehicles.

- Requirement:* 6 The center shall collect, process, store, and disseminate weather information to travelers.
- Requirement:* 7 The center shall collect, process, store, and disseminate event information to travelers.
- Requirement:* 8 The center shall collect, process, store, and disseminate air quality information to travelers.
- Requirement:* 9 The center shall provide the capability to support requests from the media for traffic and incident data.
- Requirement:* 10 The center shall provide the capability for a system operator to control the type and update frequency of broadcast traveler information.

Functional Area: Interactive Infrastructure Information

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

- Requirement:* 1 The center shall collect, process, store, and disseminate customized traffic and highway condition information to travelers, including incident information, detours and road closures, recommended routes, and current speeds on specific routes upon request.
- Requirement:* 2 The center shall collect, process, store, and disseminate customized maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities upon request.
- Requirement:* 3 The center shall collect, process, store, and disseminate customized transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers upon request.
- Requirement:* 4 The center shall collect, process, store, and disseminate customized parking information to travelers, including location, availability, and fees upon request.
- Requirement:* 5 The center shall collect, process, store, and disseminate customized toll fee information to travelers upon request.
- Requirement:* 6 The center shall collect, process, store, and disseminate customized weather information to travelers upon request.
- Requirement:* 7 The center shall collect, process, store, and disseminate customized multimodal transportation service information (for example, from ferry and airline operators), including transfer points and other information, to travelers upon request.
- Requirement:* 8 The center shall collect, process, store, and disseminate customized event information to travelers upon request.
- Requirement:* 9 The center shall collect, process, store, and disseminate customized air quality information to travelers upon request.
- Requirement:* 10 The center shall provide all traveler information based on the traveler's current location or a specific location identified by the traveler, and filter or customize the provided information accordingly.
- Requirement:* 11 The center shall accept traveler profiles for determining the type of personalized data to send to the traveler.
- Requirement:* 12 The center shall manage payment for services, such as tolls, transit fares, parking lot charges, map updates, and advanced payment for tolls, and provide transaction success or failure details.
- Requirement:* 13 The center shall support requests for traveler information and advanced payment for traveler services from commercial fleet operators.

Architecture**Northern New Jersey ITS Architecture***Element:Private ISPs**Entity:Information Service Provider**Functional Area: Interactive Infrastructure Information*

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

- Requirement:* 14 The center shall provide the capability to exchange information with another traveler information service provider current or predicted data for road links that are outside the area served by the local supplier.
- Requirement:* 15 The center shall manage updates of digitized map data and provide updates to traveler interface systems upon request.
- Requirement:* 16 The center shall provide the capability to support requests from the media for traffic and incident data.
- Requirement:* 17 The center shall provide the capability for a system operator to control the type and update frequency of traveler information.

Functional Area: Traveler Telephone Information

Collection and distribution of traveler information and wide-area alerts to traveler telephone information systems such as 511, based on voice-based traveler requests.

- Requirement:* 1 The center shall provide the capability to process voice-formatted requests for traveler information from a traveler telephone information system, and return the information in the requested format.
- Requirement:* 2 The center shall provide the capability to process dual-tone multifrequency (DTMF)-based requests (touch-tone) for traveler information from a traveler telephone information system.
- Requirement:* 3 The center shall provide the capability to process traveler information requests from a traveler telephone information system.
- Requirement:* 4 The center shall collect and provide information on traffic conditions in the requested voice format and for the requested location.
- Requirement:* 5 The center shall collect and provide work zone and roadway maintenance information in the requested voice format and for the requested location.
- Requirement:* 6 The center shall collect and provide roadway environment conditions information in the requested voice format and for the requested location.
- Requirement:* 7 The center shall collect and provide weather and event information in the requested voice format and for the requested location.
- Requirement:* 8 The center shall collect and provide transit service information in the requested voice format and for the requested location.
- Requirement:* 9 The center shall collect and provide yellow pages services information in the requested voice format and for the requested location.
- Requirement:* 10 The center shall collect and provide current ferry and rail schedule and airport status information in the requested voice format and for the requested location.
- Requirement:* 11 The center shall provide the capability to support both specific caller requests as well as bulk upload of regional traveler information.
- Requirement:* 12 The center shall receive and forward region-specific wide-area alert and advisory information to the traveler telephone information system, including major emergencies such as a natural or man-made disaster, civil emergency, child abductions, severe weather watches and warnings, military activities, and law enforcement warnings.

*Element:Private Long-Distance Bus Operators Systems**Entity:Transit Management**Functional Area: Transit Center Multi-Modal Coordination*

Architecture

Northern New Jersey ITS Architecture

Element: **Private Long-Distance Bus Operators Systems**

Entity: **Transit Management**

Functional Area: **Transit Center Multi-Modal Coordination**

Generate requests for transit priority on routes and at certain intersections. Coordinate schedules with other agencies and modes, including transit transfer cluster and transfer point information.

- Requirement:* 1 The center shall analyze transit vehicle schedule performance to determine the need for priority along certain routes or at certain intersections.
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- Requirement:* 2 The center shall send requests for priority along routes or at intersections to traffic management.
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- Requirement:* 3 The center shall coordinate schedules and services between transit agencies, traffic management, maintenance and construction operations, parking management, and other surface or air transportation modes.
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- Requirement:* 4 The center shall share transfer cluster and transfer point information with multimodal transportation service providers, other transit agencies, and traveler information service providers. A transfer cluster is a collection of stops, stations, or terminals where transfers can be made conveniently.
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Functional Area: **Transit Data Collection**

Collection and storage of transit management data. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect transit management data such as transit fares and passenger use, transit services, paratransit operations, transit vehicle maintenance data, etc.
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- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.
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- Requirement:* 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the transit data or for the data itself.
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- Requirement:* 4 The center shall be able to produce sample products of the data available.
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Element: **Private Terminal Operators Systems**

Entity: **Fleet and Freight Management**

Functional Area: **Fleet Administration**

Commercial vehicle fleet tracking, dispatch, and reporting - includes interfaces to state/federal commercial vehicle administration, toll administration, emergency management, map update providers, and traveler information service providers.

- Requirement:* 1 The center shall send data concerning enrollment of commercial vehicles for electronic clearance and tax filing to the appropriate commercial vehicle administration center. The data may include driver and vehicle identification, safety inspections/status, carrier credentials, related citations, and accident information.
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- Requirement:* 2 The center shall obtain and manage commercial vehicle routes for its fleet of vehicles, taking into account route restrictions, advance payment of tolls, HAZMAT restrictions, and current traffic and road conditions provided by traveler information systems.
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- Requirement:* 3 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as the background for commercial vehicle fleet administration - includes commercial vehicle specific data such as route or HAZMAT restrictions.
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- Requirement:* 4 The center shall monitor the locations and progress of commercial vehicles against their planned routes and raise appropriate warnings based on route monitoring parameters.
-
- Requirement:* 5 The center shall coordinate the response to security incidents and the sharing of security threat information involving commercial vehicles with other agencies including emergency management centers and alerting/advisory systems.
-

Architecture**Northern New Jersey ITS Architecture***Element:Private Terminal Operators Systems**Entity:Fleet and Freight Management**Functional Area: Fleet HAZMAT Management*

Notification of hazardous materials (HAZMAT) shipments to emergency management centers for commercial vehicles managed by the center - includes information on the nature of the cargo, the vehicle, and its expected route.

- Requirement:* 1 The center shall track the routing and cargo information, including the manifest data plus the chemical characteristics of a hazardous materials (HAZMAT) load being carried by its fleet of commercial vehicles.
- Requirement:* 2 The center shall provide information concerning commercial vehicles carrying hazardous materials (HAZMAT) upon request from an emergency management center. The information includes the nature of the cargo being carried, identity of the vehicle and unloading instructions.

*Element:Private Tow Dispatch**Entity:Emergency Management**Functional Area: Emergency Response Management*

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

- Requirement:* 1 The center shall provide strategic emergency response capabilities such as that of an Emergency Operations Center for large-scale incidents and disasters.
- Requirement:* 2 The center shall manage coordinated inter-agency responses to and recovery from large-scale emergencies. Such agencies include traffic management, transit, maintenance and construction management, rail operations, and other emergency management agencies.
- Requirement:* 3 The center shall provide the capability to implement response plans and track progress through the incident by exchanging incident information and distributing response status to allied agencies.
- Requirement:* 4 The center shall develop, coordinate with other agencies, and store emergency response plans.
- Requirement:* 5 The center shall track the availability of resources (including vehicles, roadway cleanup?, etc.), request additional resources from traffic, maintenance, or other emergency centers if needed.
- Requirement:* 6 The center shall allocate the appropriate emergency services, resources, and vehicle (s) to respond to incidents, and shall provide the capability to override the current allocation to suit the special needs of a current incident.
- Requirement:* 7 The center shall receive event scheduling information from Event Promoters.
- Requirement:* 8 The center shall receive hazardous materials incident information from commercial fleet operators.
- Requirement:* 9 The center shall provide the capability to request the safe disabling of a commercial vehicle during a hazardous materials incident.
- Requirement:* 10 The center shall provide the capability to request transit resource availability from transit centers for use during disaster and evacuation operations.
- Requirement:* 11 The center shall assimilate the status of the transit, traffic, rail, maintenance, and other emergency center services and systems to create an overall transportation system status, and disseminate to each of these centers and the traveling public via traveler information providers.
- Requirement:* 12 The center shall provide information to the media concerning the status of an emergency response.
- Requirement:* 13 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.
- Requirement:* 14 The center shall provide the capability for center personnel to provide inputs to the management of incidents, disasters and evacuations.

Functional Area: Incident Command

Architecture**Northern New Jersey ITS Architecture***Element:Private Tow Dispatch**Entity:Emergency Management**Functional Area: Incident Command*

Tactical decision support, resource coordination, and communications integration among emergency management agencies for Incident Commands that are established by first responders to support local management of an incident.

- Requirement:* 1 The center shall provide tactical decision support, resource coordination, and communications integration for Incident Commands that are established by first responders to support local management of an incident.
- Requirement:* 2 The center shall provide incident command communications with public safety, emergency management, transportation, and other allied response agency centers.
- Requirement:* 3 The center shall track and maintain resource information and action plans pertaining to the incident command.
- Requirement:* 4 The center shall share incident command information with other public safety agencies including resource deployment status, hazardous material information, rail incident information, evacuation advice as well as traffic, road, and weather conditions.
- Requirement:* 5 The center shall assess the status of responding emergency vehicles as part of an incident command.

*Element:Private Venues TOCs**Entity:Emergency Management**Functional Area: Emergency Response Management*

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

- Requirement:* 1 The center shall provide strategic emergency response capabilities such as that of an Emergency Operations Center for large-scale incidents and disasters.
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- Requirement:* 3 The center shall provide the capability to implement response plans and track progress through the incident by exchanging incident information and distributing response status to allied agencies.
- Requirement:* 4 The center shall develop, coordinate with other agencies, and store emergency response plans.
- Requirement:* 5 The center shall track the availability of resources (including vehicles, roadway cleanup?, etc.), request additional resources from traffic, maintenance, or other emergency centers if needed.
- Requirement:* 6 The center shall allocate the appropriate emergency services, resources, and vehicle (s) to respond to incidents, and shall provide the capability to override the current allocation to suit the special needs of a current incident.
- Requirement:* 7 The center shall receive event scheduling information from Event Promoters.
- Requirement:* 8 The center shall receive hazardous materials incident information from commercial fleet operators.
- Requirement:* 9 The center shall provide the capability to request the safe disabling of a commercial vehicle during a hazardous materials incident.
- Requirement:* 10 The center shall provide the capability to request transit resource availability from transit centers for use during disaster and evacuation operations.
- Requirement:* 11 The center shall assimilate the status of the transit, traffic, rail, maintenance, and other emergency center services and systems to create an overall transportation system status, and disseminate to each of these centers and the traveling public via traveler information providers.
- Requirement:* 12 The center shall provide information to the media concerning the status of an emergency response.

Architecture

Northern New Jersey ITS Architecture

Element: **Private Venues TOCs**

Entity: **Emergency Management**

Functional Area: **Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

Requirement: 13 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.

Requirement: 14 The center shall provide the capability for center personnel to provide inputs to the management of incidents, disasters and evacuations.

Functional Area: **Incident Command**

Tactical decision support, resource coordination, and communications integration among emergency management agencies for Incident Commands that are established by first responders to support local management of an incident.

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Requirement: 4 The center shall share incident command information with other public safety agencies including resource deployment status, hazardous material information, rail incident information, evacuation advice as well as traffic, road, and weather conditions.

Requirement: 5 The center shall assess the status of responding emergency vehicles as part of an incident command.

Entity: **Traffic Management**

Functional Area: **TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

Requirement: 1 The center shall remotely control traffic signal controllers.

Requirement: 2 The center shall accept notifications of right-of-way requests from pedestrians.

Requirement: 3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center.

Requirement: 4 The center shall collect traffic signal controller fault data from the field.

Requirement: 5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.

Functional Area: **TMC Freeway Management**

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

Requirement: 1 The center shall remotely control systems to manage use of the freeways, including ramp meters, mainline metering, and lane controls.

Requirement: 2 The center shall collect operational status from ramp meters, mainline metering, and lane controls and compare against the control information sent by the center.

Architecture

Northern New Jersey ITS Architecture

Element: **Private Venues TOCs**

Entity: **Traffic Management**

Functional Area: **TMC Freeway Management**

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

Requirement: 3 The center shall collect fault data from ramp meters, mainline metering, and lane controls.

Requirement: 4 The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, mainline metering, and lane controls), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the ramps themselves.

Functional Area: **TMC Regional Traffic Control**

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

Requirement: 1 The center shall exchange traffic information with other traffic management centers, includes incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.

Requirement: 2 The center shall exchange traffic control information with other traffic management centers, includes remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).

Functional Area: **TMC Incident Detection**

Remotely controls traffic and video sensors to support incident detection and verification; exchange information with other agencies including emergency management, maintenance and construction, alerting and advisory systems, event promoters, intermodal freight depots, and traveler information systems.

Requirement: 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.

Requirement: 2 The center shall collect and store traffic flow and image data from the field equipment to detect and verify incidents.

Requirement: 3 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, and intermodal freight depots.

Requirement: 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.

Requirement: 5 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field.

Requirement: 6 The center shall provide road network conditions and traffic images to emergency management centers to support the detection, verification, and classification of incidents.

Requirement: 7 The center shall provide video and traffic sensor control commands to the field equipment to detect and verify incidents.

Functional Area: **TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

Architecture**Northern New Jersey ITS Architecture***Element:Private Venues TOCs**Entity:Traffic Management**Functional Area: TMC Incident Dispatch Coordination/Communication*

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

- Requirement:* 1 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction for distribution to the public. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, and information and instructions necessary for the public to respond to the alert. This may also identify specific information that should not be released to the public.
- Requirement:* 2 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.
- Requirement:* 3 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field, provide special routing for emergency vehicles, and to provide responding emergency vehicles with signal preemption.
- Requirement:* 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.
- Requirement:* 5 The center shall respond to requests from emergency management to provide traffic management resources to implement special traffic control measures, assist in clean up, verify an incident, etc. This may also involve coordination with maintenance centers.
- Requirement:* 6 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, media, and rail operations centers.
- Requirement:* 7 The center shall provide road network conditions and traffic images to emergency management centers, maintenance and construction centers, and traveler information service providers.
- Requirement:* 8 The center shall exchange road network status assessment information with emergency management and maintenance centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.
- Requirement:* 9 The center shall coordinate information and controls with other traffic management centers.
- Requirement:* 10 The center shall receive inputs from emergency management and transit management centers to develop an overall status of the transportation system including emergency transit schedules in effect and current status and condition of the transportation infrastructure.
- Requirement:* 11 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic incident management.

*Element:Rutgers Campus Shuttle System**Entity:Transit Management**Functional Area: Transit Center Tracking and Dispatch*

Monitoring transit vehicle locations via interactions with on-board systems and determining vehicle schedule adherence. Furnish users with real-time transit related information and maintain interface with digital map providers.

- Requirement:* 1 The center shall monitor the locations of all transit vehicles within its network.
- Requirement:* 2 The center shall determine adherence of transit vehicles to their assigned schedule.

Architecture**Northern New Jersey ITS Architecture****Element: Rutgers Campus Shuttle System****Entity: Transit Management****Functional Area: Transit Center Tracking and Dispatch**

Monitoring transit vehicle locations via interactions with on-board systems and determining vehicle schedule adherence. Furnish users with real-time transit related information and maintain interface with digital map providers.

- Requirement:* 3 The center shall collect trip monitoring data from on-board systems including transit vehicle mileage, fuel usage, passenger loading, availability, etc.
- Requirement:* 4 The center shall provide transit operational data to traveler information service providers.
- Requirement:* 5 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for transit tracking and dispatch.

Functional Area: Transit Center Fixed-Route Operations

Planning and scheduling associated with fixed and flexible route transit services, automatically updates customer service operator systems, and provides current vehicle schedule adherence and optimum scenarios for schedule adjustment.

- Requirement:* 1 The center shall generate transit routes and schedules based on such factors as parameters input by the system operator, road network conditions, operational data on current routes and schedules, and digitized map data.
- Requirement:* 2 The center shall provide the interface to the system operator to control the generation of new routes and schedules (transit services) including the ability to review and update the parameters used by the routes and schedules generation processes and to initiate these processes
- Requirement:* 3 The center shall be able to generate special routes and schedules to support an incident, disaster, evacuation, or other emergency.
- Requirement:* 4 The center shall accept requests from traffic management to change routes and schedules as part of the implementation of demand management strategies.
- Requirement:* 5 The center shall collect transit operational data for use in the generation of routes and schedules.
- Requirement:* 6 The center shall assign transit vehicle operators based on factors such as eligibility, route preferences, seniority, and transit vehicle availability.
- Requirement:* 7 The center shall manage large deviations of individual transit vehicles, deviations in rural areas, and deviations of large numbers of vehicles.
- Requirement:* 8 The center shall generate the necessary corrective actions which may involve more than the vehicles concerned and more far reaching action, such as, the introduction of extra vehicles, wide area signal priority by traffic management, the premature termination of some services, etc.
- Requirement:* 9 The center shall exchange information with Maintenance and Construction Operations concerning work zones, roadway conditions, asset restrictions, work plans, etc.
- Requirement:* 10 The center shall disseminate up-to-date schedules and route information to other centers for fixed and flexible route services.

Functional Area: Transit Center Paratransit Operations

Planning and scheduling of demand responsive transit (i.e. paratransit) services, includes automatic operator assignment and monitoring.

- Requirement:* 1 The center shall process trip requests for demand responsive transit services, i.e. paratransit. Sources of the requests may include traveler information service providers.
- Requirement:* 2 The center shall track the location and availability of transit vehicles for use in demand responsive transit (paratransit) operations.

Architecture**Northern New Jersey ITS Architecture****Element: Rutgers Campus Shuttle System****Entity: Transit Management****Functional Area: Transit Center Paratransit Operations**

Planning and scheduling of demand responsive transit (i.e. paratransit) services, includes automatic operator assignment and monitoring.

- Requirement:* 3 The center shall generate demand responsive transit (paratransit) routes and schedules based on such factors as parameters input by the system operator, what other demand responsive transit schedules have been planned, the availability and location of vehicles, the relevance of any fixed transit routes and schedules, and road network information.
- Requirement:* 4 The center shall assign transit vehicle operators for confirmed demand responsive transit (paratransit) trips based on factors such as eligibility, route preferences, seniority, and transit vehicle availability.
- Requirement:* 5 The center shall exchange information with Maintenance and Construction Operations concerning work zones, roadway conditions, asset restrictions, work plans, etc.
- Requirement:* 6 The center shall disseminate up-to-date schedules and route information to other centers for demand responsive transit services (paratransit).

Functional Area: Transit Center Security

Monitor transit vehicle operator or traveler activated alarms; authenticate transit vehicle operators; remotely disable a transit vehicle; alert operators, travelers, and police to potential incidents identified by these security features.

- Requirement:* 1 The center shall monitor transit vehicle operational data to determine if the transit vehicle is off-route and assess whether a security incident is occurring.
- Requirement:* 2 The center shall receive reports of emergencies on-board transit vehicles entered directly by the transit vehicle operator or from a traveler through interfaces such as panic buttons or alarm switches.
- Requirement:* 3 The center shall support the back-office portion of functionality to authenticate transit vehicle operators.
- Requirement:* 4 The center shall exchange transit incident information along with other service data with other transit agencies.
- Requirement:* 5 The center shall receive information pertaining to a wide-area alert such as weather alerts, disaster situations, or child abductions. This information may come from Emergency Management or from other Alerting and Advisory Systems.
- Requirement:* 6 The center shall send wide-area alert information to travelers (on-board transit vehicles or at stations/stops) and transit vehicle operators.
- Requirement:* 7 The center shall coordinate the response to security incidents involving transit with other agencies including Emergency Management, other transit agencies, media, traffic management, and traveler information service providers.
- Requirement:* 8 The center shall receive threat information and status on the integrity of the transit infrastructure.
- Requirement:* 9 The center shall provide support to remotely disable (or reset the disabling of) a transit vehicle in service.

Functional Area: Transit Garage Operations

Assignment of transit vehicles and operators to routes or service areas in a fair manner while minimizing labor and overtime services, considering operator preferences, qualifications, accumulated work hours, and other information about each operator.

- Requirement:* 1 The center shall maintain records of a transit vehicle operator's performance. This may be done utilizing standardized performance evaluation criteria set forth by governmental regulations and transit operating company policies, assessing the transit vehicle operator's driving history, and assessing comments from the transit vehicle operator's supervisor(s) as well as noting any moving violations or accidents, supervisor comments, government regulations, and company policies.

Architecture

Northern New Jersey ITS Architecture

*Element:***Rutgers Campus Shuttle System**

*Entity:***Transit Management**

Functional Area: **Transit Garage Operations**

Assignment of transit vehicles and operators to routes or service areas in a fair manner while minimizing labor and overtime services, considering operator preferences, qualifications, accumulated work hours, and other information about each operator.

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| <i>Requirement:</i> | 2 The center shall assess the transit vehicle operator's availability based on previous work assignments, accumulated hours, plus health and vacation commitments. |
| <i>Requirement:</i> | 3 The center shall assign transit vehicle operators to transit schedules based on their eligibility, route preferences, seniority, and transit vehicle availability. |
| <i>Requirement:</i> | 4 The center shall provide an interface through which the transit vehicle operator information can be maintained - either from the transit vehicle operator, a transit system operator (i.e. center personnel), or other functions. |
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*Element:***Rutgers Campus Shuttles**

*Entity:***Transit Vehicle Subsystem**

Functional Area: **On-board Transit Trip Monitoring**

Support fleet management with automatic vehicle location (AVL) and automated mileage and fuel reporting and auditing.

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| <i>Requirement:</i> | 1 The transit vehicle shall compute the location of the transit vehicle based on inputs from a vehicle location determination function. |
| <i>Requirement:</i> | 2 The transit vehicle shall support the computation of the location of a transit vehicle using on-board sensors to augment the location determination function. This may include proximity to the transit stops or other known reference points as well as recording trip length. |
| <i>Requirement:</i> | 3 The transit vehicle shall record transit trip monitoring data including vehicle mileage and fuel usage. |
| <i>Requirement:</i> | 4 The transit vehicle shall record transit trip monitoring data including operational status information such as doors open/closed, passenger loading, running times, etc. |
| <i>Requirement:</i> | 5 The transit vehicle shall send the transit vehicle trip monitoring data to center-based trip monitoring functions. |
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Functional Area: **On-board Fixed Route Schedule Management**

Collecting of data for schedule generation and adjustment on-board a transit vehicle. Supports communication between the vehicle, operator, and center.

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| <i>Requirement:</i> | 1 The transit vehicle shall receive transit route information for its assigned route including transit service instructions, traffic information, road conditions, and other information for the operator. |
| <i>Requirement:</i> | 2 The transit vehicle shall use the route information and its current location to determine the deviation from the predetermined schedule. |
| <i>Requirement:</i> | 3 The transit vehicle shall calculate the estimated times of arrival (ETA) at transit stops. |
| <i>Requirement:</i> | 4 The transit vehicle shall determine scenarios to correct the schedule deviation. |
| <i>Requirement:</i> | 5 The transit vehicle shall provide the schedule deviations and instructions for schedule corrections to the transit vehicle operator if the deviation is small, or the transit vehicle is operating in an urban area. |
| <i>Requirement:</i> | 6 The transit vehicle shall send the schedule deviation and estimated arrival time information to the center. |
| <i>Requirement:</i> | 7 The transit vehicle shall support the operations of a flexible route service. This may include requests for route deviations that would then lead to schedule corrective actions. |
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Functional Area: **On-board Paratransit Operations**

Architecture**Northern New Jersey ITS Architecture***Element:***Rutgers Campus Shuttles***Entity:***Transit Vehicle Subsystem***Functional Area:* **On-board Paratransit Operations**

On-board systems to manage paratransit and flexible-route dispatch requests, including multi-stop runs. Inputs based on the transit vehicle's type and passenger capacity.

- Requirement:* 1 The transit vehicle shall manage data input to sensor(s) on-board a transit vehicle to determine the vehicle's availability for use in demand responsive and flexible-route transit services based on identity, type, and passenger capacity.
- Requirement:* 2 The transit vehicle shall receive the status of demand responsive or flexible-route transit schedules and passenger loading from the transit vehicle operator.
- Requirement:* 3 The transit vehicle shall provide the transit vehicle operator instructions about the demand responsive or flexible-route transit schedule that has been confirmed from the center.

Functional Area: **On-board Transit Security**

On-board video/audio surveillance systems, threat sensors, and object detection sensors to enhance security and safety on-board a transit vehicles. Also includes silent alarms activated by transit user or vehicle operator, operator authentication, and remote vehicle disabling.

- Requirement:* 1 The transit vehicle shall perform video and audio surveillance inside of transit vehicles and output raw video or audio data for either local monitoring (for processing or direct output to the transit vehicle operator), remote monitoring or for local storage (e.g., in an event recorder).
- Requirement:* 2 The transit vehicle shall perform local monitoring of video or audio surveillance data collected inside of transit vehicles, and identify potential incidents or threats based on received processing parameters.
- Requirement:* 3 The transit vehicle shall output an indication of potential incidents or threats and the processed video or audio information to the center along with the vehicle's current location.
- Requirement:* 4 The transit vehicle shall detect potential threats via sensors for chemical agents, toxic industrial chemicals, biological agents, explosives, and radiation.
- Requirement:* 5 The transit vehicle shall detect potential threats via object detection sensors(e.g. metal detectors).
- Requirement:* 6 The transit vehicle shall output an indication of potential incidents or threats and the processed sensor information to the center along with the vehicle's current location.
- Requirement:* 7 The transit vehicle shall accept sensor control data to allow remote control of the sensors.
- Requirement:* 8 The transit vehicle shall monitor and output surveillance and sensor equipment status and fault indications.
- Requirement:* 9 The transit vehicle shall accept emergency inputs from either the transit vehicle operator or a traveler through such interfaces as panic buttons, silent or audible alarms, etc.
- Requirement:* 10 The transit vehicle shall output reported emergencies to the center.
- Requirement:* 11 The transit vehicle shall receive acknowledgments of the emergency request from the center and output this acknowledgment to the transit vehicle operator or to the travelers.
- Requirement:* 12 The transit vehicle shall be capable of receiving an emergency message for broadcast to the travelers or to the transit vehicle operator.
- Requirement:* 13 The transit vehicle shall be capable of disabling or enabling the transit vehicle based on commands from the center or authentic inputs from the transit vehicle operator.
- Requirement:* 14 The transit vehicle shall perform authentication of the transit vehicle operator.

Functional Area: **On-board Transit Signal Priority**

On-board systems to provides request signal priority through short range communication directly with traffic control equipment at the roadside (intersections, crossings, ramp meters, etc.).

Architecture

Northern New Jersey ITS Architecture

*Element:***Rutgers Campus Shuttles**

*Entity:***Transit Vehicle Subsystem**

Functional Area: **On-board Transit Signal Priority**

On-board systems to provides request signal priority through short range communication directly with traffic control equipment at the roadside (intersections, crossings, ramp meters, etc.).

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| <i>Requirement:</i> | 1 The transit vehicle shall determine the schedule deviation and estimated times of arrival (ETA) at transit stops. |
| <i>Requirement:</i> | 2 The transit vehicle shall send priority requests to traffic signal controllers at intersections, pedestrian crossings, and multimodal crossings on the roads (surface streets) and freeway (ramp controls) network that enable a transit vehicle schedule deviation to be corrected. |
| <i>Requirement:</i> | 3 The transit vehicle shall send the schedule deviation data and status of priority requests to the transit vehicle operator. |
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*Element:***School Bus Operators**

*Entity:***Transit Management**

Functional Area: **Transit Center Tracking and Dispatch**

Monitoring transit vehicle locations via interactions with on-board systems and determining vehicle schedule adherence. Furnish users with real-time transit related information and maintain interface with digital map providers.

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| <i>Requirement:</i> | 1 The center shall monitor the locations of all transit vehicles within its network. |
| <i>Requirement:</i> | 2 The center shall determine adherence of transit vehicles to their assigned schedule. |
| <i>Requirement:</i> | 3 The center shall collect trip monitoring data from on-board systems including transit vehicle mileage, fuel usage, passenger loading, availability, etc. |
| <i>Requirement:</i> | 4 The center shall provide transit operational data to traveler information service providers. |
| <i>Requirement:</i> | 5 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for transit tracking and dispatch. |
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Functional Area: **Transit Center Fixed-Route Operations**

Planning and scheduling associated with fixed and flexible route transit services, automatically updates customer service operator systems, and provides current vehicle schedule adherence and optimum scenarios for schedule adjustment.

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| <i>Requirement:</i> | 1 The center shall generate transit routes and schedules based on such factors as parameters input by the system operator, road network conditions, operational data on current routes and schedules, and digitized map data. |
| <i>Requirement:</i> | 2 The center shall provide the interface to the system operator to control the generation of new routes and schedules (transit services) including the ability to review and update the parameters used by the routes and schedules generation processes and to initiate these processes |
| <i>Requirement:</i> | 3 The center shall be able to generate special routes and schedules to support an incident, disaster, evacuation, or other emergency. |
| <i>Requirement:</i> | 4 The center shall accept requests from traffic management to change routes and schedules as part of the implementation of demand management strategies. |
| <i>Requirement:</i> | 5 The center shall collect transit operational data for use in the generation of routes and schedules. |
| <i>Requirement:</i> | 6 The center shall assign transit vehicle operators based on factors such as eligibility, route preferences, seniority, and transit vehicle availability. |
| <i>Requirement:</i> | 7 The center shall manage large deviations of individual transit vehicles, deviations in rural areas, and deviations of large numbers of vehicles. |
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Architecture

Northern New Jersey ITS Architecture

Element: **School Bus Operators**

Entity: **Transit Management**

Functional Area: **Transit Center Fixed-Route Operations**

Planning and scheduling associated with fixed and flexible route transit services, automatically updates customer service operator systems, and provides current vehicle schedule adherence and optimum scenarios for schedule adjustment.

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| <i>Requirement:</i> | 8 The center shall generate the necessary corrective actions which may involve more than the vehicles concerned and more far reaching action, such as, the introduction of extra vehicles, wide area signal priority by traffic management, the premature termination of some services, etc. |
| <i>Requirement:</i> | 9 The center shall exchange information with Maintenance and Construction Operations concerning work zones, roadway conditions, asset restrictions, work plans, etc. |
| <i>Requirement:</i> | 10 The center shall disseminate up-to-date schedules and route information to other centers for fixed and flexible route services. |
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Functional Area: **Transit Center Security**

Monitor transit vehicle operator or traveler activated alarms; authenticate transit vehicle operators; remotely disable a transit vehicle; alert operators, travelers, and police to potential incidents identified by these security features.

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| <i>Requirement:</i> | 1 The center shall monitor transit vehicle operational data to determine if the transit vehicle is off-route and assess whether a security incident is occurring. |
| <i>Requirement:</i> | 2 The center shall receive reports of emergencies on-board transit vehicles entered directly by the transit vehicle operator or from a traveler through interfaces such as panic buttons or alarm switches. |
| <i>Requirement:</i> | 3 The center shall support the back-office portion of functionality to authenticate transit vehicle operators. |
| <i>Requirement:</i> | 4 The center shall exchange transit incident information along with other service data with other transit agencies. |
| <i>Requirement:</i> | 5 The center shall receive information pertaining to a wide-area alert such as weather alerts, disaster situations, or child abductions. This information may come from Emergency Management or from other Alerting and Advisory Systems. |
| <i>Requirement:</i> | 6 The center shall send wide-area alert information to travelers (on-board transit vehicles or at stations/stops) and transit vehicle operators. |
| <i>Requirement:</i> | 7 The center shall coordinate the response to security incidents involving transit with other agencies including Emergency Management, other transit agencies, media, traffic management, and traveler information service providers. |
| <i>Requirement:</i> | 8 The center shall receive threat information and status on the integrity of the transit infrastructure. |
| <i>Requirement:</i> | 9 The center shall provide support to remotely disable (or reset the disabling of) a transit vehicle in service. |
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Functional Area: **Transit Garage Operations**

Assignment of transit vehicles and operators to routes or service areas in a fair manner while minimizing labor and overtime services, considering operator preferences, qualifications, accumulated work hours, and other information about each operator.

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| <i>Requirement:</i> | 1 The center shall maintain records of a transit vehicle operator's performance. This may be done utilizing standardized performance evaluation criteria set forth by governmental regulations and transit operating company policies, assessing the transit vehicle operator's driving history, and assessing comments from the transit vehicle operator's supervisor(s) as well as noting any moving violations or accidents, supervisor comments, government regulations, and company policies. |
| <i>Requirement:</i> | 2 The center shall assess the transit vehicle operator's availability based on previous work assignments, accumulated hours, plus health and vacation commitments. |
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Architecture

Northern New Jersey ITS Architecture

*Element:***School Bus Operators**

*Entity:***Transit Management**

Functional Area: **Transit Garage Operations**

Assignment of transit vehicles and operators to routes or service areas in a fair manner while minimizing labor and overtime services, considering operator preferences, qualifications, accumulated work hours, and other information about each operator.

Requirement: 3 The center shall assign transit vehicle operators to transit schedules based on their eligibility, route preferences, seniority, and transit vehicle availability.

Requirement: 4 The center shall provide an interface through which the transit vehicle operator information can be maintained - either from the transit vehicle operator, a transit system operator (i.e. center personnel), or other functions.

Functional Area: **Transit Center Multi-Modal Coordination**

Generate requests for transit priority on routes and at certain intersections. Coordinate schedules with other agencies and modes, including transit transfer cluster and transfer point information.

Requirement: 1 The center shall analyze transit vehicle schedule performance to determine the need for priority along certain routes or at certain intersections.

Requirement: 2 The center shall send requests for priority along routes or at intersections to traffic management.

Requirement: 3 The center shall coordinate schedules and services between transit agencies, traffic management, maintenance and construction operations, parking management, and other surface or air transportation modes.

Requirement: 4 The center shall share transfer cluster and transfer point information with multimodal transportation service providers, other transit agencies, and traveler information service providers. A transfer cluster is a collection of stops, stations, or terminals where transfers can be made conveniently.

*Element:***School Buses**

*Entity:***Transit Vehicle Subsystem**

Functional Area: **On-board Transit Trip Monitoring**

Support fleet management with automatic vehicle location (AVL) and automated mileage and fuel reporting and auditing.

Requirement: 1 The transit vehicle shall compute the location of the transit vehicle based on inputs from a vehicle location determination function.

Requirement: 2 The transit vehicle shall support the computation of the location of a transit vehicle using on-board sensors to augment the location determination function. This may include proximity to the transit stops or other known reference points as well as recording trip length.

Requirement: 3 The transit vehicle shall record transit trip monitoring data including vehicle mileage and fuel usage.

Requirement: 4 The transit vehicle shall record transit trip monitoring data including operational status information such as doors open/closed, passenger loading, running times, etc.

Requirement: 5 The transit vehicle shall send the transit vehicle trip monitoring data to center-based trip monitoring functions.

Functional Area: **On-board Fixed Route Schedule Management**

Collecting of data for schedule generation and adjustment on-board a transit vehicle. Supports communication between the vehicle, operator, and center.

Requirement: 1 The transit vehicle shall receive transit route information for its assigned route including transit service instructions, traffic information, road conditions, and other information for the operator.

Requirement: 2 The transit vehicle shall use the route information and its current location to determine the deviation from the predetermined schedule.

Architecture**Northern New Jersey ITS Architecture***Element:School Buses**Entity:Transit Vehicle Subsystem**Functional Area: On-board Fixed Route Schedule Management*

Collecting of data for schedule generation and adjustment on-board a transit vehicle. Supports communication between the vehicle, operator, and center.

- Requirement:* 3 The transit vehicle shall calculate the estimated times of arrival (ETA) at transit stops.
- Requirement:* 4 The transit vehicle shall determine scenarios to correct the schedule deviation.
- Requirement:* 5 The transit vehicle shall provide the schedule deviations and instructions for schedule corrections to the transit vehicle operator if the deviation is small, or the transit vehicle is operating in an urban area.
- Requirement:* 6 The transit vehicle shall send the schedule deviation and estimated arrival time information to the center.
- Requirement:* 7 The transit vehicle shall support the operations of a flexible route service. This may include requests for route deviations that would then lead to schedule corrective actions.

*Element:Subregional Data Archives**Entity:Archived Data Management Subsystem**Functional Area: ITS Data Repository*

Collect and maintain data and data catalogs from one or more data sources. May include quality checks, error notification, and archive coordination.

- Requirement:* 1 The center shall collect data to be archived from one or more data sources.
- Requirement:* 2 The center shall collect data catalogs from one or more data sources. A catalog describes the data contained in the collection of archived data and may include descriptions of the schema or structure of the data, a description of the contents of the data; e.g., time range of entries, number of entries; or a sample of the data (e. g. a thumbnail).
- Requirement:* 3 The center shall store the archived data in a focused repository that is suited to a particular set of ITS data users.
- Requirement:* 4 The center shall include capabilities for performing quality checks on the incoming archived data.
- Requirement:* 5 The center shall include capabilities for error notification on the incoming archived data.
- Requirement:* 6 The center shall include capabilities for archive to archive coordination.
- Requirement:* 7 The center shall support a broad range of archived data management implementations, ranging from simple data marts that collect a focused set of data and serve a particular user community to large-scale data warehouses that collect, integrate, and summarize transportation data from multiple sources and serve a broad array of users within a region.
- Requirement:* 8 The center shall perform quality checks on received data.
- Requirement:* 9 The center shall provide the capability to execute methods on the incoming data such as cleansing, summarizations, aggregations, or transformations applied to the data before it is stored in the archive.
- Requirement:* 10 The center shall respond to requests from the administrator interface function to maintain the archive data.
- Requirement:* 11 When data or a catalog of data is received from the archive, the center shall generate the requested data product for the users systems.
- Requirement:* 12 For archive data requiring financial payment, the center shall process the financial requests and manage an interface to a Financial Institution.

Functional Area: Virtual Data Warehouse Services

Provides access to data from geographically dispersed archives and coordinates information exchange with a local data warehouse. Also provides the specialized publishing, directory services, and transaction management functions associated with coordinating remote archives.

Architecture

Northern New Jersey ITS Architecture

Element:Subregional Data Archives

Entity:Archived Data Management Subsystem

Functional Area: Virtual Data Warehouse Services

Provides access to data from geographically dispersed archives and coordinates information exchange with a local data warehouse. Also provides the specialized publishing, directory services, and transaction management functions associated with coordinating remote archives.

- Requirement:* 1 The center shall provide capabilities to access "in-place" data from geographically dispersed archives. These capabilities may include analysis, data fusion, or data mining.
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- Requirement:* 2 The center shall coordinate information exchange with a local data warehouse.
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- Requirement:* 3 The center shall provide the specialized publishing, directory services, and transaction management functions associated with coordinating remote archives.
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- Requirement:* 4 The center shall support the collection of archived data from other archives on an as-needed basis. (This minimizes the need to duplicate the comprehensive set of data from the remote archives in the local data warehouse.)
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- Requirement:* 5 The center shall use data collected from different archives to build a set of global schema including the data archive definitions for the local archive plus any archives known to the local archive.
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- Requirement:* 6 The center shall provide the local archived data schema to other archive systems.
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Element:TMA Vehicles

Entity:Transit Vehicle Subsystem

Functional Area: On-board Transit Trip Monitoring

Support fleet management with automatic vehicle location (AVL) and automated mileage and fuel reporting and auditing.

- Requirement:* 1 The transit vehicle shall compute the location of the transit vehicle based on inputs from a vehicle location determination function.
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- Requirement:* 2 The transit vehicle shall support the computation of the location of a transit vehicle using on-board sensors to augment the location determination function. This may include proximity to the transit stops or other known reference points as well as recording trip length.
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- Requirement:* 3 The transit vehicle shall record transit trip monitoring data including vehicle mileage and fuel usage.
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- Requirement:* 4 The transit vehicle shall record transit trip monitoring data including operational status information such as doors open/closed, passenger loading, running times, etc.
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- Requirement:* 5 The transit vehicle shall send the transit vehicle trip monitoring data to center-based trip monitoring functions.
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Functional Area: On-board Fixed Route Schedule Management

Collecting of data for schedule generation and adjustment on-board a transit vehicle. Supports communication between the vehicle, operator, and center.

- Requirement:* 1 The transit vehicle shall receive transit route information for its assigned route including transit service instructions, traffic information, road conditions, and other information for the operator.
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- Requirement:* 2 The transit vehicle shall use the route information and its current location to determine the deviation from the predetermined schedule.
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- Requirement:* 3 The transit vehicle shall calculate the estimated times of arrival (ETA) at transit stops.
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- Requirement:* 4 The transit vehicle shall determine scenarios to correct the schedule deviation.
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- Requirement:* 5 The transit vehicle shall provide the schedule deviations and instructions for schedule corrections to the transit vehicle operator if the deviation is small, or the transit vehicle is operating in an urban area.
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- Requirement:* 6 The transit vehicle shall send the schedule deviation and estimated arrival time information to the center.
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Architecture**Northern New Jersey ITS Architecture***Element:* **TMA Vehicles***Entity:* **Transit Vehicle Subsystem***Functional Area:* **On-board Fixed Route Schedule Management**

Collecting of data for schedule generation and adjustment on-board a transit vehicle. Supports communication between the vehicle, operator, and center.

- Requirement:* 7 The transit vehicle shall support the operations of a flexible route service. This may include requests for route deviations that would then lead to schedule corrective actions.

Functional Area: **On-board Paratransit Operations**

On-board systems to manage paratransit and flexible-route dispatch requests, including multi-stop runs. Inputs based on the transit vehicle's type and passenger capacity.

- Requirement:* 1 The transit vehicle shall manage data input to sensor(s) on-board a transit vehicle to determine the vehicle's availability for use in demand responsive and flexible-route transit services based on identity, type, and passenger capacity.

- Requirement:* 2 The transit vehicle shall receive the status of demand responsive or flexible-route transit schedules and passenger loading from the transit vehicle operator.

- Requirement:* 3 The transit vehicle shall provide the transit vehicle operator instructions about the demand responsive or flexible-route transit schedule that has been confirmed from the center.

Functional Area: **On-board Transit Security**

On-board video/audio surveillance systems, threat sensors, and object detection sensors to enhance security and safety on-board a transit vehicles. Also includes silent alarms activated by transit user or vehicle operator, operator authentication, and remote vehicle disabling.

- Requirement:* 1 The transit vehicle shall perform video and audio surveillance inside of transit vehicles and output raw video or audio data for either local monitoring (for processing or direct output to the transit vehicle operator), remote monitoring or for local storage (e.g., in an event recorder).

- Requirement:* 2 The transit vehicle shall perform local monitoring of video or audio surveillance data collected inside of transit vehicles, and identify potential incidents or threats based on received processing parameters.

- Requirement:* 3 The transit vehicle shall output an indication of potential incidents or threats and the processed video or audio information to the center along with the vehicle's current location.

- Requirement:* 4 The transit vehicle shall detect potential threats via sensors for chemical agents, toxic industrial chemicals, biological agents, explosives, and radiation.

- Requirement:* 5 The transit vehicle shall detect potential threats via object detection sensors(e.g. metal detectors).

- Requirement:* 6 The transit vehicle shall output an indication of potential incidents or threats and the processed sensor information to the center along with the vehicle's current location.

- Requirement:* 7 The transit vehicle shall accept sensor control data to allow remote control of the sensors.

- Requirement:* 8 The transit vehicle shall monitor and output surveillance and sensor equipment status and fault indications.

- Requirement:* 9 The transit vehicle shall accept emergency inputs from either the transit vehicle operator or a traveler through such interfaces as panic buttons, silent or audible alarms, etc.

- Requirement:* 10 The transit vehicle shall output reported emergencies to the center.

- Requirement:* 11 The transit vehicle shall receive acknowledgments of the emergency request from the center and output this acknowledgment to the transit vehicle operator or to the travelers.

- Requirement:* 12 The transit vehicle shall be capable of receiving an emergency message for broadcast to the travelers or to the transit vehicle operator.

- Requirement:* 13 The transit vehicle shall be capable of disabling or enabling the transit vehicle based on commands from the center or authentic inputs from the transit vehicle operator.

Architecture

Northern New Jersey ITS Architecture

Element: **TMA Vehicles**

Entity: **Transit Vehicle Subsystem**

Functional Area: **On-board Transit Security**

On-board video/audio surveillance systems, threat sensors, and object detection sensors to enhance security and safety on-board a transit vehicles. Also includes silent alarms activated by transit user or vehicle operator, operator authentication, and remote vehicle disabling.

Requirement: 14 The transit vehicle shall perform authentication of the transit vehicle operator.

Functional Area: **On-board Transit Information Services**

On-board systems to furnish next-stop annunciation as well as interactive travel-related information, including routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, non-motorized transportation services, and special events.

Requirement: 1 The transit vehicle shall enable traffic and travel advisory information to be requested and output to the traveler. Such information may include transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events.

Requirement: 2 The transit vehicle shall enable yellow pages (including non-motorized transportation) information to be requested and output to the traveler.

Requirement: 3 The transit vehicle shall broadcast advisories about the imminent arrival of the transit vehicle at the next stop via an on-board automated annunciation system.

Requirement: 4 The transit vehicle shall support input and output forms that are suitable for travelers with physical disabilities.

Requirement: 5 The transit vehicle shall gather transit advisory data, including alerts and advisories pertaining to major emergencies, or man made disasters.

Requirement: 6 The transit vehicle shall tailor the output of the request traveler information based on the current location of the transit vehicle.

Element: **TRANSCOM Archived Data Management System**

Entity: **Archived Data Management Subsystem**

Functional Area: **ITS Data Repository**

Collect and maintain data and data catalogs from one or more data sources. May include quality checks, error notification, and archive coordination.

Requirement: 1 The center shall collect data to be archived from one or more data sources.

Requirement: 2 The center shall collect data catalogs from one or more data sources. A catalog describes the data contained in the collection of archived data and may include descriptions of the schema or structure of the data, a description of the contents of the data; e.g., time range of entries, number of entries; or a sample of the data (e. g. a thumbnail).

Requirement: 3 The center shall store the archived data in a focused repository that is suited to a particular set of ITS data users.

Requirement: 4 The center shall include capabilities for performing quality checks on the incoming archived data.

Requirement: 5 The center shall include capabilities for error notification on the incoming archived data.

Requirement: 6 The center shall include capabilities for archive to archive coordination.

Requirement: 7 The center shall support a broad range of archived data management implementations, ranging from simple data marts that collect a focused set of data and serve a particular user community to large-scale data warehouses that collect, integrate, and summarize transportation data from multiple sources and serve a broad array of users within a region.

Requirement: 8 The center shall perform quality checks on received data.

Architecture

Northern New Jersey ITS Architecture

Element: **TRANSCOM Archived Data Management System**

Entity: **Archived Data Management Subsystem**

Functional Area: **ITS Data Repository**

Collect and maintain data and data catalogs from one or more data sources. May include quality checks, error notification, and archive coordination.

Requirement: 9 The center shall provide the capability to execute methods on the incoming data such as cleansing, summarizations, aggregations, or transformations applied to the data before it is stored in the archive.

Requirement: 10 The center shall respond to requests from the administrator interface function to maintain the archive data.

Requirement: 11 When data or a catalog of data is received from the archive, the center shall generate the requested data product for the users systems.

Requirement: 12 For archive data requiring financial payment, the center shall process the financial requests and manage an interface to a Financial Institution.

Functional Area: **Traffic and Roadside Data Archival**

Collects and archives traffic and environmental information directly from the roadside for use in off-line planning, research, and analysis.

Requirement: 1 The center shall manage the collection of archive data directly from collection equipment located at the roadside.

Requirement: 2 The center shall collect traffic sensor information from roadside devices.

Requirement: 3 The center shall collect environmental sensor information that from roadside devices.

Requirement: 4 The center shall respond to requests from the Archive Data Administer to input the parameters that control the collection process.

Requirement: 5 The center shall send the request for data and control parameters to the field equipment where the information is collected and returned.

Requirement: 6 The center shall record the status about the imported traffic and roadside data.

Requirement: 7 The center shall use the status information to adjust the collection of traffic and roadside data.

Functional Area: **Government Reporting Systems Support**

Selects and formats data residing in an ITS archive to facilitate local, state, and federal government data reporting requirements.

Requirement: 1 The center shall provide data from an ITS archive to federal, state, or local government reporting systems.

Requirement: 2 The center shall provide the capability to select data from an ITS archive for use in government reports.

Requirement: 3 The center shall provide the capability to format data from an ITS archive suitable for input into government reports.

Requirement: 4 The center shall support requests for ITS archived data from Government Reporting Systems.

Requirement: 5 The center shall provide the applicable meta-data for any ITS archived data to satisfy government reporting system requests. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

Functional Area: **Virtual Data Warehouse Services**

Provides access to data from geographically dispersed archives and coordinates information exchange with a local data warehouse. Also provides the specialized publishing, directory services, and transaction management functions associated with coordinating remote archives.

Requirement: 1 The center shall provide capabilities to access "in-place" data from geographically dispersed archives. These capabilities may include analysis, data fusion, or data mining.

Architecture

Northern New Jersey ITS Architecture

*Element:***TRANSCOM Archived Data Management System**

*Entity:***Archived Data Management Subsystem**

Functional Area: **Virtual Data Warehouse Services**

Provides access to data from geographically dispersed archives and coordinates information exchange with a local data warehouse. Also provides the specialized publishing, directory services, and transaction management functions associated with coordinating remote archives.

Requirement: 2 The center shall coordinate information exchange with a local data warehouse.

Requirement: 3 The center shall provide the specialized publishing, directory services, and transaction management functions associated with coordinating remote archives.

Requirement: 4 The center shall support the collection of archived data from other archives on an as-needed basis. (This minimizes the need to duplicate the comprehensive set of data from the remote archives in the local data warehouse.)

Requirement: 5 The center shall use data collected from different archives to build a set of global schema including the data archive definitions for the local archive plus any archives known to the local archive.

Requirement: 6 The center shall provide the local archived data schema to other archive systems.

*Element:***TRANSCOM Communications Center Servers**

*Entity:***Emergency Management**

Functional Area: **Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

Requirement: 1 The center shall support the interface to the Emergency Telecommunications System (e.g. 911 or 7-digit call routing) to receive emergency notification information and provide it to the emergency system operator.

Requirement: 2 The center shall receive emergency call information from 911 services and present the possible incident information to the emergency system operator.

Requirement: 3 The center shall receive emergency call information from motorist call-boxes and present the possible incident information to the emergency system operator.

Requirement: 4 The center shall receive emergency call information from mayday service providers and present the possible incident information to the emergency system operator.

Requirement: 5 The center shall receive emergency notification information from other public safety agencies and present the possible incident information to the emergency system operator.

Requirement: 6 The center shall receive emergency notification information from public transit systems and present the possible incident information to the emergency system operator.

Requirement: 7 The center shall receive emergency notification information from commercial vehicles, commercial vehicle check stations, or commercial fleet operators and present the possible incident information to the emergency system operator. This may include detection of non-permitted transport of security sensitive hazmat, hazardous cargo spills, etc.

Requirement: 8 The center shall receive details of the cargo being carried by commercial vehicles from their commercial fleet manager for incidents involving potential hazardous materials.

Requirement: 9 The center shall coordinate, correlate, and verify all emergency inputs, including those identified based on external calls and internal analysis of security sensor and surveillance data, and assign each a level of confidence.

Requirement: 10 The center shall send a request for remote control of CCTV systems from a traffic management center in order to verify the reported incident.

Architecture**Northern New Jersey ITS Architecture***Element:***TRANSCOM Communications Center Servers***Entity:***Emergency Management***Functional Area:* **Emergency Call-Taking**

Provides interface to the emergency call-taking systems such as the Emergency Telecommunications System (e.g., 911) that correlate call information with emergencies reported by transit agencies, commercial vehicle operators, or other public safety agencies. Allows the operator to verify the incident and forward the information to the responding agencies.

- Requirement:* 11 The center shall update the incident information log once the emergency system operator has verified the incident.
- Requirement:* 12 The center shall provide the capability for digitized map data to act as the background to the emergency information presented to the emergency system operator.
- Requirement:* 13 The center shall forward the verified emergency information to the responding agency based on the location and nature of the emergency.

Functional Area: **Emergency Dispatch**

Dispatch emergency vehicles to incidents, tracking their location and status. Pertinent incident information is gathered and relayed to the responding units; includes requests for signal preemption.

- Requirement:* 1 The center shall dispatch emergency vehicles to respond to verified emergencies and provide suggested routing under center personnel control.
- Requirement:* 2 The center shall store the current status of all emergency vehicles available for dispatch and those that have been dispatched.
- Requirement:* 3 The center shall relay location and incident details to the responding vehicles.
- Requirement:* 4 The center shall provide the capability to request traffic control measures from traffic management centers such as signal preemption, traffic barriers and road closures.
- Requirement:* 5 The center shall track the location and status of emergency vehicles responding to an emergency and update the incident status based on information from the emergency vehicle.
- Requirement:* 6 The center shall receive status information from care facilities to determine the appropriate facility and its location.
- Requirement:* 7 The center shall store and maintain the emergency service responses in an action log.
- Requirement:* 8 The center shall receive asset restriction information from maintenance centers to support the dispatching of appropriate emergency resources.
- Requirement:* 9 The center shall receive traffic information, including closures, traffic conditions, etc. from traffic management centers.
- Requirement:* 10 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator.
- Requirement:* 11 The center shall receive road network conditions and traffic images to support dispatch of emergency vehicles.
- Requirement:* 12 The center shall coordinate response to incidents with other Emergency Management centers to ensure appropriate resources are dispatched and utilized.

Functional Area: **Emergency Early Warning System**

Monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies in order to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to other ITS centers to notify the traveling public. Includes support for Child Abduction notices.

Architecture**Northern New Jersey ITS Architecture***Element:* **TRANSCOM Communications Center Servers***Entity:* **Emergency Management***Functional Area:* **Emergency Early Warning System**

Monitors alerting and advisory systems, information collected by ITS surveillance and sensors, and reports from other agencies in order to identify potential, imminent, or in-progress major incidents or disasters. Notification is provided to other ITS centers to notify the traveling public. Includes support for Child Abduction notices.

- Requirement:*
- 1 The center shall monitor information from Alerting and Advisory Systems such as the Information Sharing and Analysis Centers (ISACs), the National Infrastructure Protection Center (NIPC), the Homeland Security Advisory System (HSAS), etc. The information may include assessments (general incident and vulnerability awareness information), advisories (identification of threats or recommendations to increase preparedness levels), or alerts (information on imminent or in-progress emergencies).
 - 2 The center shall provide the capability to correlate alerts and advisories, incident information, and security sensor and surveillance data.
 - 3 The center shall broadcast wide-area alerts and advisories to traffic management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
 - 4 The center shall broadcast wide-area alerts and advisories to transit management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
 - 5 The center shall broadcast wide-area alerts and advisories to toll administration centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
 - 6 The center shall broadcast wide-area alerts and advisories to traveler information service providers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
 - 7 The center shall broadcast wide-area alerts and advisories to maintenance centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
 - 8 The center shall broadcast wide-area alerts and advisories to other emergency management centers for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER alert system), military activities, and other situations that pose a threat to life and property.
 - 9 The center shall process status information from each of the centers that have been sent the wide-area alert.
 - 10 The center shall coordinate the broadcast of wide-area alerts and advisories with other emergency management centers.
 - 11 The center shall receive incident information from other transportation management centers to support the early warning system.
 - 12 The center shall present the alert and advisory information and the status of the actions taken in response to the alert by the other centers to the emergency system operator as received from other system inputs.
 - 13 The center shall support the entry of alert and advisory information directly from the emergency system operator.

Functional Area: **Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

- Requirement:*
- 1 The center shall provide strategic emergency response capabilities such as that of an Emergency Operations Center for large-scale incidents and disasters.

Architecture

Northern New Jersey ITS Architecture

Element: **TRANSCOM Communications Center Servers**

Entity: **Emergency Management**

Functional Area: **Emergency Response Management**

Strategic emergency planning and response capabilities and broad inter-agency interfaces to support large-scale incidents and disasters, commonly associated with Emergency Operations Centers.

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| <i>Requirement:</i> | 2 The center shall manage coordinated inter-agency responses to and recovery from large-scale emergencies. Such agencies include traffic management, transit, maintenance and construction management, rail operations, and other emergency management agencies. |
| <i>Requirement:</i> | 3 The center shall provide the capability to implement response plans and track progress through the incident by exchanging incident information and distributing response status to allied agencies. |
| <i>Requirement:</i> | 4 The center shall develop, coordinate with other agencies, and store emergency response plans. |
| <i>Requirement:</i> | 5 The center shall track the availability of resources (including vehicles, roadway cleanup?, etc.), request additional resources from traffic, maintenance, or other emergency centers if needed. |
| <i>Requirement:</i> | 6 The center shall allocate the appropriate emergency services, resources, and vehicle (s) to respond to incidents, and shall provide the capability to override the current allocation to suit the special needs of a current incident. |
| <i>Requirement:</i> | 7 The center shall receive event scheduling information from Event Promoters. |
| <i>Requirement:</i> | 8 The center shall receive hazardous materials incident information from commercial fleet operators. |
| <i>Requirement:</i> | 9 The center shall provide the capability to request the safe disabling of a commercial vehicle during a hazardous materials incident. |
| <i>Requirement:</i> | 10 The center shall provide the capability to request transit resource availability from transit centers for use during disaster and evacuation operations. |
| <i>Requirement:</i> | 11 The center shall assimilate the status of the transit, traffic, rail, maintenance, and other emergency center services and systems to create an overall transportation system status, and disseminate to each of these centers and the traveling public via traveler information providers. |
| <i>Requirement:</i> | 12 The center shall provide information to the media concerning the status of an emergency response. |
| <i>Requirement:</i> | 13 The center shall provide the capability for digitized map data to act as the background to the information presented to the emergency system operator. |
| <i>Requirement:</i> | 14 The center shall provide the capability for center personnel to provide inputs to the management of incidents, disasters and evacuations. |
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Functional Area: **Incident Command**

Tactical decision support, resource coordination, and communications integration among emergency management agencies for Incident Commands that are established by first responders to support local management of an incident.

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| <i>Requirement:</i> | 1 The center shall provide tactical decision support, resource coordination, and communications integration for Incident Commands that are established by first responders to support local management of an incident. |
| <i>Requirement:</i> | 2 The center shall provide incident command communications with public safety, emergency management, transportation, and other allied response agency centers. |
| <i>Requirement:</i> | 3 The center shall track and maintain resource information and action plans pertaining to the incident command. |
| <i>Requirement:</i> | 4 The center shall share incident command information with other public safety agencies including resource deployment status, hazardous material information, rail incident information, evacuation advice as well as traffic, road, and weather conditions. |
| <i>Requirement:</i> | 5 The center shall assess the status of responding emergency vehicles as part of an incident command. |
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Architecture**Northern New Jersey ITS Architecture****Element:TRANSCOM Communications Center Servers****Entity:Emergency Management****Functional Area: Emergency Evacuation Support**

Evacuation planning and coordination to manage evacuation and reentry of a population in the vicinity of a disaster or other emergency that poses a risk to public safety.

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| <i>Requirement:</i> | 1 The center shall manage inter-agency coordination of evacuation operations, from initial planning through the evacuation process and reentry. |
| <i>Requirement:</i> | 2 The center shall develop and exchange evacuation plans with allied agencies prior to the occurrence of a disaster. |
| <i>Requirement:</i> | 3 The center shall provide an interface to the emergency system operator to enter evacuation plans and procedures and present the operator with other agencies' plans. |
| <i>Requirement:</i> | 4 The center shall coordinate evacuation destinations and shelter needs with shelter providers (e.g., the American Red Cross) in the region. |
| <i>Requirement:</i> | 5 The center shall provide evacuation information to traffic, transit, maintenance and construction, rail operations, and other emergency management centers as needed. |
| <i>Requirement:</i> | 6 The center shall request resources from transit agencies as needed to support the evacuation. |
| <i>Requirement:</i> | 7 The center shall request traffic management agencies to implement special traffic control strategies and to control evacuation traffic, including traffic on local streets and arterials as well as the major evacuation routes. |
| <i>Requirement:</i> | 8 The center shall provide traveler information systems with evacuation guidance including basic information to assist potential evacuees in determining whether evacuation is necessary and when it is safe to return. |
| <i>Requirement:</i> | 9 The center shall monitor the progress or status of the evacuation once it begins and exchange tactical plans, prepared during the incident, with allied agencies. |
| <i>Requirement:</i> | 10 The center shall monitor the progress of the reentry process. |
| <i>Requirement:</i> | 11 The center shall submit evacuation information to toll administration centers along with requests for changes in the toll services or fee collection during an evacuation. |

Functional Area: Emergency Environmental Monitoring

Current and forecast road and weather information assimilated from weather service providers and emergency vehicles equipped with environmental sensors; used by the operator to more effectively manage incidents.

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| <i>Requirement:</i> | 1 The center shall collect current and forecast road and weather information from weather service providers (such as the National Weather Service and value-added sector specific meteorological services). |
| <i>Requirement:</i> | 2 The center shall receive environmental probe information from its fleet of emergency vehicles. |
| <i>Requirement:</i> | 3 The center shall collect current road and weather information from roadway maintenance operations. |
| <i>Requirement:</i> | 4 The center shall assimilate current and forecast road conditions and surface weather information to support incident management. |
| <i>Requirement:</i> | 5 The center shall present the current and forecast road and weather information to the emergency system operator. |
| <i>Requirement:</i> | 6 The center shall provide aggregated or processed environmental probe information from its fleet of emergency vehicles to traffic management and maintenance centers. |

Functional Area: Center Secure Area Surveillance

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

Architecture**Northern New Jersey ITS Architecture****Element:TRANSCOM Communications Center Servers****Entity:Emergency Management****Functional Area: Center Secure Area Surveillance**

Management of security surveillance devices and analysis of that data to detect potential threats. Areas under surveillance may include transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 1 The center shall remotely monitor video images and audio surveillance data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The data may be raw or pre-processed in the field.
- Requirement:* 2 The center shall remotely monitor video images and audio surveillance data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The data may be raw or pre-processed in the field.
- Requirement:* 3 The center shall remotely monitor video images and audio surveillance data collected on-board transit vehicles. The data may be raw or pre-processed in the field.
- Requirement:* 4 The center shall exchange surveillance data with other emergency centers.
- Requirement:* 5 The center shall identify potential security threats based on collected security surveillance data.
- Requirement:* 6 The center shall verify potential security threats by correlating security surveillance data from multiple sources.
- Requirement:* 7 The center shall remotely control security surveillance devices in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways).
- Requirement:* 8 The center shall remotely control security surveillance devices in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers).
- Requirement:* 9 The center shall remotely control security surveillance devices on-board transit vehicles.
- Requirement:* 10 The center shall match traveler video images against a database from the Alerting and Advisory Systems of known images that may represent criminals and terrorists.
- Requirement:* 11 The center shall exchange traveler images with other emergency management centers to support traveler image matching.
- Requirement:* 12 The center shall respond to control data from center personnel regarding security surveillance data collection, processing, threat detection, and image matching.

Functional Area: Center Secure Area Sensor Management

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 1 The center shall remotely monitor and control security sensor data collected in secure areas including facilities (e.g. transit yards) and transportation infrastructure (e.g. bridges, tunnels, interchanges, roadway infrastructure, and transit railways or guideways). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), infrastructure condition and integrity, intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.

Architecture**Northern New Jersey ITS Architecture****Element:TRANSCOM Communications Center Servers****Entity:Emergency Management****Functional Area: Center Secure Area Sensor Management**

Management of security sensors, analysis of sensor data, correlation with surveillance data and alerts from other agencies to detect potential threats, and dissemination of threat information to other agencies. Sensors may be placed in areas such as transit stops, transit stations, rest areas, park and ride lots, modal interchange facilities, on-board a transit vehicle, etc.

- Requirement:* 2 The center shall remotely monitor and control security sensor data collected in traveler secure areas, which include transit stations, transit stops, rest areas, park and ride lots, and other fixed sites along travel routes (e.g., emergency pull-off areas and travel information centers). The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors), intrusion and motion, and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 3 The center shall remotely monitor and control security sensor data collected on-board transit vehicles. The types of security sensor data include environmental threat (e.g. chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors) and object detection sensors. The data may be raw or pre-processed in the field.
- Requirement:* 4 The center shall exchange security sensor data with other emergency centers.
- Requirement:* 5 The center shall identify potential security threats based on collected security sensor data.
- Requirement:* 6 The center shall verify potential security threats by correlating security sensor data from multiple sources.
- Requirement:* 7 The center shall perform threat analysis based on correlations of security sensor and surveillance data.
- Requirement:* 8 The center shall exchange threat analysis data with Alerting and Advisory Systems and use that data in local threat analysis processing.
- Requirement:* 9 The center shall disseminate threat information to other agencies, including traffic, transit, maintenance, rail operations, and other emergency management centers.
- Requirement:* 10 The center shall respond to control data from center personnel regarding security sensor data collection, processing, threat detection, and threat analysis.

Functional Area: Center Secure Area Alarm Support

Collection and response to silent and audible alarms received from travelers in secure areas (such as transit stops, rest areas, park-and-ride lots) and from on-board transit vehicles.

- Requirement:* 1 The center shall collect silent and audible alarms received from travelers in secure areas (such as transit stops, rest areas, park and ride lots, modal interchange facilities).
- Requirement:* 2 The center shall collect silent and audible alarms received from transit vehicles, originated by the traveler or the transit vehicle operator.
- Requirement:* 3 After the alarm message has been received, the center shall generate an alarm acknowledgment to the sender.
- Requirement:* 4 After the alarm message becomes a verified incident, the center shall determine the appropriate response.
- Requirement:* 5 The center shall determine whether the alarm message indicates an emergency that requires the attention of public safety agencies, and forward alarm message data to the appropriate agency as necessary.
- Requirement:* 6 The center shall forward the alarm message to center personnel and respond to the traveler or transit vehicle operator as directed by the personnel.

Functional Area: Emergency Data Collection

Collection and storage of information related to Emergency Management. For use by operations personnel or data archives in the region.

Architecture**Northern New Jersey ITS Architecture***Element:* **TRANSCOM Communications Center Servers***Entity:* **Emergency Management***Functional Area:* **Emergency Data Collection**

Collection and storage of information related to Emergency Management. For use by operations personnel or data archives in the region.

Requirement: 1 The center shall collect emergency service data, emergency vehicle management data, emergency vehicle data, sensor and surveillance data, threat data, and incident data.

Requirement: 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

Requirement: 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the emergency management data or for the data itself.

Requirement: 4 The center shall be able to produce sample products of the data available.

Entity: **Information Service Provider***Functional Area:* **Basic Information Broadcast**

Collection, processing, storage, and broadcast dissemination of traffic, transit, maintenance and construction, event, and weather information to traveler interface systems and vehicles.

Requirement: 1 The center shall collect, process, store, and disseminate traffic and highway condition information to travelers, including incident information, detours and road closures, event information, recommended routes, and current speeds on specific routes.

Requirement: 2 The center shall collect, process, store, and disseminate maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities.

Requirement: 3 The center shall collect, process, store, and disseminate transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers.

Requirement: 4 The center shall collect, process, store, and disseminate parking information to travelers, including location, availability, and fees.

Requirement: 5 The center shall collect, process, store, and disseminate toll fee information to travelers.

Requirement: 6 The center shall collect, process, store, and disseminate weather information to travelers.

Requirement: 7 The center shall collect, process, store, and disseminate event information to travelers.

Requirement: 8 The center shall collect, process, store, and disseminate air quality information to travelers.

Requirement: 9 The center shall provide the capability to support requests from the media for traffic and incident data.

Requirement: 10 The center shall provide the capability for a system operator to control the type and update frequency of broadcast traveler information.

Functional Area: **Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

Requirement: 1 The center shall collect, process, store, and disseminate customized traffic and highway condition information to travelers, including incident information, detours and road closures, recommended routes, and current speeds on specific routes upon request.

Requirement: 2 The center shall collect, process, store, and disseminate customized maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities upon request.

Requirement: 3 The center shall collect, process, store, and disseminate customized transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers upon request.

Architecture**Northern New Jersey ITS Architecture***Element:* **TRANSCOM Communications Center Servers***Entity:* **Information Service Provider***Functional Area:* **Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

Requirement: 4 The center shall collect, process, store, and disseminate customized parking information to travelers, including location, availability, and fees upon request.

Requirement: 5 The center shall collect, process, store, and disseminate customized toll fee information to travelers upon request.

Requirement: 6 The center shall collect, process, store, and disseminate customized weather information to travelers upon request.

Requirement: 7 The center shall collect, process, store, and disseminate customized multimodal transportation service information (for example, from ferry and airline operators), including transfer points and other information, to travelers upon request.

Requirement: 8 The center shall collect, process, store, and disseminate customized event information to travelers upon request.

Requirement: 9 The center shall collect, process, store, and disseminate customized air quality information to travelers upon request.

Requirement: 10 The center shall provide all traveler information based on the traveler's current location or a specific location identified by the traveler, and filter or customize the provided information accordingly.

Requirement: 11 The center shall accept traveler profiles for determining the type of personalized data to send to the traveler.

Requirement: 12 The center shall manage payment for services, such as tolls, transit fares, parking lot charges, map updates, and advanced payment for tolls, and provide transaction success or failure details.

Requirement: 13 The center shall support requests for traveler information and advanced payment for traveler services from commercial fleet operators.

Requirement: 14 The center shall provide the capability to exchange information with another traveler information service provider current or predicted data for road links that are outside the area served by the local supplier.

Requirement: 15 The center shall manage updates of digitized map data and provide updates to traveler interface systems upon request.

Requirement: 16 The center shall provide the capability to support requests from the media for traffic and incident data.

Requirement: 17 The center shall provide the capability for a system operator to control the type and update frequency of traveler information.

Functional Area: **Traveler Telephone Information**

Collection and distribution of traveler information and wide-area alerts to traveler telephone information systems such as 511, based on voice-based traveler requests.

Requirement: 1 The center shall provide the capability to process voice-formatted requests for traveler information from a traveler telephone information system, and return the information in the requested format.

Requirement: 2 The center shall provide the capability to process dual-tone multifrequency (DTMF)-based requests (touch-tone) for traveler information from a traveler telephone information system.

Requirement: 3 The center shall provide the capability to process traveler information requests from a traveler telephone information system.

Requirement: 4 The center shall collect and provide information on traffic conditions in the requested voice format and for the requested location.

Architecture**Northern New Jersey ITS Architecture****Element:TRANSCOM Communications Center Servers****Entity:Information Service Provider****Functional Area: Traveler Telephone Information**

Collection and distribution of traveler information and wide-area alerts to traveler telephone information systems such as 511, based on voice-based traveler requests.

- Requirement:* 5 The center shall collect and provide work zone and roadway maintenance information in the requested voice format and for the requested location.
- Requirement:* 6 The center shall collect and provide roadway environment conditions information in the requested voice format and for the requested location.
- Requirement:* 7 The center shall collect and provide weather and event information in the requested voice format and for the requested location.
- Requirement:* 8 The center shall collect and provide transit service information in the requested voice format and for the requested location.
- Requirement:* 9 The center shall collect and provide yellow pages services information in the requested voice format and for the requested location.
- Requirement:* 10 The center shall collect and provide current ferry and rail schedule and airport status information in the requested voice format and for the requested location.
- Requirement:* 11 The center shall provide the capability to support both specific caller requests as well as bulk upload of regional traveler information.
- Requirement:* 12 The center shall receive and forward region-specific wide-area alert and advisory information to the traveler telephone information system, including major emergencies such as a natural or man-made disaster, civil emergency, child abductions, severe weather watches and warnings, military activities, and law enforcement warnings.

Functional Area: Infrastructure Provided Route Selection

Generation of pre-trip and enroute trip plans for travelers (and vehicles) based on current traffic conditions, work zones, weather, and travelers constraints and preferences. Includes end-to-end trips using multiple modes, such as bicycle, transit, etc.

- Requirement:* 1 The center shall provide the capability to provide specific pre-trip and enroute directions to travelers (and drivers), including costs, arrival times, and transfer points.
- Requirement:* 2 The center shall include bicycle routes, walkways, skyways, and multi-use trails in the pre-trip and enroute directions it provides to travelers.
- Requirement:* 3 The center shall support on-line route guidance for travelers using personal devices (such as PDAs).
- Requirement:* 4 The center shall support on-line route guidance for drivers in vehicles.
- Requirement:* 5 The center shall support on-line route guidance for specialty vehicles, such as commercial vehicles.
- Requirement:* 6 The center shall generate route plans based on current and/or predicted conditions of the road network, scheduled maintenance and construction work activities, and work zone activities.
- Requirement:* 7 The center shall generate route plans based on transit services, including fares, schedules, and requirements for travelers with special needs.
- Requirement:* 8 The center shall generate route plans based on current asset restrictions, such as height and weight restrictions on tunnels or bridges.
- Requirement:* 9 The center shall generate route plans based on current or forecasted weather.
- Requirement:* 10 The center shall generate route plans based on ferry, rail, air, or other multimodal transportation data.
- Requirement:* 11 The center shall exchange route segment information with other centers outside the area served by the local center.
- Requirement:* 12 The center shall generate trips based on the use of more than one mode of transport.

Architecture

Northern New Jersey ITS Architecture

Element: **TRANSCOM Communications Center Servers**

Entity: **Information Service Provider**

Functional Area: **Infrastructure Provided Route Selection**

Generation of pre-trip and enroute trip plans for travelers (and vehicles) based on current traffic conditions, work zones, weather, and travelers constraints and preferences. Includes end-to-end trips using multiple modes, such as bicycle, transit, etc.

- Requirement:* 13 The center shall use the preferences and constraints specified by the traveler in the trip request to select the most appropriate mode of transport.
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- Requirement:* 14 The center shall provide the capability for the traveler to confirm the proposed trip plan.
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- Requirement:* 15 The center shall log route plans, particularly for special vehicles such as those containing hazardous materials, over-sized vehicles, or motorcades, with a traffic center.
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- Requirement:* 16 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used to determine vehicle and non-vehicle routes, trip planning, and on-line vehicle guidance.
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- Requirement:* 17 The center shall provide the capability for center personnel to control route calculation parameters.
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Functional Area: **ISP Emergency Traveler Information**

Collection and distribution of emergency information to the traveler public, including evacuation information and wide-area alerts.

- Requirement:* 1 The center shall collect and provide to the traveler interface systems emergency evacuation information, including evacuation zones, shelter information, available transportation modes, road closures and detours, changes to transit services, and traffic and road conditions at the origin, destination, and along the evacuation routes.
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- Requirement:* 2 The center shall provide evacuation information to shelter providers.
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- Requirement:* 3 The center shall collect and provide wide-area alert information to the traveler interface system with region-specific data, including major emergencies such as a natural or man-made disaster, civil emergency, child abductions, severe weather watches and warnings, military activities, and law enforcement warnings.
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- Requirement:* 4 The center shall provide the capability for a system operator to control the type and update frequency of emergency and wide-area alert information distributed to travelers.
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Functional Area: **ISP Probe Information Collection**

Collection and aggregation of vehicle probe data, including calculation and dissemination of route travel times and usage. Includes environmental probe data collection, aggregation and dissemination.

- Requirement:* 1 The center shall collect vehicle probe data from various sources, including vehicles under infrastructure-based route guidance and electronic toll collection points.
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- Requirement:* 2 The center shall aggregate collected vehicle probe data (route segment identity and the time), calculate route segment travel times, route segment speeds, and route usage, and disseminate to other centers.
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- Requirement:* 3 The center shall collect environmental probe data (air temperature, wind speed, surface temperature, etc.) from appropriately equipped vehicles.
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- Requirement:* 4 The center shall aggregate collected environmental probe data, and disseminate environmental conditions to other centers.
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Functional Area: **ISP Data Collection**

Collection and storage of information supporting the operations of traveler information service providers. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect traveler information data, such as parking lot data, rideshare data, road network use data, vehicle probe data, and other data from traveler information system operations.
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Architecture**Northern New Jersey ITS Architecture***Element:* **TRANSCOM Communications Center Servers***Entity:* **Information Service Provider***Functional Area:* **ISP Data Collection**

Collection and storage of information supporting the operations of traveler information service providers. For use by operations personnel or data archives in the region.

- Requirement:* 2 The center shall collect traveler requests, confirmations, and payment transaction data for traveler services provided.
- Requirement:* 3 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.
- Requirement:* 4 The center shall receive and respond to requests from ITS Archives for either a catalog of the traveler information data or for the data itself.
- Requirement:* 5 The center shall be able to produce sample products of the data available.

Entity: **Maintenance and Construction Management***Functional Area:* **MCM Environmental Information Processing**

Processes current and forecast weather data, road condition information, local environmental data, and uses internal models to develop specialized detailed forecasts of local weather and surface conditions. Disseminates road weather information to other agencies and centers.

- Requirement:* 1 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.
- Requirement:* 2 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services) and local environmental sensor data.
- Requirement:* 3 The center shall use the various data inputs of environmental sensors and road weather data to develop a view of current and predicted road weather and road conditions.
- Requirement:* 4 The center shall disseminate current and forecasted road weather and road condition information to weather service providers (such as the National Weather Service and value-added sector specific meteorological services) as well as other agencies including traffic, emergency, and transit management, traveler information providers, rail operations centers, media, and other maintenance management centers.
- Requirement:* 5 The center shall provide value-added sector specific meteorological services with information on basic road facility and treatment information that supports forecasts for road conditions.

Functional Area: **MCM Incident Management**

Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.

- Requirement:* 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.
- Requirement:* 2 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, etc.
- Requirement:* 3 The center shall exchange incident and threat information with emergency management centers as well as traffic management centers; including notification of existence of incident and expected severity, location, time and nature of incident.
- Requirement:* 4 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.

Architecture**Northern New Jersey ITS Architecture***Element:* **TRANSCOM Communications Center Servers***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Incident Management**

Supports coordinated response to incidents - share incident notifications, manage incident response resources, and coordinate overall incident situation and response among allied response organizations.

- Requirement:* 5 The center shall respond to requests from emergency management to provide maintenance and construction resources to implement response plans, assist in clean up, verify an incident, etc. This may also involve coordination with traffic management centers and other maintenance centers.
- Requirement:* 6 The center shall exchange road network status assessment information with emergency management and traffic management centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.
- Requirement:* 7 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.
- Requirement:* 8 The center shall receive information indicating the damage sustained by transportation assets, derived from aerial surveillance, field reports, inspections, tests, and analyses to support incident management.

Functional Area: **MCM Maintenance Decision Support**

Maintenance Decision Support Systems recommend courses of action based on current and forecast environmental and road conditions (filtered and fused for specific time horizons) and additional application specific information. Recommendations and dispatch instructions are generated based on this integrated information.

- Requirement:* 1 The center shall provide the center personnel with tailored external information, including weather or road condition observations, forecasted weather information or road conditions, current usage of treatments and materials, available resources, equipment and vehicle availability, road network information, and source reliability information.
- Requirement:* 2 The center shall tailor the decision support information to include filtering (selection from a large amount of external information), error reduction ('smoothing' the information), fusion (combination of disparate information to match the decision needs), and analysis (creating the decision).
- Requirement:* 3 The center shall provide an interface to the center personnel to input control parameters for the decision support process and receive decisions or information presentation.
- Requirement:* 4 The center shall provide dispatch information to maintenance and construction vehicles based on the outputs of the decision support system, including recommended roadway treatment actions.

Functional Area: **MCM Winter Maintenance Management**

Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.

- Requirement:* 1 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other winter roadway maintenance.
- Requirement:* 2 The center shall exchange information with administrative systems to support the planning and scheduling of winter maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
- Requirement:* 3 The center shall provide status information about scheduled winter maintenance activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, and the media.

Architecture**Northern New Jersey ITS Architecture***Element:* **TRANSCOM Communications Center Servers***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Winter Maintenance Management**

Manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.

- Requirement:* 4 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of winter maintenance activities.
- Requirement:* 5 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of winter maintenance activities.
- Requirement:* 6 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
- Requirement:* 7 The center shall dispatch and route winter maintenance vehicle drivers and support them with route-specific environmental, incident, advisory, threat, alert, and traffic congestion information.
- Requirement:* 8 The center shall determine the need for roadway treatment based on current and forecasted weather information, current usage of treatments and materials, available resources, requests for action from other agencies, and recommendations from the Maintenance Decision Support system, specifically under winter conditions. This supports winter maintenance such as plowing, treating, anti-icing, etc.
- Requirement:* 9 The center shall provide dispatch instructions for vehicle operators based on input parameters from center personnel, specifically for winter conditions. This could include a treatment route, treatment application rates, start and end times, and other treatment instructions.
- Requirement:* 10 The center shall support remote control of on-board maintenance and construction vehicle systems and field equipment that is remotely controlled by the vehicle such as adjusting material application rates and spread patterns.
- Requirement:* 11 The center shall assess the current status of all winter maintenance activities, including actual work activities performed, current locations and operational conditions of vehicles, materials and equipment inventories, field equipment status, environmental information, etc.

Functional Area: **MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

- Requirement:* 1 The center shall maintain an interface with asset management systems to track the inventory, restrictions, repair needs and status updates of transportation assets (pavement, bridges, signs, etc.) including location, installation and materials information, vendor/contractor, current maintenance status, standard height, width, and weight restrictions.
- Requirement:* 2 The center shall respond to requests from emergency management and traffic management centers for hazard removal, field equipment repair, and other roadway maintenance.
- Requirement:* 3 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
- Requirement:* 4 The center shall provide emergency management and traffic management centers with information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.

Architecture**Northern New Jersey ITS Architecture***Element:* **TRANSCOM Communications Center Servers***Entity:* **Maintenance and Construction Management***Functional Area:* **MCM Roadway Maintenance and Construction**

Overall management and support for routine maintenance on the roadway or right-of-way. Includes landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment.

- Requirement:* 5 The center shall collect the status and fault data from roadside equipment, such as traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
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- Requirement:* 6 The center shall collect the status and fault data from traffic management centers, including data for traffic, infrastructure, and environmental sensors, highway advisory radio and dynamic message signs, automated roadway treatment systems, barrier and safeguard systems, cameras, traffic signals and override equipment, ramp meters, beacons, security sensors and surveillance equipment, etc., and provide a cohesive view of equipment repair needs.
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- Requirement:* 7 The center shall remotely control and collect data from infrastructure monitoring sensors located along the roadway infrastructure or on maintenance and construction vehicles.
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- Requirement:* 8 The center shall receive equipment availability and materials storage status information from storage facilities to support the scheduling of roadway maintenance and construction activities.
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- Requirement:* 9 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for the scheduling of roadway maintenance and construction activities.
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- Requirement:* 10 The center shall collect current and forecast traffic and weather information from traffic management centers and weather service providers (such as the National Weather Service and value-added sector specific meteorological services).
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- Requirement:* 11 The center shall dispatch and route maintenance and construction vehicle drivers and support them with route- specific environmental, incident, advisory, threat, alert, and traffic congestion information.
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- Requirement:* 12 The center shall manage an interface with center personnel to accept vehicle systems control information and remotely control maintenance and construction vehicle on-board equipment.
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- Requirement:* 13 The center shall track the status of roadway maintenance and construction activities by monitoring collected data from the dispatched vehicles and equipment.

Functional Area: **MCM Work Zone Management**

Remotely monitors and supports work zone activities, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).

- Requirement:* 1 The center shall generate new work zone activity schedules for use by maintenance and construction vehicles, maintenance and construction operators, and for information coordination purposes.
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- Requirement:* 2 The center shall control the collection of work zone status information including video images from cameras located in or near the work zone.
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- Requirement:* 3 The center shall disseminate work zone information to other agencies and centers including traffic, transit, emergency management centers, other maintenance centers, traveler information providers, and the media.
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- Requirement:* 4 The center shall control traffic in work zones by providing remote control of dynamic message signs and highway advisory radio systems located in or near the work zone.

Architecture

Northern New Jersey ITS Architecture

Element: **TRANSCOM Communications Center Servers**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Work Zone Management**

Remotely monitors and supports work zone activities, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., traveler information systems, traffic management centers, other maintenance and construction centers).

- Requirement:* 5 The center shall exchange information with administrative systems to support the planning and scheduling of work zone activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
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Functional Area: **MCM Work Activity Coordination**

Disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

- Requirement:* 1 The center shall provide work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.
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- Requirement:* 2 The center shall provide status information about scheduled maintenance and construction activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations. The information is provided to other management centers such as traffic, emergency, transit, traveler information providers, other maintenance centers, multimodal transportation providers, rail operations, and the media.
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- Requirement:* 3 The center shall collect and respond to feedback concerning scheduled maintenance and construction activities with other management centers such as traffic, emergency, transit, and rail operations.
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- Requirement:* 4 The center shall collect and disseminate asset restriction information levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.
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- Requirement:* 5 The center shall exchange information with administrative systems to support the planning and scheduling of maintenance and construction activities. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
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- Requirement:* 6 The center shall exchange rail schedules and work plans with rail operations centers.
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Functional Area: **MCM Data Collection**

Collection and storage of maintenance and construction information. For use by operations personnel or data archives in the region.

- Requirement:* 1 The center shall collect maintenance and construction data (such as field equipment status, infrastructure status, maintenance and construction activity data) gathered from roadway, traffic, and other maintenance and construction sources.
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- Requirement:* 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.
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- Requirement:* 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the maintenance and construction data or for the data itself.
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- Requirement:* 4 The center shall be able to produce sample products of the data available.
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Architecture

Northern New Jersey ITS Architecture

Element: **TRANSCOM Communications Center Servers**

Entity: **Maintenance and Construction Management**

Functional Area: **MCM Data Collection**

Collection and storage of maintenance and construction information. For use by operations personnel or data archives in the region.

- Requirement:* 5 The center shall provide data to Asset Management to be used in updating the status of assets in the inventory.
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Entity: **Traffic Management**

Functional Area: **TMC Probe Information Collection**

Collects, assimilates, and disseminates vehicle probe data collected from roadside beacons and centers controlling transit vehicles, emergency vehicles, toll collection points, and route-guided vehicles.

- Requirement:* 1 The center shall collect probe data including traffic and road conditions from vehicles via roadside beacon field elements; the data may be aggregated and initial link time calculations performed in the field.

- Requirement:* 2 The center shall collect road condition data from probe-equipped transit vehicles via transit management centers; the data may be aggregated and preliminarily processed at the sending center.

- Requirement:* 3 The center shall collect traffic data from probe-equipped emergency vehicles via emergency management centers; the data may be aggregated and initial link time calculations performed at the sending center.

- Requirement:* 4 The center shall collect traffic data from traveler information centers based on data from their subscriber vehicles; the data may be aggregated and initial link time calculations performed at the sending center.

- Requirement:* 5 The center shall collect traffic data from toll administrative centers containing journey times between toll collection points for those vehicles equipped for electronic toll collection; the data may be aggregated and processed at the sending center.

- Requirement:* 6 The center shall assimilate current and forecast traffic and road conditions based on collected probe data and distribute to other centers for dissemination to travelers.

- Requirement:* 7 The center shall collect operational status for the roadside probe data collection equipment.

- Requirement:* 8 The center shall collect fault data for the roadside probe data collection equipment for repair.
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Functional Area: **TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

- Requirement:* 1 The center shall remotely control traffic signal controllers.

- Requirement:* 2 The center shall accept notifications of right-of-way requests from pedestrians.

- Requirement:* 3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center.

- Requirement:* 4 The center shall collect traffic signal controller fault data from the field.

- Requirement:* 5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.
-

Functional Area: **TMC Freeway Management**

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

Architecture

Northern New Jersey ITS Architecture

Element: **TRANSCOM Communications Center Servers**

Entity: **Traffic Management**

Functional Area: **TMC Freeway Management**

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

- Requirement:* 1 The center shall remotely control systems to manage use of the freeways, including ramp meters, mainline metering, and lane controls.
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- Requirement:* 2 The center shall collect operational status from ramp meters, mainline metering, and lane controls and compare against the control information sent by the center.
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- Requirement:* 3 The center shall collect fault data from ramp meters, mainline metering, and lane controls.
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- Requirement:* 4 The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, mainline metering, and lane controls), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the ramps themselves.
-

Functional Area: **TMC Traffic Information Dissemination**

Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.

- Requirement:* 1 The center shall remotely control dynamic messages signs for dissemination of traffic and other information to drivers.
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- Requirement:* 2 The center shall remotely control driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers.
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- Requirement:* 3 The center shall collect operational status for the driver information systems equipment (DMS, HAR, etc.).
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- Requirement:* 4 The center shall collect fault data for the driver information systems equipment (DMS, HAR, etc.) for repair.
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- Requirement:* 5 The center shall retrieve locally stored traffic information, including current and forecasted traffic information, road and weather conditions, traffic incident information, information on diversions and alternate routes, closures, and special traffic restrictions (lane/shoulder use, weight restrictions, width restrictions, HOV requirements), etc.
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- Requirement:* 6 The center shall distribute traffic data to maintenance and construction centers, transit centers, emergency management centers, and traveler information providers.
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- Requirement:* 7 The center shall distribute traffic data to the media upon request; the capability to provide the information in both data stream and graphical display shall be supported.
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- Requirement:* 8 The center shall provide the capability for center personnel to control the nature of the data that is available to non-traffic operations centers and the media.
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Functional Area: **TMC Regional Traffic Control**

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

- Requirement:* 1 The center shall exchange traffic information with other traffic management centers, includes incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.
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- Requirement:* 2 The center shall exchange traffic control information with other traffic management centers, includes remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).
-

Functional Area: **TMC Incident Detection**

Architecture**Northern New Jersey ITS Architecture****Element:TRANSCOM Communications Center Servers****Entity:Traffic Management****Functional Area: TMC Incident Detection**

Remotely controls traffic and video sensors to support incident detection and verification; exchange information with other agencies including emergency management, maintenance and construction, alerting and advisory systems, event promoters, intermodal freight depots, and traveler information systems.

- Requirement:* 1 The center shall receive inputs from the Alerting and Advisory System concerning the possibility or occurrence of severe weather, terrorist activity, or other major emergency, including information provided by the Emergency Alert System.
- Requirement:* 2 The center shall collect and store traffic flow and image data from the field equipment to detect and verify incidents.
- Requirement:* 3 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, and intermodal freight depots.
- Requirement:* 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.
- Requirement:* 5 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field.
- Requirement:* 6 The center shall provide road network conditions and traffic images to emergency management centers to support the detection, verification, and classification of incidents.
- Requirement:* 7 The center shall provide video and traffic sensor control commands to the field equipment to detect and verify incidents.

Functional Area: TMC Incident Dispatch Coordination/Communication

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

- Requirement:* 1 The center shall exchange alert information and status with emergency management centers. The information includes notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction for distribution to the public. The information may include the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, and information and instructions necessary for the public to respond to the alert. This may also identify specific information that should not be released to the public.
- Requirement:* 2 The center shall coordinate planning for incidents with emergency management centers - including pre-planning activities for disaster response, evacuation, and recovery operations.
- Requirement:* 3 The center shall support requests from emergency management centers to remotely control sensor and surveillance equipment located in the field, provide special routing for emergency vehicles, and to provide responding emergency vehicles with signal preemption.
- Requirement:* 4 The center shall exchange incident and threat information with emergency management centers as well as maintenance and construction centers; including notification of existence of incident and expected severity, location, time and nature of incident.
- Requirement:* 5 The center shall respond to requests from emergency management to provide traffic management resources to implement special traffic control measures, assist in clean up, verify an incident, etc. This may also involve coordination with maintenance centers.
- Requirement:* 6 The center shall receive inputs concerning upcoming events that would effect the traffic network from event promoters, traveler information service providers, media, and rail operations centers.
- Requirement:* 7 The center shall provide road network conditions and traffic images to emergency management centers, maintenance and construction centers, and traveler information service providers.

Architecture

Northern New Jersey ITS Architecture

Element: **TRANSCOM Communications Center Servers**

Entity: **Traffic Management**

Functional Area: **TMC Incident Dispatch Coordination/Communication**

Center-based capability to formulate an incident response that takes into account the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

- Requirement:* 8 The center shall exchange road network status assessment information with emergency management and maintenance centers including an assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.
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- Requirement:* 9 The center shall coordinate information and controls with other traffic management centers.
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- Requirement:* 10 The center shall receive inputs from emergency management and transit management centers to develop an overall status of the transportation system including emergency transit schedules in effect and current status and condition of the transportation infrastructure.
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- Requirement:* 11 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic incident management.
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Functional Area: **TMC Evacuation Support**

Development, coordination, and execution of special traffic management strategies during evacuation and subsequent reentry of a population in the vicinity of a disaster or major emergency. Interfaces with emergency management and other traffic management centers.

- Requirement:* 1 The center shall coordinate planning for evacuation with emergency management centers - including pre-planning activities such as establishing routes, areas to be evacuated, timing, etc.
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- Requirement:* 2 The center shall support requests from emergency management centers to preempt the current traffic control strategy, activate traffic control and closure systems such as gates and barriers, activate safeguard systems, or use driver information systems to support evacuation traffic control plans.
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- Requirement:* 3 The center shall coordinate information and controls with other traffic management centers.
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- Requirement:* 4 The center shall coordinate execution of evacuation strategies with emergency management centers - including activities such as setting closures and detours, establishing routes, updating areas to be evacuated, timing the process, etc.
-

Functional Area: **TMC Environmental Monitoring**

Management of environmental sensors and assimilation of collected data with other current and forecast road conditions and surface weather information from weather service providers and roadway maintenance operations.

- Requirement:* 1 The center shall remotely control environmental sensors that measure road surface temperature, moisture, icing, salinity, and other measures.
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- Requirement:* 2 The center shall remotely control environmental sensors that measure weather conditions including temperature, wind, humidity, precipitation, and visibility.
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- Requirement:* 3 The center shall assimilate current and forecast road conditions and surface weather information using a combination of weather service provider information (such as the National Weather Service and value-added sector specific meteorological services), data from roadway maintenance operations, and environmental data collected from sensors deployed on and about the roadway.
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- Requirement:* 4 The center shall provide weather and road condition information to weather service providers and center personnel.
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- Requirement:* 5 The center shall respond to control data from center personnel regarding environmental sensor control and weather data collection and processing.
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Architecture**Northern New Jersey ITS Architecture***Element:***TRANSCOM Communications Center Servers***Entity:***Traffic Management***Functional Area:* **TMC Multimodal Crossing Management**

Remotely monitors and manages multimodal crossings, such as draw bridges and other crossings between highway traffic and other modes; does not include highway-rail intersection.

Requirement: 1 The center shall receive requests from non-highway traffic to cross at multimodal crossings for specified durations (such as draw bridges and miscellaneous other interference crossings between highway traffic and other modes such as river traffic, aircraft, etc.)

Requirement: 2 The center shall remotely control traffic signal controllers for use at major multimodal crossings.

Requirement: 3 The center shall remotely control driver information systems (such as dynamic messages signs, highway advisory radios (HAR), and equipment that controls warning lights and gates) to notify drivers of closure durations and times at multimodal crossings.

Requirement: 4 The center shall collect operational status for the equipment at multimodal crossings.

Requirement: 5 The center shall collect fault data for the equipment at multimodal crossings for repair.

Requirement: 6 The center shall receive and respond to requests for right-of-way at multimodal crossings.

Requirement: 7 The center shall collect and analyze the planned multimodal crossing closures as a possible incident.

Requirement: 8 The center shall distribute multimodal crossing information to other centers for dissemination to travelers.

Functional Area: **Barrier System Management**

Remotely controls barrier systems such as gates and other systems that manage entry to roadways, transportation facilities and infrastructure.

Requirement: 1 The center shall remotely control barrier systems for transportation facilities and infrastructure. Barrier systems include automated or remotely controlled gates, barriers and other systems that manage entry to roadways.

Requirement: 2 The center shall collect barrier system operational status.

Requirement: 3 The center shall collect barrier system fault data and send to the maintenance center for repair.

Requirement: 4 The center shall accept requests for barrier system activation from other centers and from center personnel to support emergency response and detours.

Functional Area: **Safeguard System Management**

Remotely controls safeguard systems such as blast shields and tunnel exhaust systems that are used to mitigate the impact of incidents on transportation infrastructure.

Requirement: 1 The center shall remotely control safeguard systems, equipment used to mitigate the impact of incidents on transportation infrastructure (e.g., blast shields, tunnel exhaust systems, etc.)

Requirement: 2 The center shall collect safeguard system operational status.

Requirement: 3 The center shall collect safeguard system fault data and send to the maintenance center for repair.

Requirement: 4 The center shall accept requests for safeguard system activation from other centers and from center personnel to support emergency response.

Functional Area: **Traffic Maintenance**

Monitoring and remote diagnostics of field equipment - detect failures, issue problem reports, and track the repair or replacement of the failed equipment.

Requirement: 1 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) operational status.

Requirement: 2 The center shall collect and store CCTV surveillance system (traffic, pedestrian) operational status.

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Northern New Jersey ITS Architecture

Element: **TRANSCOM Communications Center Servers**

Entity: **Traffic Management**

Functional Area: **Traffic Maintenance**

Monitoring and remote diagnostics of field equipment - detect failures, issue problem reports, and track the repair or replacement of the failed equipment.

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| <i>Requirement:</i> | 3 The center shall collect and store sensor (traffic, pedestrian, multimodal crossing) fault data and send to the maintenance center for repair. |
| <i>Requirement:</i> | 4 The center shall collect and store CCTV surveillance system (traffic, pedestrian) fault data send to the maintenance center for repair. |
| <i>Requirement:</i> | 5 The center shall collect environmental sensor operational status. |
| <i>Requirement:</i> | 6 The center shall collect environmental sensor equipment fault data and send to the maintenance center for repair. |
| <i>Requirement:</i> | 7 The center shall exchange data with maintenance centers concerning the reporting of faulty equipment and the schedule/status of their repair. Information exchanged includes details of new equipment faults, and clearances when the faults are cleared. |
| <i>Requirement:</i> | 8 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as a background for traffic maintenance data. |
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Functional Area: **TMC Work Zone Traffic Management**

Coordination with maintenance systems using work zone images and traveler information systems (such as DMS), and distribution of work plans so that work zones are established that have minimum traffic impact.

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| <i>Requirement:</i> | 1 The center shall receive work zone images from a maintenance center. |
| <i>Requirement:</i> | 2 The center shall analyze work zone images for indications of a possible incident. |
| <i>Requirement:</i> | 3 The center shall remotely control driver information systems (such as dynamic messages signs, highway advisory radios) to advise drivers of activity around a work zone. |
| <i>Requirement:</i> | 4 The center shall collect operational status for the driver information systems equipment in work zones. |
| <i>Requirement:</i> | 5 The center shall collect fault data for the driver information systems equipment in work zones for repair. |
| <i>Requirement:</i> | 6 The center shall receive proposed maintenance and construction work plans, analyze the activity as a possible incident, and provide work plan feedback to the sending center. |
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Functional Area: **TMC Multimodal Coordination**

Provides traffic signal priority for transit vehicles based on center-to-center communications with the transit management center; also exchange traffic and transit information.

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| <i>Requirement:</i> | 1 The center shall respond to requests from transit management centers for signal priority at one or more intersections along a particular transit route. |
| <i>Requirement:</i> | 2 The center shall exchange information with transit management centers including details current transit routes, the level of service on each route, and the progress of individual vehicles along their routes. |
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Functional Area: **Traffic Data Collection**

Collection and storage of traffic management data. For use by operations personnel or data archives in the region.

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| <i>Requirement:</i> | 1 The center shall collect traffic management data such as operational data, event logs, etc. |
| <i>Requirement:</i> | 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data. |
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Architecture**Northern New Jersey ITS Architecture***Element:***TRANSCOM Communications Center Servers***Entity:***Traffic Management***Functional Area:* **Traffic Data Collection**

Collection and storage of traffic management data. For use by operations personnel or data archives in the region.

Requirement: 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the traffic data or for the data itself.

Requirement: 4 The center shall be able to produce sample products of the data available.

*Entity:***Transit Management***Functional Area:* **Transit Center Fixed-Route Operations**

Planning and scheduling associated with fixed and flexible route transit services, automatically updates customer service operator systems, and provides current vehicle schedule adherence and optimum scenarios for schedule adjustment.

Requirement: 1 The center shall generate transit routes and schedules based on such factors as parameters input by the system operator, road network conditions, operational data on current routes and schedules, and digitized map data.

Requirement: 2 The center shall provide the interface to the system operator to control the generation of new routes and schedules (transit services) including the ability to review and update the parameters used by the routes and schedules generation processes and to initiate these processes

Requirement: 3 The center shall be able to generate special routes and schedules to support an incident, disaster, evacuation, or other emergency.

Requirement: 4 The center shall accept requests from traffic management to change routes and schedules as part of the implementation of demand management strategies.

Requirement: 5 The center shall collect transit operational data for use in the generation of routes and schedules.

Requirement: 6 The center shall assign transit vehicle operators based on factors such as eligibility, route preferences, seniority, and transit vehicle availability.

Requirement: 7 The center shall manage large deviations of individual transit vehicles, deviations in rural areas, and deviations of large numbers of vehicles.

Requirement: 8 The center shall generate the necessary corrective actions which may involve more than the vehicles concerned and more far reaching action, such as, the introduction of extra vehicles, wide area signal priority by traffic management, the premature termination of some services, etc.

Requirement: 9 The center shall exchange information with Maintenance and Construction Operations concerning work zones, roadway conditions, asset restrictions, work plans, etc.

Requirement: 10 The center shall disseminate up-to-date schedules and route information to other centers for fixed and flexible route services.

Functional Area: **Transit Center Paratransit Operations**

Planning and scheduling of demand responsive transit (i.e. paratransit) services, includes automatic operator assignment and monitoring.

Requirement: 1 The center shall process trip requests for demand responsive transit services, i.e. paratransit. Sources of the requests may include traveler information service providers.

Requirement: 2 The center shall track the location and availability of transit vehicles for use in demand responsive transit (paratransit) operations.

Requirement: 3 The center shall generate demand responsive transit (paratransit) routes and schedules based on such factors as parameters input by the system operator, what other demand responsive transit schedules have been planned, the availability and location of vehicles, the relevance of any fixed transit routes and schedules, and road network information.

Architecture

Northern New Jersey ITS Architecture

Element: **TRANSCOM Communications Center Servers**

Entity: **Transit Management**

Functional Area: **Transit Center Paratransit Operations**

Planning and scheduling of demand responsive transit (i.e. paratransit) services, includes automatic operator assignment and monitoring.

Requirement: 4 The center shall assign transit vehicle operators for confirmed demand responsive transit (paratransit) trips based on factors such as eligibility, route preferences, seniority, and transit vehicle availability.

Requirement: 5 The center shall exchange information with Maintenance and Construction Operations concerning work zones, roadway conditions, asset restrictions, work plans, etc.

Requirement: 6 The center shall disseminate up-to-date schedules and route information to other centers for demand responsive transit services (paratransit).

Functional Area: **Transit Center Security**

Monitor transit vehicle operator or traveler activated alarms; authenticate transit vehicle operators; remotely disable a transit vehicle; alert operators, travelers, and police to potential incidents identified by these security features.

Requirement: 1 The center shall monitor transit vehicle operational data to determine if the transit vehicle is off-route and assess whether a security incident is occurring.

Requirement: 2 The center shall receive reports of emergencies on-board transit vehicles entered directly by the transit vehicle operator or from a traveler through interfaces such as panic buttons or alarm switches.

Requirement: 3 The center shall support the back-office portion of functionality to authenticate transit vehicle operators.

Requirement: 4 The center shall exchange transit incident information along with other service data with other transit agencies.

Requirement: 5 The center shall receive information pertaining to a wide-area alert such as weather alerts, disaster situations, or child abductions. This information may come from Emergency Management or from other Alerting and Advisory Systems.

Requirement: 6 The center shall send wide-area alert information to travelers (on-board transit vehicles or at stations/stops) and transit vehicle operators.

Requirement: 7 The center shall coordinate the response to security incidents involving transit with other agencies including Emergency Management, other transit agencies, media, traffic management, and traveler information service providers.

Requirement: 8 The center shall receive threat information and status on the integrity of the transit infrastructure.

Requirement: 9 The center shall provide support to remotely disable (or reset the disabling of) a transit vehicle in service.

Functional Area: **Transit Garage Operations**

Assignment of transit vehicles and operators to routes or service areas in a fair manner while minimizing labor and overtime services, considering operator preferences, qualifications, accumulated work hours, and other information about each operator.

Requirement: 1 The center shall maintain records of a transit vehicle operator's performance. This may be done utilizing standardized performance evaluation criteria set forth by governmental regulations and transit operating company policies, assessing the transit vehicle operator's driving history, and assessing comments from the transit vehicle operator's supervisor(s) as well as noting any moving violations or accidents, supervisor comments, government regulations, and company policies.

Requirement: 2 The center shall assess the transit vehicle operator's availability based on previous work assignments, accumulated hours, plus health and vacation commitments.

Architecture

Northern New Jersey ITS Architecture

Element: **TRANSCOM Communications Center Servers**

Entity: **Transit Management**

Functional Area: **Transit Garage Operations**

Assignment of transit vehicles and operators to routes or service areas in a fair manner while minimizing labor and overtime services, considering operator preferences, qualifications, accumulated work hours, and other information about each operator.

Requirement: 3 The center shall assign transit vehicle operators to transit schedules based on their eligibility, route preferences, seniority, and transit vehicle availability.

Requirement: 4 The center shall provide an interface through which the transit vehicle operator information can be maintained - either from the transit vehicle operator, a transit system operator (i.e. center personnel), or other functions.

Functional Area: **Transit Center Information Services**

Provide interactive traveler information to travelers (on-board transit vehicles, at stops/stations, using personal devices), traveler information service providers, media, and other transit organizations. Includes routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, yellow pages, and special events.

Requirement: 1 The center shall provide travelers using public transportation with traffic and advisory information upon request. Such information may include transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events.

Requirement: 2 The center shall provide transit information to the media including details of deviations from schedule of regular transit services.

Requirement: 3 The center shall exchange transit schedules, real-time arrival information, fare schedules, and general transit service information with other transit organizations to support transit traveler information systems.

Requirement: 4 The center shall provide transit service information to traveler information service providers including routes, schedules, schedule adherence, and fare information as well as transit service information during evacuation.

Requirement: 5 The center shall enable yellow pages (including non-motorized transportation) information to be output to the traveler.

Requirement: 6 The center shall broadcast transit advisory data, including alerts and advisories pertaining to major emergencies, or man made disasters.

Functional Area: **Transit Environmental Monitoring**

Current and forecast road and weather information assimilated from weather service providers and vehicle probes. The information is monitored and forwarded to other agencies to more effectively manage transit operations.

Requirement: 1 The center shall assimilate current and forecast road conditions and surface weather information to more effectively manage transit operations.

Requirement: 2 The center shall collect current and forecast road and weather information from weather service providers and vehicle probes.

Requirement: 3 The center shall receive road network probe information from its fleet of transit vehicles.

Requirement: 4 The center shall provide road network probe information from its fleet of transit vehicles to traffic management as well as maintenance and construction management.

Functional Area: **Transit Center Multi-Modal Coordination**

Generate requests for transit priority on routes and at certain intersections. Coordinate schedules with other agencies and modes, including transit transfer cluster and transfer point information.

Requirement: 1 The center shall analyze transit vehicle schedule performance to determine the need for priority along certain routes or at certain intersections.

Architecture

Northern New Jersey ITS Architecture

*Element:***TRANSCOM Communications Center Servers**

*Entity:***Transit Management**

Functional Area: **Transit Center Multi-Modal Coordination**

Generate requests for transit priority on routes and at certain intersections. Coordinate schedules with other agencies and modes, including transit transfer cluster and transfer point information.

Requirement: 2 The center shall send requests for priority along routes or at intersections to traffic management.

Requirement: 3 The center shall coordinate schedules and services between transit agencies, traffic management, maintenance and construction operations, parking management, and other surface or air transportation modes.

Requirement: 4 The center shall share transfer cluster and transfer point information with multimodal transportation service providers, other transit agencies, and traveler information service providers. A transfer cluster is a collection of stops, stations, or terminals where transfers can be made conveniently.

Functional Area: **Transit Evacuation Support**

Support evacuation and subsequent reentry of a population in the vicinity of a disaster or other emergency. Coordinate regional evacuation plans and resources including transit and school bus fleets.

Requirement: 1 The center shall manage the use of transit resources to support evacuation and subsequent reentry of a population in the vicinity of a disaster or other emergency.

Requirement: 2 The center shall coordinate regional evacuation plans with Emergency Management - identifying the transit role in an evacuation and the transit resources that would be used.

Requirement: 3 The center shall coordinate the use of transit and school bus fleets during an evacuation, supporting evacuation of those with special needs and the general population.

Requirement: 4 The center shall adjust and update transit service and fare schedules and provide that information to other agencies as they coordinate evacuations.

Functional Area: **Transit Data Collection**

Collection and storage of transit management data. For use by operations personnel or data archives in the region.

Requirement: 1 The center shall collect transit management data such as transit fares and passenger use, transit services, paratransit operations, transit vehicle maintenance data, etc.

Requirement: 2 The center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.

Requirement: 3 The center shall receive and respond to requests from ITS Archives for either a catalog of the transit data or for the data itself.

Requirement: 4 The center shall be able to produce sample products of the data available.

*Element:***TRANSCOM Kiosks**

*Entity:***Remote Traveler Support**

Functional Area: **Remote Interactive Information Reception**

Public traveler interface, such as a kiosk, that provides traffic, transit, yellow pages, event, and trip planning information, as well as payment services for tolls, parking, and other personalized traveler information services upon request.

Requirement: 1 The public interface for travelers shall receive traffic information from a center and present it to the traveler upon request.

Requirement: 2 The public interface for travelers shall receive transit information from a center and present it to the traveler upon request.

Architecture**Northern New Jersey ITS Architecture***Element:TRANSCOM Kiosks**Entity:Remote Traveler Support**Functional Area: Remote Interactive Information Reception*

Public traveler interface, such as a kiosk, that provides traffic, transit, yellow pages, event, and trip planning information, as well as payment services for tolls, parking, and other personalized traveler information services upon request.

- Requirement:* 3 The public interface for travelers shall receive yellow pages information (such as lodging, restaurants, theaters, bicycle facilities, and other tourist activities) from a center and present it to the traveler upon request.
- Requirement:* 4 The public interface for travelers shall receive event information from a center and present it to the traveler upon request.
- Requirement:* 5 The public interface for travelers shall receive evacuation information from a center and present it to the traveler.
- Requirement:* 6 The public interface for travelers shall receive wide-area alerts and present it to the traveler.
- Requirement:* 7 The public interface for travelers shall accept reservations for confirmed trip plans.
- Requirement:* 8 The public interface for travelers shall support payment for services, such as confirmed trip plans, confirmed yellow pages services, tolls, transit fares, parking lot charges, and advanced payment for tolls.
- Requirement:* 9 The public interface for travelers shall provide an interface through which credit identities and stored credit values may be collected from tags, traveler cards, or payment instruments used by travelers.
- Requirement:* 10 The public interface for travelers shall base requests from the traveler on the traveler's current location or a specific location identified by the traveler, and filter the provided information accordingly.
- Requirement:* 11 The public interface for travelers shall provide digitized map data to act as the background to the information presented to the traveler.
- Requirement:* 12 The public interface for travelers shall support traveler input in audio or manual form.
- Requirement:* 13 The public interface for travelers shall present information to the traveler in audible or visual forms consistent with a kiosk, including those that are suitable for travelers with hearing or vision physical disabilities.
- Requirement:* 14 The public interface for travelers shall be able to store frequently requested data.

Functional Area: Remote Transit Information Services

Public traveler interface that provides real-time travel-related information at transit stops and multi-modal transfer points, including general annunciation, display of imminent arrival information, the latest available information on transit routes, schedules, transfer options, bicycle accessibility, fares, real-time schedule adherence, current incidents, weather conditions, and special events

- Requirement:* 1 The public interface for travelers shall collect and provide real-time travel-related information at transit stops, multi-modal transfer points, and other public transportation areas.
- Requirement:* 2 The public interface for travelers shall collect and present to the transit traveler information on transit routes, schedules, and real-time schedule adherence.
- Requirement:* 3 The public interface for travelers shall provide support for general annunciation and/or display of imminent arrival information and other information of general interest to transit users.
- Requirement:* 4 The public interface for travelers shall present information to the traveler in a form suitable for travelers with physical disabilities.

*Element:TRANSCOM TRIPS123 Subscriber Systems**Entity:Personal Information Access**Functional Area: Personal Interactive Information Reception*

Architecture**Northern New Jersey ITS Architecture***Element:***TRANSCOM TRIPS123 Subscriber Systems***Entity:***Personal Information Access***Functional Area:* **Personal Interactive Information Reception**

Personal traveler interface that provides traffic, transit, yellow pages, event, and trip planning information, as well as payment services for tolls, parking, and other personalized traveler information services upon request. Devices include desktop computers at home, work, or at major trip generation sites, plus personal portable devices such as PDAs and pagers.

- Requirement:* 1 The personal traveler interface shall receive traffic information from a center and present it to the traveler upon request.
- Requirement:* 2 The personal traveler interface shall receive transit information from a center and present it to the traveler upon request.
- Requirement:* 3 The personal traveler interface shall receive yellow pages information (such as lodging, restaurants, theaters, bicycle facilities, and other tourist activities) from a center and present it to the traveler upon request.
- Requirement:* 4 The personal traveler interface shall receive event information from a center and present it to the traveler upon request.
- Requirement:* 5 The personal traveler interface shall receive evacuation information from a center and present it to the traveler.
- Requirement:* 6 The personal traveler interface shall receive wide-area alerts and present it to the traveler.
- Requirement:* 7 The personal traveler interface shall accept reservations for confirmed trip plans.
- Requirement:* 8 The personal traveler interface shall support payment for services, such as confirmed trip plans, tolls, transit fares, parking lot charges, map updates, and advanced payment for tolls.
- Requirement:* 9 The personal traveler interface shall provide an interface through which credit identity, stored credit value, or traveler information may be collected from a traveler card being used by a traveler with a personal device.
- Requirement:* 10 The personal traveler interface shall base requests from the traveler on the traveler's current location or a specific location identified by the traveler, and filter the provided information accordingly.
- Requirement:* 11 The personal traveler interface shall provide digitized map data to act as the background to the information presented to the traveler.
- Requirement:* 12 The personal traveler interface shall support traveler input in audio or manual form.
- Requirement:* 13 The personal traveler interface shall present information to the traveler in audible or visual forms consistent with a personal device, and suitable for travelers with hearing and vision physical disabilities.
- Requirement:* 14 The personal traveler interface shall be able to store frequently requested or used data, including the traveler's identity, home and work locations, etc.

Functional Area: **Personal Location Determination**

Determines current location of a personal device using GPS or similar location referencing and uses this information for navigation, guidance, and emergency notification systems.

- Requirement:* 1 The personal traveler interface shall provide the traveler's current location. It is intended for use by traveler personal navigation and guidance systems, as well as emergency notification systems.
- Requirement:* 2 The personal traveler interface shall calculate the location from one or more sources of position data such as GPS or DGPS.
- Requirement:* 3 The personal traveler interface shall refine its calculations as required by other functions such as navigation, guidance, and emergency notification.

Functional Area: **Personal Provider-Based Route Guidance**

Architecture**Northern New Jersey ITS Architecture***Element:***TRANSCOM TRIPS123 Subscriber Systems***Entity:***Personal Information Access***Functional Area:* **Personal Provider-Based Route Guidance**

Personal traveler interface that coordinates with a traveler information center to provide a route plan that is tailored to the traveler's preferences. During the trip the route plan can be modified to account for new information. Devices include desktop computers at home, work, or at major trip generation sites, plus personal portable devices such as PDAs and pagers.

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| <i>Requirement:</i> | 1 The personal traveler interface shall provide the capability for a traveler to request and confirm multi-modal route guidance from a specified source to a destination. |
| <i>Requirement:</i> | 2 The personal traveler interface shall forward the request for route guidance to a traveler information center for route calculation. |
| <i>Requirement:</i> | 3 The personal traveler interface shall forward user preferences, background information, constraints, and payment information to the supplying traveler information center. |
| <i>Requirement:</i> | 4 The personal traveler interface shall present information to the traveler in audible or visual forms consistent with a personal device, and suitable for travelers with hearing and vision physical disabilities. |
| <i>Requirement:</i> | 5 The personal traveler interface shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used for route guidance displays. |

*Element:***TRANSCOM TRIPS123 Traveler Information System***Entity:***Information Service Provider***Functional Area:* **Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

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| <i>Requirement:</i> | 1 The center shall collect, process, store, and disseminate customized traffic and highway condition information to travelers, including incident information, detours and road closures, recommended routes, and current speeds on specific routes upon request. |
| <i>Requirement:</i> | 2 The center shall collect, process, store, and disseminate customized maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities upon request. |
| <i>Requirement:</i> | 3 The center shall collect, process, store, and disseminate customized transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers upon request. |
| <i>Requirement:</i> | 4 The center shall collect, process, store, and disseminate customized parking information to travelers, including location, availability, and fees upon request. |
| <i>Requirement:</i> | 5 The center shall collect, process, store, and disseminate customized toll fee information to travelers upon request. |
| <i>Requirement:</i> | 6 The center shall collect, process, store, and disseminate customized weather information to travelers upon request. |
| <i>Requirement:</i> | 7 The center shall collect, process, store, and disseminate customized multimodal transportation service information (for example, from ferry and airline operators), including transfer points and other information, to travelers upon request. |
| <i>Requirement:</i> | 8 The center shall collect, process, store, and disseminate customized event information to travelers upon request. |
| <i>Requirement:</i> | 9 The center shall collect, process, store, and disseminate customized air quality information to travelers upon request. |

Architecture**Northern New Jersey ITS Architecture***Element:***TRANSCOM TRIPS123 Traveler Information System***Entity:***Information Service Provider***Functional Area:* **Interactive Infrastructure Information**

Collection, processing, storage, and personalized dissemination of traffic, transit, maintenance and construction, multimodal, event, and weather information to traveler interface systems and vehicles, upon request.

Requirement: 10 The center shall provide all traveler information based on the traveler's current location or a specific location identified by the traveler, and filter or customize the provided information accordingly.

Requirement: 11 The center shall accept traveler profiles for determining the type of personalized data to send to the traveler.

Requirement: 12 The center shall manage payment for services, such as tolls, transit fares, parking lot charges, map updates, and advanced payment for tolls, and provide transaction success or failure details.

Requirement: 13 The center shall support requests for traveler information and advanced payment for traveler services from commercial fleet operators.

Requirement: 14 The center shall provide the capability to exchange information with another traveler information service provider current or predicted data for road links that are outside the area served by the local supplier.

Requirement: 15 The center shall manage updates of digitized map data and provide updates to traveler interface systems upon request.

Requirement: 16 The center shall provide the capability to support requests from the media for traffic and incident data.

Requirement: 17 The center shall provide the capability for a system operator to control the type and update frequency of traveler information.

Functional Area: **Traveler Telephone Information**

Collection and distribution of traveler information and wide-area alerts to traveler telephone information systems such as 511, based on voice-based traveler requests.

Requirement: 1 The center shall provide the capability to process voice-formatted requests for traveler information from a traveler telephone information system, and return the information in the requested format.

Requirement: 2 The center shall provide the capability to process dual-tone multifrequency (DTMF)-based requests (touch-tone) for traveler information from a traveler telephone information system.

Requirement: 3 The center shall provide the capability to process traveler information requests from a traveler telephone information system.

Requirement: 4 The center shall collect and provide information on traffic conditions in the requested voice format and for the requested location.

Requirement: 5 The center shall collect and provide work zone and roadway maintenance information in the requested voice format and for the requested location.

Requirement: 6 The center shall collect and provide roadway environment conditions information in the requested voice format and for the requested location.

Requirement: 7 The center shall collect and provide weather and event information in the requested voice format and for the requested location.

Requirement: 8 The center shall collect and provide transit service information in the requested voice format and for the requested location.

Requirement: 9 The center shall collect and provide yellow pages services information in the requested voice format and for the requested location.

Requirement: 10 The center shall collect and provide current ferry and rail schedule and airport status information in the requested voice format and for the requested location.

Architecture**Northern New Jersey ITS Architecture****Element:TRANSCOM TRIPS123 Traveler Information System****Entity:Information Service Provider****Functional Area: Traveler Telephone Information**

Collection and distribution of traveler information and wide-area alerts to traveler telephone information systems such as 511, based on voice-based traveler requests.

Requirement: 11 The center shall provide the capability to support both specific caller requests as well as bulk upload of regional traveler information.

Requirement: 12 The center shall receive and forward region-specific wide-area alert and advisory information to the traveler telephone information system, including major emergencies such as a natural or man-made disaster, civil emergency, child abductions, severe weather watches and warnings, military activities, and law enforcement warnings.

Functional Area: Infrastructure Provided Route Selection

Generation of pre-trip and enroute trip plans for travelers (and vehicles) based on current traffic conditions, work zones, weather, and travelers constraints and preferences. Includes end-to-end trips using multiple modes, such as bicycle, transit, etc.

Requirement: 1 The center shall provide the capability to provide specific pre-trip and enroute directions to travelers (and drivers), including costs, arrival times, and transfer points.

Requirement: 2 The center shall include bicycle routes, walkways, skyways, and multi-use trails in the pre-trip and enroute directions it provides to travelers.

Requirement: 3 The center shall support on-line route guidance for travelers using personal devices (such as PDAs).

Requirement: 4 The center shall support on-line route guidance for drivers in vehicles.

Requirement: 5 The center shall support on-line route guidance for specialty vehicles, such as commercial vehicles.

Requirement: 6 The center shall generate route plans based on current and/or predicted conditions of the road network, scheduled maintenance and construction work activities, and work zone activities.

Requirement: 7 The center shall generate route plans based on transit services, including fares, schedules, and requirements for travelers with special needs.

Requirement: 8 The center shall generate route plans based on current asset restrictions, such as height and weight restrictions on tunnels or bridges.

Requirement: 9 The center shall generate route plans based on current or forecasted weather.

Requirement: 10 The center shall generate route plans based on ferry, rail, air, or other multimodal transportation data.

Requirement: 11 The center shall exchange route segment information with other centers outside the area served by the local center.

Requirement: 12 The center shall generate trips based on the use of more than one mode of transport.

Requirement: 13 The center shall use the preferences and constraints specified by the traveler in the trip request to select the most appropriate mode of transport.

Requirement: 14 The center shall provide the capability for the traveler to confirm the proposed trip plan.

Requirement: 15 The center shall log route plans, particularly for special vehicles such as those containing hazardous materials, over-sized vehicles, or motorcades, with a traffic center.

Requirement: 16 The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used to determine vehicle and non-vehicle routes, trip planning, and on-line vehicle guidance.

Requirement: 17 The center shall provide the capability for center personnel to control route calculation parameters.

Entity:Transit Management**Functional Area: Transit Center Security**

Architecture**Northern New Jersey ITS Architecture****Element:TRANSCOM TRIPS123 Traveler Information System****Entity:Transit Management****Functional Area: Transit Center Security**

Monitor transit vehicle operator or traveler activated alarms; authenticate transit vehicle operators; remotely disable a transit vehicle; alert operators, travelers, and police to potential incidents identified by these security features.

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| <i>Requirement:</i> | 1 The center shall monitor transit vehicle operational data to determine if the transit vehicle is off-route and assess whether a security incident is occurring. |
| <i>Requirement:</i> | 2 The center shall receive reports of emergencies on-board transit vehicles entered directly by the transit vehicle operator or from a traveler through interfaces such as panic buttons or alarm switches. |
| <i>Requirement:</i> | 3 The center shall support the back-office portion of functionality to authenticate transit vehicle operators. |
| <i>Requirement:</i> | 4 The center shall exchange transit incident information along with other service data with other transit agencies. |
| <i>Requirement:</i> | 5 The center shall receive information pertaining to a wide-area alert such as weather alerts, disaster situations, or child abductions. This information may come from Emergency Management or from other Alerting and Advisory Systems. |
| <i>Requirement:</i> | 6 The center shall send wide-area alert information to travelers (on-board transit vehicles or at stations/stops) and transit vehicle operators. |
| <i>Requirement:</i> | 7 The center shall coordinate the response to security incidents involving transit with other agencies including Emergency Management, other transit agencies, media, traffic management, and traveler information service providers. |
| <i>Requirement:</i> | 8 The center shall receive threat information and status on the integrity of the transit infrastructure. |
| <i>Requirement:</i> | 9 The center shall provide support to remotely disable (or reset the disabling of) a transit vehicle in service. |

Functional Area: Transit Center Information Services

Provide interactive traveler information to travelers (on-board transit vehicles, at stops/stations, using personal devices), traveler information service providers, media, and other transit organizations. Includes routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, yellow pages, and special events.

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| <i>Requirement:</i> | 1 The center shall provide travelers using public transportation with traffic and advisory information upon request. Such information may include transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events. |
| <i>Requirement:</i> | 2 The center shall provide transit information to the media including details of deviations from schedule of regular transit services. |
| <i>Requirement:</i> | 3 The center shall exchange transit schedules, real-time arrival information, fare schedules, and general transit service information with other transit organizations to support transit traveler information systems. |
| <i>Requirement:</i> | 4 The center shall provide transit service information to traveler information service providers including routes, schedules, schedule adherence, and fare information as well as transit service information during evacuation. |
| <i>Requirement:</i> | 5 The center shall enable yellow pages (including non-motorized transportation) information to be output to the traveler. |
| <i>Requirement:</i> | 6 The center shall broadcast transit advisory data, including alerts and advisories pertaining to major emergencies, or man made disasters. |

Functional Area: Transit Center Multi-Modal Coordination

Architecture**Northern New Jersey ITS Architecture****Element:TRANSCOM TRIPS123 Traveler Information System****Entity:Transit Management****Functional Area: Transit Center Multi-Modal Coordination**

Generate requests for transit priority on routes and at certain intersections. Coordinate schedules with other agencies and modes, including transit transfer cluster and transfer point information.

- Requirement:* 1 The center shall analyze transit vehicle schedule performance to determine the need for priority along certain routes or at certain intersections.
- Requirement:* 2 The center shall send requests for priority along routes or at intersections to traffic management.
- Requirement:* 3 The center shall coordinate schedules and services between transit agencies, traffic management, maintenance and construction operations, parking management, and other surface or air transportation modes.
- Requirement:* 4 The center shall share transfer cluster and transfer point information with multimodal transportation service providers, other transit agencies, and traveler information service providers. A transfer cluster is a collection of stops, stations, or terminals where transfers can be made conveniently.

Element:TRANSCOM XBL Corridor Field Equipment**Entity:Roadway Subsystem****Functional Area: Roadway Probe Beacons**

Field elements to collect traffic and road conditions from passing vehicles; both anonymous toll/parking tag readings for link time calculations and smart probe data supported.

- Requirement:* 1 The field element shall use toll and parking tags on passing vehicles for traffic data link time calculations and send to the controlling center; tag identities will be removed to ensure anonymity.
- Requirement:* 2 The field element shall include equipment that monitors traffic conditions (e.g., average speed) by communicating with passing vehicles equipped with a transponder or other short range communications device; also called smart probes.
- Requirement:* 3 The field element shall include equipment that monitors road conditions by communicating with passing vehicles equipped with a transponder or other short range communications device; also called smart probes.
- Requirement:* 4 The field element shall aggregate, format, and store collected vehicle smart probe data (traffic and road conditions data), calculate link travel times and processed road condition data, and send to future passing vehicles.
- Requirement:* 5 The field element shall provide roadside beacon equipment operational status to the center.
- Requirement:* 6 The field element shall provide roadside beacon equipment fault indication to the center for repair.

Element:TRANSMIT Agencies Field Equipment**Entity:Roadway Subsystem****Functional Area: Roadway Probe Beacons**

Field elements to collect traffic and road conditions from passing vehicles; both anonymous toll/parking tag readings for link time calculations and smart probe data supported.

- Requirement:* 1 The field element shall use toll and parking tags on passing vehicles for traffic data link time calculations and send to the controlling center; tag identities will be removed to ensure anonymity.
- Requirement:* 2 The field element shall include equipment that monitors traffic conditions (e.g., average speed) by communicating with passing vehicles equipped with a transponder or other short range communications device; also called smart probes.
- Requirement:* 3 The field element shall include equipment that monitors road conditions by communicating with passing vehicles equipped with a transponder or other short range communications device; also called smart probes.

Architecture

Northern New Jersey ITS Architecture

*Element:***TRANSMIT Agencies Field Equipment**

*Entity:***Roadway Subsystem**

Functional Area: **Roadway Probe Beacons**

Field elements to collect traffic and road conditions from passing vehicles; both anonymous toll/parking tag readings for link time calculations and smart probe data supported.

Requirement: 4 The field element shall aggregate, format, and store collected vehicle smart probe data (traffic and road conditions data), calculate link travel times and processed road condition data, and send to future passing vehicles.

Requirement: 5 The field element shall provide roadside beacon equipment operational status to the center.

Requirement: 6 The field element shall provide roadside beacon equipment fault indication to the center for repair.

*Element:***TRANSMIT Agencies TRANSMIT Servers**

*Entity:***Traffic Management**

Functional Area: **TMC Probe Information Collection**

Collects, assimilates, and disseminates vehicle probe data collected from roadside beacons and centers controlling transit vehicles, emergency vehicles, toll collection points, and route-guided vehicles.

Requirement: 1 The center shall collect probe data including traffic and road conditions from vehicles via roadside beacon field elements; the data may be aggregated and initial link time calculations performed in the field.

Requirement: 2 The center shall collect road condition data from probe-equipped transit vehicles via transit management centers; the data may be aggregated and preliminarily processed at the sending center.

Requirement: 3 The center shall collect traffic data from probe-equipped emergency vehicles via emergency management centers; the data may be aggregated and initial link time calculations performed at the sending center.

Requirement: 4 The center shall collect traffic data from traveler information centers based on data from their subscriber vehicles; the data may be aggregated and initial link time calculations performed at the sending center.

Requirement: 5 The center shall collect traffic data from toll administrative centers containing journey times between toll collection points for those vehicles equipped for electronic toll collection; the data may be aggregated and processed at the sending center.

Requirement: 6 The center shall assimilate current and forecast traffic and road conditions based on collected probe data and distribute to other centers for dissemination to travelers.

Requirement: 7 The center shall collect operational status for the roadside probe data collection equipment.

Requirement: 8 The center shall collect fault data for the roadside probe data collection equipment for repair.

Functional Area: **TMC Signal Control**

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

Requirement: 1 The center shall remotely control traffic signal controllers.

Requirement: 2 The center shall accept notifications of right-of-way requests from pedestrians.

Requirement: 3 The center shall collect traffic signal controller operational status and compare against the control information sent by the center.

Requirement: 4 The center shall collect traffic signal controller fault data from the field.

Architecture

Northern New Jersey ITS Architecture

Element: TRANSMIT Agencies TRANSMIT Servers

Entity: Traffic Management

Functional Area: TMC Signal Control

Remotely controls traffic signal controllers to implement traffic management strategies at major intersections and on main highways for urban areas, based on traffic conditions, incidents, emergency vehicle preemptions, pedestrian crossings, etc.

- Requirement:* 5 The center shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.

Functional Area: TMC Freeway Management

Remotely controls ramp meters, mainline metering, and lane controls on freeways based on upstream and downstream traffic flow and ramp queue length algorithms.

- Requirement:* 1 The center shall remotely control systems to manage use of the freeways, including ramp meters, mainline metering, and lane controls.
- Requirement:* 2 The center shall collect operational status from ramp meters, mainline metering, and lane controls and compare against the control information sent by the center.
- Requirement:* 3 The center shall collect fault data from ramp meters, mainline metering, and lane controls.
- Requirement:* 4 The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, mainline metering, and lane controls), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the ramps themselves.

Functional Area: TMC Traffic Information Dissemination

Controls dissemination of traffic-related data to other centers, the media, and travelers via the driver information systems (DMS, HAR) that it operates.

- Requirement:* 1 The center shall remotely control dynamic messages signs for dissemination of traffic and other information to drivers.
- Requirement:* 2 The center shall remotely control driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers.
- Requirement:* 3 The center shall collect operational status for the driver information systems equipment (DMS, HAR, etc.).
- Requirement:* 4 The center shall collect fault data for the driver information systems equipment (DMS, HAR, etc.) for repair.
- Requirement:* 5 The center shall retrieve locally stored traffic information, including current and forecasted traffic information, road and weather conditions, traffic incident information, information on diversions and alternate routes, closures, and special traffic restrictions (lane/shoulder use, weight restrictions, width restrictions, HOV requirements), etc.
- Requirement:* 6 The center shall distribute traffic data to maintenance and construction centers, transit centers, emergency management centers, and traveler information providers.
- Requirement:* 7 The center shall distribute traffic data to the media upon request; the capability to provide the information in both data stream and graphical display shall be supported.
- Requirement:* 8 The center shall provide the capability for center personnel to control the nature of the data that is available to non-traffic operations centers and the media.

Functional Area: TMC Regional Traffic Control

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

Architecture

Northern New Jersey ITS Architecture

*Element:***TRANSMIT Agencies TRANSMIT Servers**

*Entity:***Traffic Management**

Functional Area: **TMC Regional Traffic Control**

Coordination between traffic management centers in order to share traffic information between centers as well as control of traffic management field equipment. This may be used during incidents and special events and during day-to-day operations.

- Requirement:* 1 The center shall exchange traffic information with other traffic management centers, includes incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.
-
- Requirement:* 2 The center shall exchange traffic control information with other traffic management centers, includes remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).
-

*Element:***Travelers Personal Computing Devices**

*Entity:***Personal Information Access**

Functional Area: **Personal Basic Information Reception**

Personal traveler interface that provides formatted traffic advisories, transit, event, and other traveler information, as well as broadcast alerts. Devices include desktop computers at home, work, or at major trip generation sites, plus personal portable devices such as PDAs and pagers.

- Requirement:* 1 The personal traveler interface shall receive traffic information from a center and present it to the traveler.
-
- Requirement:* 2 The personal traveler interface shall receive transit information from a center and present it to the traveler.
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- Requirement:* 3 The personal traveler interface shall receive event information from a center and present it to the traveler.
-
- Requirement:* 4 The personal traveler interface shall receive evacuation information from a center and present it to the traveler.
-
- Requirement:* 5 The personal traveler interface shall receive wide-area alerts and present it to the traveler.
-
- Requirement:* 6 The personal traveler interface shall provide the capability for digitized map data to act as the background to the information presented to the traveler.
-
- Requirement:* 7 The personal traveler interface shall support traveler input in audio or manual form.
-
- Requirement:* 8 The personal traveler interface shall present information to the traveler in audible or visual forms, consistent with a personal device.
-

Functional Area: **Personal Interactive Information Reception**

Personal traveler interface that provides traffic, transit, yellow pages, event, and trip planning information, as well as payment services for tolls, parking, and other personalized traveler information services upon request. Devices include desktop computers at home, work, or at major trip generation sites, plus personal portable devices such as PDAs and pagers.

- Requirement:* 1 The personal traveler interface shall receive traffic information from a center and present it to the traveler upon request.
-
- Requirement:* 2 The personal traveler interface shall receive transit information from a center and present it to the traveler upon request.
-
- Requirement:* 3 The personal traveler interface shall receive yellow pages information (such as lodging, restaurants, theaters, bicycle facilities, and other tourist activities) from a center and present it to the traveler upon request.
-
- Requirement:* 4 The personal traveler interface shall receive event information from a center and present it to the traveler upon request.
-

Architecture**Northern New Jersey ITS Architecture****Element:Travelers Personal Computing Devices****Entity:Personal Information Access****Functional Area: Personal Interactive Information Reception**

Personal traveler interface that provides traffic, transit, yellow pages, event, and trip planning information, as well as payment services for tolls, parking, and other personalized traveler information services upon request. Devices include desktop computers at home, work, or at major trip generation sites, plus personal portable devices such as PDAs and pagers.

- Requirement:* 5 The personal traveler interface shall receive evacuation information from a center and present it to the traveler.
- Requirement:* 6 The personal traveler interface shall receive wide-area alerts and present it to the traveler.
- Requirement:* 7 The personal traveler interface shall accept reservations for confirmed trip plans.
- Requirement:* 8 The personal traveler interface shall support payment for services, such as confirmed trip plans, tolls, transit fares, parking lot charges, map updates, and advanced payment for tolls.
- Requirement:* 9 The personal traveler interface shall provide an interface through which credit identity, stored credit value, or traveler information may be collected from a traveler card being used by a traveler with a personal device.
- Requirement:* 10 The personal traveler interface shall base requests from the traveler on the traveler's current location or a specific location identified by the traveler, and filter the provided information accordingly.
- Requirement:* 11 The personal traveler interface shall provide digitized map data to act as the background to the information presented to the traveler.
- Requirement:* 12 The personal traveler interface shall support traveler input in audio or manual form.
- Requirement:* 13 The personal traveler interface shall present information to the traveler in audible or visual forms consistent with a personal device, and suitable for travelers with hearing and vision physical disabilities.
- Requirement:* 14 The personal traveler interface shall be able to store frequently requested or used data, including the traveler's identity, home and work locations, etc.

Functional Area: Personal Location Determination

Determines current location of a personal device using GPS or similar location referencing and uses this information for navigation, guidance, and emergency notification systems.

- Requirement:* 1 The personal traveler interface shall provide the traveler's current location. It is intended for use by traveler personal navigation and guidance systems, as well as emergency notification systems.
- Requirement:* 2 The personal traveler interface shall calculate the location from one or more sources of position data such as GPS or DGPS.
- Requirement:* 3 The personal traveler interface shall refine its calculations as required by other functions such as navigation, guidance, and emergency notification.

Functional Area: Personal Provider-Based Route Guidance

Personal traveler interface that coordinates with a traveler information center to provide a route plan that is tailored to the traveler's preferences. During the trip the route plan can be modified to account for new information. Devices include desktop computers at home, work, or at major trip generation sites, plus personal portable devices such as PDAs and pagers.

- Requirement:* 1 The personal traveler interface shall provide the capability for a traveler to request and confirm multi-modal route guidance from a specified source to a destination.
- Requirement:* 2 The personal traveler interface shall forward the request for route guidance to a traveler information center for route calculation.
- Requirement:* 3 The personal traveler interface shall forward user preferences, background information, constraints, and payment information to the supplying traveler information center.

Architecture**Northern New Jersey ITS Architecture****Element:Travelers Personal Computing Devices****Entity:Personal Information Access****Functional Area: Personal Provider-Based Route Guidance**

Personal traveler interface that coordinates with a traveler information center to provide a route plan that is tailored to the traveler's preferences. During the trip the route plan can be modified to account for new information. Devices include desktop computers at home, work, or at major trip generation sites, plus personal portable devices such as PDAs and pagers.

Requirement: 4 The personal traveler interface shall present information to the traveler in audible or visual forms consistent with a personal device, and suitable for travelers with hearing and vision physical disabilities.

Requirement: 5 The personal traveler interface shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used for route guidance displays.

Element:Travelers Vehicles**Entity:Vehicle****Functional Area: Basic Vehicle Reception**

Provides drivers basic transportation information including formatted traffic advisories, event, and other traveler information as well as broadcast alerts.

Requirement: 1 The vehicle shall receive formatted traffic information from a center and present it to the driver.

Requirement: 2 The vehicle shall receive transit information from a center and present it to the driver.

Requirement: 3 The vehicle shall receive event information from a center and present it to the driver.

Requirement: 4 The vehicle shall receive evacuation information from a center and present it to the driver.

Requirement: 5 The vehicle shall receive wide-area alerts and present it to the driver.

Requirement: 6 The vehicle shall provide data from the vehicle itself to the driver. This vehicle data may include vehicle conditions, environmental conditions, safety or position warnings.

Requirement: 7 The vehicle shall prioritize safety and warning messages to supersede advisory and broadcast messages.

Requirement: 8 The vehicle shall support driver input in audio or manual form.

Requirement: 9 The vehicle shall present information to the driver in audible or visual forms without impairing the driver's ability to control the vehicle in a safe manner.

Functional Area: Interactive Vehicle Reception

Provides drivers with traffic, transit, yellow pages, event, vehicle condition, and vehicle signage information upon request.

Requirement: 1 The vehicle shall receive formatted traffic and travel advisories from a center and present them to the driver upon request.

Requirement: 2 The transit vehicle shall receive formatted traffic and travel advisories from a center and present them to the transit vehicle traveler upon request.

Requirement: 3 The vehicle shall receive yellow pages information (such as lodging, restaurants, theaters, and other tourist activities) from a center and present it to the driver upon request.

Requirement: 4 The vehicle shall receive event information from a center and present it to the driver upon request.

Requirement: 5 The vehicle shall collect vehicle data and present it to the driver (including vehicle conditions, smart probe data, safety and position warnings, and enhanced vision images) upon request .

Requirement: 6 The vehicle shall provide the capability of translating signage for presentation to the driver, including fixed signage, situational messages, or work zone intrusion messages.

Architecture**Northern New Jersey ITS Architecture***Element:***Travelers Vehicles***Entity:***Vehicle***Functional Area:* **Interactive Vehicle Reception**

Provides drivers with traffic, transit, yellow pages, event, vehicle condition, and vehicle signage information upon request.

Requirement: 7 The vehicle shall accept reservations for yellow pages services, non-motorized transportation information and event information.

Requirement: 8 The vehicle shall prioritize safety and warning messages to supersede advisory and broadcast messages.

Requirement: 9 The vehicle shall base requests from the driver on the vehicle's current location, and filter the provided information accordingly.

Requirement: 10 The vehicle shall support driver input to invoke and cancel automatic control of the vehicle including the use of the automated highway system (AHS) lanes.

Requirement: 11 The vehicle shall support driver input in audio or manual form.

Requirement: 12 The vehicle shall present information to the driver in audible or visual forms without impairing the driver's ability to control the vehicle in a safe manner.

Functional Area: **Vehicle Provider-Based Route Guidance**

In-vehicle system that coordinates with a traveler information center to provide a suggested route plan that is tailored to the driver's preferences. During the trip the route plan can be modified to account for new information.

Requirement: 1 The vehicle shall provide the capability for a driver to request and confirm multi-modal route guidance from a specified source to a destination.

Requirement: 2 The vehicle shall forward the request for route guidance to a traveler information center for route calculation.

Requirement: 3 The vehicle shall forward user preferences, background information, constraints, and payment information to the supplying traveler information center.

Requirement: 4 The vehicle shall present information to the driver in audible or visual forms without impairing the driver's ability to control the vehicle in a safe manner.

Requirement: 5 The vehicle shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used for route guidance.

Functional Area: **Vehicle Location Determination**

Determines current location of the vehicle using GPS or similar location referencing and provides this information to other in-vehicle functions.

Requirement: 1 The vehicle shall provide the vehicle's current location to other in-vehicle functions.

Requirement: 2 The vehicle shall calculate the location from one or more sources of position data. These location referencing systems include position systems such as GPS, DGPS, odometer and differential odometers.

Requirement: 3 The vehicle shall refine its calculations as required by other in-vehicle functions.

Functional Area: **Vehicle Toll/Parking Interface**

On-board systems to support paying toll without stopping and pay for parking without the use of cash through the use of an active tag interface and debit/credit card interface.

Requirement: 1 The vehicle shall respond to requests from toll collection equipment for tag information including credit identity, stored value card cash, etc.

Requirement: 2 The vehicle shall respond to request from parking field equipment for tag information including credit identity, stored value card cash, etc.

Architecture**Northern New Jersey ITS Architecture***Element:***Travelers Vehicles***Entity:***Vehicle***Functional Area:* **Vehicle Toll/Parking Interface**

On-board systems to support paying toll without stopping and pay for parking without the use of cash through the use of an active tag interface and debit/credit card interface.

Requirement: 3 The vehicle shall provide an interface to the driver to make requests for advance payments of tolls, parking, and transit fares and present the status of electronic payment transactions.

Requirement: 4 The vehicle shall provide an interface with the traveler card / payment instrument carried on-board the vehicle (tag) - to exchange identity information and payment transactions.

Requirement: 5 The vehicle shall present information to the driver in audible or visual forms without impairing the driver's ability to control the vehicle in a safe manner.

Functional Area: **Vehicle Probe Support**

On-board systems that identify location, measure traffic conditions such as link travel time and speed and transmit data to a center or roadside beacons.

Requirement: 1 The vehicle shall collect and process traffic conditions data, including location, speed, and link travel times.

Requirement: 2 The vehicle shall transmit data to the center upon request including speed, link travel times, location and timestamp information.

Requirement: 3 The vehicle shall transmit data to field equipment located along the roadway upon request including speed, link travel times, location and timestamp information.

Functional Area: **In-Vehicle Signaling System**

Provides drivers with road condition, environmental, advisory, and other special information via in-vehicle signage equipment.

Requirement: 1 The vehicle shall receive road condition and environmental information and present it to the driver via on-board signage equipment.

Requirement: 2 The vehicle shall receive advisory information, such as evacuation information, proximity to a maintenance and construction vehicle, wide-area alerts, incident information, work zone intrusion information, and other special information and present it to the driver via on-board signage equipment.

Requirement: 3 The vehicle shall receive indicator and fixed sign information, such as actual intersection traffic signal states, stop, or yield signs and present it to the driver via on-board signage equipment.

Requirement: 4 The vehicle shall store a translation table for road sign and message templates used for in-vehicle display.

Requirement: 5 The vehicle shall present information to the driver in audible or visual forms without impairing the driver's ability to control the vehicle in a safe manner.

Appendix 9.A

Architecture Flows and Definitions

Architecture Flow Descriptions

<i>Architecture Flow</i>	<i>Description</i>
alarm	Information about a Commercial Vehicle or Freight Equipment breach, non-permitted security sensitive hazmat detected at the roadside, route deviation, or Commercial Vehicle Driver / Commercial Vehicle / Freight Equipment assignment mismatches which includes the location of the Commercial Vehicle and appropriate identities.
alert notification	Notification of a major emergency such as a natural or man-made disaster, civil emergency, or child abduction for distribution to the public. The flow identifies the alert originator, the nature of the emergency, the geographic area affected by the emergency, the effective time period, and information and instructions necessary for the public to respond to the alert. This flow may also identify specific information that should not be released to the public.
alert status	Information indicating the current status of the emergency alert including identification of the traveler and driver information systems that are being used to provide the alert.
archive coordination	Catalog data, meta data, published data, and other information exchanged between archives to support data synchronization and satisfy user data requests.
archive requests	A request to a data source for information on available data (i.e. "catalog") or a request that defines the data to be archived. The request can be a general subscription intended to initiate a continuous or regular data stream or a specific request intended to initiate a one-time response from the recipient.
archive status	Notification that data provided to an archive contains erroneous, missing, or suspicious data or verification that the data provided appears valid. If an error has been detected, the offending data and the nature of the potential problem are identified.
archived data product requests	A user-specified request for archived data products (i.e. data, meta data, or data catalogs). The request also includes information that is used to identify and authenticate the user and support electronic payment requirements, if any.
archived data products	Raw or processed data, meta data, data catalogs and other data products provided to a user system upon request. The response may also include any associated transaction information.
arriving train information	Information for a train approaching a highway-rail intersection that may include direction and allow calculation of approximate arrival time and closure duration.
broadcast information	General broadcast information that contains link travel times, incidents, advisories, transit services and a myriad of other traveler information.
care facility status	Information regarding facility type and capabilities, facility status, and its ability to admit new patients.
care facility status request	Request for information regarding care facility availability and status.
citation	Report of commercial vehicle citation. The citation includes references to the statute(s) that was (were) violated. It includes information on the violator and the officer issuing the citation. A citation differs from a violation because it is adjudicated by the courts. The information may be provided as a response to a real-time query or proactively by the source. The query flow is not explicitly shown.
commercial vehicle disable	This flow safely disables a specific commercial vehicle.
construction and event information_ud	Construction and event plan information
credentials information	Response containing full credentials information. "Response" may be provided in reaction to a real-time query or a standing request for updated information. The query flow is not explicitly shown.
credentials information_ud	Response containing full credentials information. "Response" may be provided in reaction to a real-time query or a standing request for updated information.
credentials status information	Credentials information such as registration, licensing, insurance, check flags, and electronic screening enrollment data. A unique identifier is included. Corresponds to the credentials portion of CVISN "snapshots." The status information may be provided as a response to a real-time query or as a result of a standing request for updated information (subscription). This may also include information about non-U.S. fleets for use by U.S. authorities, and information regarding U.S. fleets made available to Mexican and Canadian authorities. The query flow is not explicitly shown.

Architecture Flow**Description**

credentials status information_ud	Credentials information such as registration, licensing, insurance, check flags, and electronic screening enrollment data. A unique identifier is included. Corresponds to the credentials portion of CVISN "snapshots." The status information may be provided as a response to a real-time query or as a result of a standing request for updated information (subscription).
current asset restrictions	Restrictions levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.
current asset restrictions_ud	
CVO weight and presence_ud	Physical attribute of commercial vehicle that can be measured (for example, weight, number of axels, axel spacing, etc.)
CVO weight_ud	The physical weight of the commercial vehicle.
daily site activity data	Record of daily activities at commercial vehicle check stations including summaries of screening events and inspections.
demand responsive transit plan	Plan regarding overall demand responsive transit schedules and deployment.
demand responsive transit request	Request for paratransit support.
disable commercial vehicle	A request that a specific commercial vehicle should be safely disabled.
driver to fleet request	Requests from the driver and vehicle for routing, payment, and enrollment information.
electronic screening request	Request for identification data to support electronic screening.
emergency acknowledge	Acknowledge request for emergency assistance and provide additional details regarding actions and verification requirements.
emergency acknowledge_ud	Acknowledge request for emergency assistance and provide additional details regarding actions and verification requirements.
emergency archive data	Logged emergency information including information that characterizes identified incidents (routine highway incidents through disasters), corresponding incident response information, evacuation information, surveillance data, threat data, and resource information. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.
emergency data request	A request for additional information or a control command issued by the emergency response agency in response to an emergency request for assistance from a traveler.
emergency data request_ud	A request for additional information or a control command issued by the fleet and freight management system in response to an emergency request for assistance from a vehicle.
emergency dispatch requests	Emergency vehicle dispatch instructions including incident location and available information concerning the incident.
emergency dispatch response	Request for additional emergency dispatch information (e.g., a suggested route) and provision of en route status.
emergency notification	An emergency request for assistance originated by a traveler using an in-vehicle, public access, or personal device or originated by a transit vehicle operator using an on-board device.
emergency notification_ud	An emergency request for assistance originated by a traveler using an in-vehicle, public access, or personal device or originated by a transit vehicle operator using an on-board device.
emergency plan coordination	Information that supports coordination of emergency management plans, continuity of operations plans, emergency response and recovery plans, evacuation plans, and other emergency plans between agencies. This includes general plans that are coordinated prior to an incident and shorter duration tactical plans that are prepared during an incident.
emergency route request	Request for access routes for emergency response vehicles and equipment. This may be a request for ingress or egress routes or other emergency routes..
emergency routes	Suggested ingress and egress routes for access to and between the scene and staging areas or other specialized emergency access routes.

Architecture Flow	Description
emergency traffic control information	Status of a special traffic control strategy or system activation implemented in response to an emergency traffic control request, a request for emergency access routes, a request for evacuation, a request to activate closure systems, a request to employ driver information systems to support public safety objectives, or other special requests. Identifies the selected traffic control strategy and system control status.
emergency traffic control request	Special request to preempt the current traffic control strategy in effect at one or more signalized intersections or highway segments, activate traffic control and closure systems such as gates and barriers, activate safeguard systems, or use driver information systems. For example, this flow can request all signals to red-flash, request a progression of traffic control preemptions along an emergency vehicle route, request a specific evacuation traffic control plan, request activation of a road closure barrier system, or place a public safety or emergency-related message on a dynamic message sign.
emergency transit schedule information	Information on transit schedule and service changes that adapt the service to better meet needs of responders and the general public in an emergency situation, including special service schedules supporting evacuation.
emergency transit service request	Request to modify transit service and fare schedules to address emergencies, including requests for transit services to evacuate people from and/or deploy response agency personnel to an emergency scene. The request may poll for resource availability or request pre-staging, staging, or immediate dispatch of transit resources.
emergency transit service response	Response indicating changes to transit service, fares, and/or restrictions that will be made and status of transit resources to be deployed to support emergency response and/or evacuation.
emergency traveler information	Public notification of an emergency such as a natural or man-made disaster, civil emergency, or child abduction. This flow also includes evacuation information including evacuation instructions, evacuation zones, recommended evacuation times, tailored evacuation routes and destinations, traffic and road conditions along the evacuation routes, traveler services and shelter information, and reentry times and instructions.
emergency vehicle tracking data	The current location and operating status of the emergency vehicle.
environmental conditions data	Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) as measured and reported by environmental sensors.
environmental probe data	Current environmental conditions (e.g., air temperature, wind speed, surface temperature) as measured by vehicle-based environmental sensors. In addition to environmental sensor inputs, this flow may also include vehicle control system information that may indicate adverse road surface conditions (e.g., traction control system activations).
environmental sensors control equipment availability	Data used to configure and control environmental sensors.
equipment maintenance status	An inventory of the maintenance and construction equipment available at the storage facility. This flow includes the type of equipment, enough descriptive information to indicate its suitability for use, and its current status. This flow may contain information for a specific type of equipment or include all equipment available at the facility.
evacuation coordination	Current status of field equipment maintenance actions.
evacuation information	Coordination of information regarding a pending or in-process evacuation. Includes evacuation zones, evacuation times, evacuation routes, forecast network conditions, and reentry times.
event plans	Evacuation instructions and information including evacuation zones, evacuation times, and reentry times.
expected driver identity characteristics	Plans for major events possibly impacting traffic.
facility incident information_ud	Driver identification information e.g. encrypted PIN codes issued to drivers, encrypted driver biometric parameters.
field equipment status	Notification of existence of incident and expected severity, location, time and nature of incident on a specific facility
fleet to driver update	Identification of field equipment requiring repair and known information about the associated faults.
	Updated instructions to the driver including dispatch, routing, and special instructions.

Architecture Flow	Description
freeway control data	Control commands and operating parameters for ramp meters, mainline metering/lane controls and other systems associated with freeway operations.
freeway control status	Current operational status and operating parameters for ramp meters, mainline metering/lane controls and other control equipment associated with freeway operations.
hazmat information	Information about a particular hazmat load including nature of the load and unloading instructions. May also include hazmat vehicle route and route update information.
hazmat information request	Request for information about a particular hazmat load.
hazmat information request_ud	Request for information about a particular hazmat load.
hazmat information_ud	Information about a particular hazmat load including nature of the load and unloading instructions. May also include hazmat vehicle route and route update information.
hazmat registration data_ud	HAZMAT permit and registration information, including payload and route information.
hazmat spill notification	This data flow is used by the on-board cargo monitoring equipment package to contact emergency response organizations when the cargo sensors detect a release of hazardous material. This information will include the vehicle location discussed above as well as identifying the carrier. The information may be provided as a response to a real-time query or proactively by the source. The query flow is not explicitly shown.
hazmat spill notification_ud	This data flow is used by the on-board cargo monitoring equipment package to contact emergency response organizations when the cargo sensors detect a release of hazardous material. This information will include the vehicle location discussed above as well as identifying the carrier. The information may be provided as a response to a real-time query or proactively by the source.
headway advisory_ud	
highway control status	Current traffic control equipment status that indicates operational status and right-of-way availability to the non-highway transportation mode at a multimodal crossing.
hri advisories	Notification of Highway-Rail Intersection equipment failure, intersection blockage, or other condition requiring attention, and maintenance activities at or near highway rail intersections.
hri advisories_ud	Notification of Highway-Rail Intersection equipment failure, intersection blockage, or other condition requiring attention, and maintenance activities at or near highway rail intersections.
hri control data	Data required for HRI information transmitted at railroad grade crossings and within railroad operations.
hri operational status	Status of the highway-rail grade crossing equipment including both the current state or mode of operation and the current equipment condition.
hri request	A request for highway-rail intersection status or a specific control request intended to modify HRI operation.
hri status	Status of the highway-rail intersection equipment including both the current state or mode of operation and the current equipment condition.
identification information_ud	The physical characteristics of a commercial vehicle that can be used to determine a vehicle's identity, such as a license plate number, USDOT number, ICC number, bar code, etc.
identities	Identification information for the Commercial Vehicle (e.g., license plate number or USDOT number), Freight Equipment (e.g., container, chassis, or trailer identification), and Driver.
incident command information coordination	Information that supports local management of an incident. It includes resource deployment status, hazardous material information, traffic, road, and weather conditions, evacuation advice, and other information that enables emergency or maintenance personnel in the field to implement an effective, safe incident response.

Architecture Flow	Description
incident information	Notification of existence of incident and expected severity, location, time and nature of incident. As additional information is gathered and the incident evolves, updated incident information is provided. Incidents include any event that impacts transportation system operation ranging from routine incidents (e.g., disabled vehicle at the side of the road) through large-scale natural or human-caused disasters that involve loss of life, injuries, extensive property damage, and multi-jurisdictional response.
incident report	Report of an identified incident including incident location, type, severity and other information necessary to initiate an appropriate incident response.
incident response coordination	Incident response procedures and current incident response status that are shared between allied response agencies to support a coordinated response to incidents. This flow provides current situation information, including a summary of incident status and its impact on the transportation system and other infrastructure, and current and planned response activities. This flow also coordinates a positive hand off of responsibility for all or part of an incident response between agencies.
incident response status	Status of the current incident response including a summary of incident status and its impact on the transportation system, traffic management strategies implemented at the site (e.g., closures, diversions, traffic signal control overrides), and current and planned response activities.
incident status	Information gathered at the incident site that more completely characterizes the incident and provides current incident response status.
information on violators	Information on violators provided by a law enforcement agency. May include information about commercial vehicle violations or other kinds of violations associated with the particular entity. The information may be provided as a response to a real-time query or proactively by the source. The query flow is not explicitly shown.
infrastructure monitoring sensor control	Data used to configure and control infrastructure monitoring sensors.
infrastructure monitoring sensor data	Data read from infrastructure-based sensors that monitor the condition or integrity of transportation infrastructure including bridges, tunnels, interchanges, pavement, culverts, signs, transit rail or guideway, and other roadway infrastructure. Includes sensor data and the operational status of the sensors.
intersection blockage notification	Notification that a highway-rail intersection is obstructed and supporting information.
ISP coordination	Coordination and exchange of transportation information between centers. This flow allows a broad range of transportation information collected by one ISP to be redistributed to many other ISPs and their clients.
local signal preemption request	Direct control signal or message to a signalized intersection that results in preemption of the current control plan and grants right-of-way to the requesting vehicle.
local signal priority request	Request from a vehicle to a signalized intersection for priority at that intersection.
maint and constr dispatch information	Information used to dispatch maintenance and construction vehicles, equipment, and crews and information used to keep work zone crews informed. This information includes routing information, traffic information, road restrictions, incident information, environmental information, decision support information, maintenance schedule data, dispatch instructions, personnel assignments, alert notifications, and corrective actions.
maint and constr dispatch status	Current maintenance and construction status including work data, operator status, crew status, and equipment status.
maint and constr equipment repair status	Current maintenance and repair status of the maintenance and construction vehicle fleet and other support equipment. This information includes a record of all maintenance and repair activities performed.
maint and constr fleet information	Information supporting maintenance of the maintenance and construction vehicle fleet and other support equipment. This information includes vehicle status and diagnostic information, vehicle utilization, and coordination of when vehicles will be available for preventative and corrective maintenance.
maint and constr resource coordination	Request for road maintenance and construction resources that can be used in the diversion of traffic (cones, portable signs), clearance of a road hazard, repair of ancillary damage, or any other incident response.

Architecture Flow	Description
maint and constr resource request	Request for road maintenance and construction resources that can be used in the diversion of traffic (cones, portable signs), clearance of a road hazard, repair of ancillary damage, or any other incident response. The request may poll for resource availability or request pre-staging, staging, or immediate dispatch of resources.
maint and constr resource response	Current status of maintenance and construction resources including availability and deployment status. General resource inventory information covering vehicles, equipment, materials, and people and specific resource deployment status may be included.
maint and constr vehicle conditions	Vehicle diagnostics information that is collected, filtered, and selectively reported by a maintenance and construction vehicle. The information includes engine temperature, mileage, tire wear, brake wear, belt wear, and any warnings or alarms concerning the operational condition of the vehicle and ancillary equipment.
maint and constr vehicle location data	The current location and related status (e.g., direction and speed) of the maintenance/construction vehicle.
maint and constr vehicle operational data	Data that describes the maintenance and construction activity performed by the vehicle. Operational data includes materials usage (amount stored and current application rate), operational state of the maintenance equipment (e.g., blade up/down, spreader pattern), vehicle safety status, and other measures associated with the operation of a maintenance, construction, or other special purpose vehicle. Operational data may include basic operational status of the vehicle equipment or a more precise record of the work performed (e.g., application of crack sealant with precise locations and application characteristics).
maint and constr vehicle system control	Configure and control data that supports remote control of on-board maintenance and construction vehicle systems and field equipment that is remotely controlled by the vehicle. For example, the data can be used to adjust material application rates and spread patterns.
maint and constr work plans	Future construction and maintenance work schedules and activities including anticipated closures with anticipated impact to the roadway, alternate routes, anticipated delays, closure times, and durations.
maintenance materials storage status	The amount and availability of maintenance materials in storage facilities.
map update request	Request for a map update which could include a new underlying map or map layer updates.
map updates	Map update which could include a new underlying static or real-time map or map layer(s) update.
media information request	Request from the media for current transportation information.
multimodal crossing status	Indication of operational status and pending requests for right-of-way from equipment supporting the non-highway mode at multimodal crossings.
multimodal information	Schedule information for alternate mode transportation providers such as train, ferry, air and bus.
multimodal information request	Information request for alternate mode transportation providers such as train, ferry, air and bus.
multimodal service data	Multimodal transportation schedules and other service information.
multimodal traveler information_ud	Multimodal traveler information comprised of traffic status, advisories, incidents, payment information and many other travel-related data updates and confirmations.
on-board vehicle data	Information about the commercial vehicle stored on-board (for maintenance purposes, gate access, cargo status, lock status, etc.).
on-board vehicle request	Request for on-board vehicle data.
overdimension vehicle alarm_ud	Alarm indicating that an overdimension vehicle is nearing an underdimension structure.
overdimension vehicle detector information_ud	Parameters or dimension criteria used by over vehicle detection system.
parking archive data	Data used to analyze and monitor trends in parking demand, pricing, and operational actions. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.
parking coordination	Information that enables parking management activities to be coordinated between different parking operators or systems in a region.

Architecture Flow	Description
parking demand management response	Response to parking demand management change requests indicating level of compliance with request.
parking information	General parking information and current parking availability.
parking information_ud	General parking information and current parking availability.
parking lot data request	Request for parking lot occupancy, fares, and availability. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.
parking lot reservation confirmation	Confirmation for parking lot reservation.
parking reservations request	Reservation request for parking lot.
parking reservations request_ud	Reservation request for parking lot.
pass/pull-in	Command to commercial vehicle to pull into or bypass inspection station.
patient status	Information that supports assessment of the patient's condition. Information could include general categorization of patient status, patient vital signs, pertinent medical history, and emergency care information.
payment	Payment of some kind (e.g., toll, parking, fare) by traveler which, in most cases, can be related to a credit account.
payment request	Request for payment from financial institution.
permit information_ud	
personal transit information	General and personalized transit information for a particular fixed route, flexible route, or paratransit system.
port clearance result_ud	Notification regarding the granting of permission for commercial freight shipment to enter and exit the port.
railroad advisories	Real-time notification of railway-related incident or advisory.
railroad schedules	Train schedules, maintenance schedules, and other information from the railroad that supports forecast of HRI closures.
regional incident information_ud	Notification of existence of a regional incident and expected severity, location, time and nature of incident.
remote vehicle disable	Signal used to remotely disable a transit vehicle.
request for payment	Request to deduct cost of service from user's payment account.
request for right-of-way	Forwarded request from signal prioritization, signal preemption, pedestrian call, multi-modal crossing activation, or other source for right-of-way.
request for vehicle measures	Request for vehicle performance and maintenance data collected by onboard sensors.
request tag data	Request for tag information including credit identity, stored value card cash, etc.
request transit information	Request for transit service information and current transit status.
resource coordination	Coordination of resource inventory information, specific resource status information, resource prioritization and reallocation between jurisdictions, and specific requests for resources and responses that service those requests..
resource deployment status	Status of traffic management resource deployment identifying the resources (vehicles, equipment, materials, and personnel) available and their current status. General resource inventory information and specific status of deployed resources may be included.
resource request	A request for traffic management resources to implement special traffic control measures, assist in clean up, verify an incident, etc. The request may poll for resource availability or request pre-staging, staging, or immediate deployment of resources.
reversible lane control_ud	
reversible lane status	Current reversible lane status including traffic sensor and surveillance data and the operational status and mode of the reversible lane control equipment.
road conditions observations_ud	Roadway conditions reported by transit bus drivers.

Architecture Flow	Description
road network conditions	Current and forecasted traffic information, road and weather conditions, traffic incident information, and other road network status. Either raw data, processed data, or some combination of both may be provided by this architecture flow. Information on diversions and alternate routes, closures, and special traffic restrictions (lane/shoulder use, weight restrictions, width restrictions, HOV requirements) in effect is also included.
road network status assessment	Assessment of damage sustained by the road network including location and extent of the damage, estimate of remaining capacity, required closures, alternate routes, necessary restrictions, and time frame for repair and recovery.
road weather information	Road conditions and weather information that are made available by road maintenance operations to other transportation system operators.
road weather information_ud	Road conditions and weather information that are made available by road maintenance operations to other transportation system operators.
roadway information system data	Information used to initialize, configure, and control roadside systems that provide driver information (e.g., dynamic message signs, highway advisory radio, beacon systems). This flow can provide message content and delivery attributes, local message store maintenance requests, control mode commands, status queries, and all other commands and associated parameters that support remote management of these systems.
roadway information system status	Current operating status of dynamic message signs, highway advisory radios, beacon systems, or other configurable field equipment that provides dynamic information to the driver.
roadway maintenance status	Summary of maintenance fleet operations affecting the road network. This includes the status of winter maintenance (snow plow schedule and current status).
roadway maintenance status_ud	
roadway treatment system control	Control data for remotely located, automated devices, that affect the roadway surface (e.g. de-icing applications).
roadway treatment system status	Current operational status of automated roadway treatment devices (e.g., anti-icing systems).
route plan	Tailored route provided by ISP in response to a specific request.
route request	Request for a tailored route based on given constraints.
safety inspection report	Report containing results of commercial vehicle safety inspection. The information may be provided as a response to a real-time query or proactively by the source. The query flow is not explicitly shown.
safety status information	Safety information such as safety ratings, inspection summaries, and violation summaries. A unique identifier is included. Corresponds to the safety portion of CVISN "snapshots." The status information may be provided as a response to a real-time query or as a result of a standing request for updated information (subscription). This may also include information about non-U.S. fleets for use by U.S. authorities, and information regarding U.S. fleets made available to Mexican and Canadian authorities. The query flow is not explicitly shown.
screening event record	Results of CVO electronic screening activity.
secure area sensor control	Information used to configure and control threat sensors (e.g., thermal, acoustic, radiological, chemical), object, motion and intrusion detection sensors. The provided information controls sensor data collection, aggregation, filtering, and other local processing.
secure area sensor data	Data provided by threat sensors (e.g., thermal, acoustic, radiological, chemical), and intrusion, motion, and object detection sensors in secure areas indicating the sensor's operational status, raw and processed sensor data, and alarm indicators when a threat has been detected.
secure area sensor data_ud	Data provided by threat sensors (e.g., thermal, acoustic, radiological, chemical, intrusion) indicating the sensor's operational status, raw and processed sensor data, and alarm indicators.
secure area surveillance control	Information used to configure and control audio and video surveillance systems used for transportation infrastructure security in secure areas. The provided information controls surveillance data collection, aggregation, filtering, and other local processing.
secure area surveillance data	Data collected from surveillance systems used to monitor secure areas. Includes video, audio, processed surveillance data, equipment operational status, and alarm indicators when a threat has been detected.

Architecture Flow	Description
security field equipment status	Identification of security sensors and surveillance equipment requiring repair and known information about the associated faults.
selected routes	Routes selected based on route request criteria.
signal control data	Information used to configure and control traffic signal systems.
signal control status	Status of surface street signal controls.
speed monitoring control	Information used to configure and control automated speed monitoring, speed warning, and speed enforcement systems.
speed monitoring information	System status including current operational state and logged information including measured speeds, warning messages displayed, and violation records.
storage facility request	Request for information about the equipment and/or materials available at a maintenance storage facility.
suggested route	Suggested route for a dispatched emergency or maintenance vehicle that may reflect current network conditions and the additional routing options available to en route emergency or maintenance vehicles that are not available to the general public.
tag data	Unique tag ID and related vehicle information.
threat information	Threats regarding transportation infrastructure, facilities, or systems detected by a variety of methods (sensors, surveillance, threat analysis of advisories from outside agencies, etc.
threat information coordination	Sensor, surveillance, and threat data including raw and processed data that is collected by sensor and surveillance equipment located in secure areas.
toll archive data	Data indicating toll facility usage and pricing schedules. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.
track status	Current status of the wayside equipment and notification of an arriving train.
traffic archive data	Information describing the use and vehicle composition on transportation facilities and the traffic control strategies employed. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.
traffic control coordination	Information transfers that enable remote monitoring and control of traffic management devices. This flow is intended to allow cooperative access to, and control of, field equipment during incidents and special events and during day-to-day operations. This flow also allows 24-hour centers to monitor and control assets of other centers during off-hours, allows system redundancies and fail-over capabilities to be established, and otherwise enables integrated traffic control strategies in a region.
traffic control priority request	Request for signal priority at one or more intersections along a particular route.
traffic control priority status	Status of signal priority request functions at the roadside (e.g. enabled or disabled).
traffic flow	Raw and/or processed traffic detector data which allows derivation of traffic flow variables (e.g., speed, volume, and density measures) and associated information (e.g., congestion, potential incidents).
traffic images	High fidelity, real-time traffic images suitable for surveillance monitoring by the operator or for use in machine vision applications. This flow includes the images and the operational status of the surveillance system.
traffic images_ud	High fidelity, real-time traffic images suitable for surveillance monitoring by the operator or for use in machine vision applications. This flow includes the images and the operational status of the surveillance system.
traffic information coordination	Traffic information exchanged between TMC's. Normally would include incidents, congestion data, traffic data, signal timing plans, and real-time signal control information.
traffic sensor control	Information used to configure and control traffic sensor systems.
traffic violation notification	Notification to enforcement agency of a detected traffic violation including speed violations and HOV violations.
transaction status	Response to transaction request. Normally dealing with a request for payment.
transit and fare schedules	Transit service information including routes, schedules, schedule adherence, and fare information. Includes transit service information during evacuation.

Architecture Flow	Description
transit and fare schedules_ud	Transit service information including routes, schedules, schedule adherence, and fare information. Includes transit service information during evacuation.
transit archive data	Data used to describe and monitor transit demand, fares, operations, and system performance. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.
transit emergency data	Initial notification of transit emergency at a transit stop or on transit vehicles and further coordination as additional details become available and the response is coordinated.
transit fare and passenger status	Information provided from the traveler location that supports fare payments, passenger data, and associated record-keeping.
transit fare coordination	Fare and pricing information shared between local/regional transit organizations.
transit fare information	Information provided by transit management that supports fare payment transactions and passenger data collection.
transit incident information	Information on transit incidents that impact transit services for public dissemination.
transit incident information_ud	Information on transit incidents that impact transit services.
transit information request	Request for transit operations information including schedule and fare information. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.
transit information user request	Request for special transit routing, real-time schedule information, and availability information.
transit multimodal information	Transit schedule information for coordination at modal interchange points.
transit request confirmation	Confirmation of a request for transit information or service.
transit schedule information	Current and projected transit schedule adherence.
transit service coordination	Schedule coordination information shared between local/regional transit organizations.
transit service coordination_ud	Schedule coordination information shared between local/regional transit organizations
transit system data	Current transit system operations information indicating current transit routes, the level of service on each route, and the progress of individual vehicles along their routes for use in forecasting demand and estimating current transportation network performance.
transit system status assessment	Assessment of damage sustained by the public transportation system including location and extent of the damage, current operational status including an estimate of remaining capacity and necessary restrictions, and time frame for repair and recovery.
transit traveler information	Transit information prepared to support transit users and other travelers. It contains transit schedules, real-time arrival information, fare schedules, alerts and advisories, and general transit service information.
transit traveler information coordination_ud	Transit schedules, real-time arrival information, fare schedules, and general transit service information shared between transit organizations to support transit traveler information systems.
transit traveler information_ud	Generally, fare and schedule information, but may include information on transit incidents, construction, service changes, etc.
transit traveler request	Request by a Transit traveler to summon assistance, request transit information, or request any other transit services.
transit trip request_ud	
transit trip status_ud	
transit vehicle conditions	Operating conditions of transit vehicle (e.g., engine running, oil pressure, or mileage).
transit vehicle location data	Current transit vehicle location and related operational conditions data provided by a transit vehicle.
transit vehicle location_ud	transit vehicle location or presence information (as in milepost type systems or for a track based system, train is present along a track section).
transit vehicle operator authentication information	Information regarding on-board transit operator authentication

Architecture Flow	Description
transit vehicle operator authentication update	Results of authentication process or update of on-board authentication database.
transit vehicle operator instructions	Transit service instructions, traffic information, road conditions, and other information for both transit and paratransit operators.
transit vehicle passenger and use data	Data collected on board the transit vehicle pertaining to availability and/or passenger count.
transit vehicle schedule performance	Estimated times of arrival and anticipated schedule deviations reported by a transit vehicle.
transit vehicle schedule performance_ud	Estimated times of arrival and anticipated schedule deviations reported by a transit vehicle.
transportation system status	Current status and condition of transportation infrastructure (e.g., tunnels, bridges, interchanges, TMC offices, maintenance facilities). In case of disaster or major incident, this flow provides an assessment of damage sustained by the surface transportation system including location and extent of the damage, estimate of remaining capacity and necessary restrictions, and time frame for repair and recovery.
travel time_ud	Measured or computed value of travel time between destination and origin points.
traveler information	Traveler information comprised of traffic and road conditions, advisories, incidents, payment information, transit services, and many other travel-related data updates and confirmations.
traveler information for media	General traveler information regarding incidents, unusual traffic conditions, transit issues, or other advisory information that has been desensitized and provided to the media.
traveler profile	Information about a traveler including equipment capabilities, personal preferences and recurring trip characteristics.
traveler request	Request by a traveler to summon assistance, request information, make a reservation, or initiate any other traveler service.
trip confirmation	Acknowledgement by the driver/traveler of acceptance of a route.
trip log	Driver's daily log, vehicle location, mileage, and trip activity (includes screening, inspection and border clearance event data as well as fare payments).
trip log request	Request for trip log.
trip plan	A sequence of links and special instructions comprising of a trip plan indicating efficient routes for navigating the links. Normally coordinated with traffic conditions, other incidents, preemption and prioritization plans.
trip request	Request by a driver/traveler for special routing.
vehicle dimensions_ud	Physical size of vehicles.
vehicle probe data	Vehicle probe data indicating identity, route segment identity, link time and location.
video surveillance control	Information used to configure and control video surveillance systems.
violation notification	Notification to enforcement agency of a violation. The violation notification flow describes the statute or regulation that was violated and how it was violated (e. g., overweight on specific axle by xxx pounds or which brake was out of adjustment and how far out of adjustment it was). A violation differs from a citation because it is not adjudicated by the courts.
weather archive data_ud	
weather information	Accumulated forecasted and current weather data (e.g., temperature, pressure, wind speed, wind direction, humidity, precipitation, visibility, light conditions, etc.).
work plan coordination	Coordination of work plan schedules and activities between maintenance and construction organizations or systems. This information includes the work plan schedules and comments and suggested changes that are exchanged as work plans are coordinated and finalized.
work plan feedback	Comments and suggested changes to proposed construction and maintenance work schedules and activities. This information influences work plan schedules so that they minimize impact to other system operations and the overall transportation system.

Architecture Flow**Description**

work zone information

Summary of maintenance and construction work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

workzone information_ud

yellow pages information

Travel service information covering tourist attractions, lodging, restaurants, service stations, emergency services, and other services and businesses of interest to the traveler.

Appendix 10.A

Northern New Jersey TIP And ITS Projects

NJTPA TIP

NJTPA TIP

	Project #	Project	Type	Description	Related Market Package(s)
1	X68	Safety Management System	AD	This program will provide for the development and improvement of the New Jersey Safety Management System, which includes a computerized system of analyzing accident data for state highways to identify potential locations for safety improvements, as required by federal law. Also included is individual field investigation of potential safety improvements to respond to concerns raised by the public on state, county, and municipal roadways.	2005-07
2	T06	Bus Passenger Facilities/Park and Ride	APTS	This program will provide funds for the purchase and installation of bus stop signs and shelters, bus park and ride program and improvements to bus passenger facilities. Key Bus Park and Ride expansions are planned at Rt. 23 in Wayne Township Passaic County , Market Street Parking Deck in Passaic County, Route 34 in Old Bridge Township in Middlesex County and Liberty State Park Parking Expansion in Hudson County.	2005-07
3	T08	Bus Support Facilities and Equipment	APTS	Investments are required to provide a well-maintained and safe bus fleet including but not limited to, bus tires, engines and transmissions and other parts, support vehicles\equipment (for rail and bus operations), maintenance equipment, bus mid-life overhaul needs, improvements to various support facilities, and other capital improvements.	2005-07
4	T117	Rail Park and Ride	APTS	This program will provide land acquisition, design, and construction funding for access improvements, the expansion of parking, and other improvements at various locations. Key Park and Ride improvements planned near major highway intercepts include Old Bridge/Garden State Parkway, Clinton/I-78, Howard Boulevard/I-80, Hamilton Station/I-295, North Hackensack/Rt. 4, and Edison Township/Rt27.	2005-07

NJTPA TIP

	Project #	Project	Type	Description	Related Market Package(s)
5	T508	Security Improvements	APTS	This program provides for continued modernization/improvements of NJT Police. Today, the NJTPD is the only transit policing agency in the country with statewide authority and jurisdiction. The NJ TRANSIT Police are responsible for policing the Hudson/Bergen Light Rail and the Southern NJ Light Rail System.	2005-07
6	T120	Small/Special Services Program	APTS	Funding will cover NJ TRANSIT efforts which initiate or promote transit solutions to reduce congestion, manage transportation demand and improve air quality. Also included are funds for the Vanpool Sponsorship Program, funding for capital acquisition/operating expenses for the Community Shuttle Program, Bike/Transit facilitation, and other activities that improve air quality and help reduce congestion.	2005-07
7	T500	Technology Improvements	APTS	This element funds improvements to passenger communication and fare collection systems and other information technology improvements to meet internal and external customer needs. Funding is included for computer systems and services, photocopy lease payments, ADA Access Link computer upgrades and upgrades to increase efficiency and productivity of NJ TRANSIT's technology infrastructure to support services to customers.	2005-07
8	053B	Contract 2 (12th Street Viaduct, 14th Street Viaduct)	ATMS		2005-07

NJTPA TIP

	Project #	Project	Type	Description	Related Market Package(s)
9	03305	Intelligent Transportation Systems	ATMS	Design, integration and construction of Intelligent Transportation System (ITS) facilities and expansion of the existing systems throughout the state. Federal participation and full oversight is recommended for the development of contract plans and specifications, investigations and construction of the following: fiber optic communications networks; interagency links to share information in support of the FHWA requirements for ITS architectures; emergency traffic management systems; identification of critical transportation infrastructure for the installation of ITS Homeland Security Systems; improvements to the NJDOT traffic information closed-circuit television web site; Amber Alert Systems; ITS component in the Portway region to facilitate the movement of motorists and increased freight traffic; installation and optimization of traffic signal systems; congestion management; development of software drivers for new ITS devices, central system control, and ITS modeling for deployment studies of ITS components; procurement, testing and installation of ITS technologies; and updates to the State Geographic Information System ITS database.	2005-07
10	97115	Main Street, Netcong	ATMS	Intersection improvements include installation of a new traffic signal to be coordinated with the adjacent at-grade railroad crossing on Main Street.	2005-07

NJTPA TIP

	Project #	Project	Type	Description	Related Market Package(s)
11	X28B	Park and Ride/Transportation Demand Management Program	ATMS	Comprehensive program of developing, implementing and evaluating a variety of statewide Transportation Demand Management (TDM) strategies that provide alternatives to single-occupant vehicle use, including commuter ridesharing assistance, planning and marketing of park and rides; grants to counties and municipalities for local park and rides; park and ride leases; marketing of TDM options; bicycle and pedestrian marketing; support of statewide voluntary employer programs; and TDM solutions in a traffic mitigation or corridor management context. Additionally, this program includes the assessment of TMA/TDM strategies on air quality, traffic congestion, and the statewide transportation system.	2005-07
12	X35A1	Rail-Highway Grade Crossing Program, Federal	ATMS	Elimination of hazards at rail-highway grade crossings, the rehabilitation of grade crossing surfaces, and the installation of protective warning devices for roadways both on and off the federal-aid system. Funding will also be provided for the traffic control items required during the construction work and the installation of advance warning signs and pavement markings at all highway-rail grade crossings.	2005-07
13	X35A	Rail-Highway Grade Crossing Program, State	ATMS	Elimination of hazards at rail-highway grade crossings by the closure of crossings or the upgrade/improvement of protective warning devices for roads throughout the state. This funding will allow flexibility in allocating monies to the areas in need regardless of their geographic location (MPO) and for emergent conditions. This program will also enable the active pursuing of grade crossing closures without drawing down the federal funds used for grade crossing improvements. Funding will also be provided for the design of traffic detours required for the crossing surface reconstruction projects.	2005-07

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	Project #	Project	Type	Description	Related Market Package(s)
14	X230	Statewide Incident Management Program	ATMS	Funding for the following: equip and train a NJDOT Incident Response Team; train county and local emergency responders on methods to reduce traffic delays caused by incidents; develop, print and distribute diversion route manuals; develop partnerships with local and state law enforcement organizations; and establish a State Police Traffic Incident Management Unit.	
15	X66	Traffic Monitoring Systems	ATMS	Collection of essential traffic data, including traffic counts, vehicle classifications, vehicle occupancy, site-specific air quality monitoring, automated mapping and various other geographical information system activities. Included in this item is the construction of monitoring sites (WIM--Weigh-in-Motion and speed monitoring) and acquisition of new equipment to upgrade existing stations. Site selection will be made through NJDOT's Traffic Monitoring Systems highway plan as approved by FHWA. These funds will also be used to retain contractors to install and repair traffic loops and sensors at sites statewide.	2005-07
16	X99	Traffic Operations Center (North)	ATMS	Development and implementation of state-of-the-art traffic management techniques in the North Jersey area, including establishment and operation of a traffic operations center; incident management and construction traffic mitigation; highway courtesy patrols; highway advisory radio; operation and maintenance of computerized traffic signals, traffic surveillance, and motorist information systems; and other techniques.	2005-07

NJTPA TIP

	Project #	Project	Type	Description	Related Market Package(s)
17	X82	Traffic Operations Center (South)	ATMS	Development and implementation of state-of-the-art traffic management techniques including establishment and operation of a traffic operations center; incident management and construction traffic mitigation; highway advisory radio; operation and maintenance of computerized traffic signal, traffic surveillance, motorist information systems; minor ITS installations; TOC operation for Route 29 tunnel; and other techniques.	
18	X47	Traffic Signal Replacement	ATMS	Purchase of materials and installation of new and upgraded traffic signals statewide and related improvements to the operation of signals.	2005-07
19	X125	TRANSCOM Membership	ATMS	NJDOT's contribution to the costs of this multi-agency sponsored organization, which provides instant traffic and incident management information to participating transportation agencies in the Northeast New Jersey/New York area.	2005-07
20	376	TRANSCOM/Project Funding	ATMS	TRANSCOM, a multi-agency coalition of operating transportation agencies in the metropolitan New York area, is deploying an Automatic Vehicle Identification (AVI) system, known as TRANSMIT, for traffic management and surveillance applications. TRANSMIT offers the ability to use vehicles equipped with EZ-Pass transponders to serve as vehicle probes within the traffic stream for traffic surveillance purposes. It requires the installation of readers (small 3-foot antennae) with the capability of identifying the vehicles equipped with EZ-Pass transponders, and measuring travel speeds at periodic intervals along the roadway.	2005-07
21	02379	Congestion Relief, Intelligent Transportation System Improvements	ATMS, ATIS	AKA--Smart Move Program. This is a program of low-cost, quick-turnaround intelligent transportation system improvements to improve traffic flow and provide traveler information on the state's transportation system.	2005-07

NJTPA TIP

	Project #	Project	Type	Description	Related Market Package(s)
22	HP01015	CARGOMATE	CVO	CARGOMATE is a trade name for an ITS application which tracks the location of intermodal assets such as containers, truck chassis, generators set and drayage tractors belonging to partner operations in port and terminal areas. PAR Government Systems has joined with the FHWA and Maersk SeaLand shipping to deploy this pilot system in the Port Newark/Port Elizabeth area. NJDOT is the pass-through agency for funding. The federal FY 2001 DOT Appropriations Act provided funding for this project under an ITS grant. This project has been allocated \$750,000.	2005-07
23	X34	Freight Program	CVO	This program will provide for the rehabilitation and improvement of key elements of the State's freight network, including acquisition, rehabilitation, facility construction, and substitute service assistance under the State Freight Assistance Program, matching of federal funds, and participation in other projects and programs for improvement of the intermodal goods movement network and support of economic development initiatives.	2005-07

NJTPA TIP

	Project #	Project	Type	Description	Related Market Package(s)
24	860	Rte. 78 Sec. Truck Weigh Stations (eastbound and westbound) (6J 6K) Mile posts: 4.10 - 7.00	CVO	<p>This project, which is approximately 1.6 miles in length, will provide state-of-the-art truck weigh and inspection facilities on both the eastbound and westbound directions of I-78. The project's limits are approximately milepost 5.7 to 7.3 and the total acreage will be approximately 60 acres. Components of the project include weigh-in-motion scales, static scales, internal weigh station roadways, a control building on the eastbound side and a scale house on the westbound side. Commercial vehicle inspection buildings will be provided on both sides. The project will include significant roadway and structural improvements also. Acceleration and deceleration lanes will be provided in both direction for the weigh stations. The entire length of the project will be resurfaced in both directions using a noise reducing pavement. The New Village Road bridge over I-78 will be replaced and shifted to improve the alignment of New Village Road. The new bridge will be similar to the existing bridge as it will carry one 12-foot lane and a 1-foot shoulder in each direction and provide a sidewalk on one side, however it will be longer to accommodate the acceleration/deceleration lanes on I-78. The I-78 mainline structures over the Musconetcong River will be widened and re-decked to accept the acceleration/deceleration lanes and the inside shoulder will be brought up to standards. There are no design exceptions in this project. This is a multi-year funded project under the provisions of Section 13 of P.L. 1995, c.108.</p>	2005-07
25	X120	Emergency Response Operations	EM	Funding of emergency response operations.	2005-07
26	X120	Emergency Response Operations	EM	This program will provide for funding of emergency response operations.	2005-07

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	Project #	Project	Type	Description	Related Market Package(s)
27	X181	Emergency Service Patrol	EM	Operation of emergency service patrols on congested state highways to detect and clear incidents rapidly by providing emergency assistance to stranded motorists.	2005-07
28	X181	Emergency Service Patrol	EM	This program will provide for the operation of emergency service patrols on congested state highways to detect and clear incidents rapidly by providing emergency assistance to stranded motorists. Approximately half of all delays experienced by highway users in congested areas are caused by traffic accidents, vehicle breakdowns, and other incidents. Prompt incident management programs can reduce this delay significantly.	2005-07
29	X150	State Police Enforcement and Safety Services	EM	Reimbursement for State Police equipment, facilities, and services for enforcement of safety rules and traffic control in construction work zones, including Operations capital projects.	
30	04312	State Police Safety Patrols	EM	Additional state police presence on state highways to reduce accidents and fatalities and document the impacts of additional enforcement on overall highway safety and compliance with traffic laws. The pilot program will provide for additional state police presence on I-78 between the Delaware River and I-287 for a period of not less than two years.	
31	4312	State Police Safety Patrols	EM	This program will provide funding for additional state police presence on state highways to reduce accidents and fatalities and document the impacts of additional enforcement on overall highway safety and compliance with traffic laws. The pilot program will provide for additional state police presence on I-78 between the Delaware River and I-287 for a period of not less than two years.	2005-07

NJTPA TIP

	Project #	Project	Type	Description	Related Market Package(s)
32	X230	Statewide Incident Management Program	EM	This statewide program is aimed at reducing delays due to transportation incidents. This program will provide funding for the following: equip and train a NJDOT Incident Response Team; train county and local emergency responders on methods to reduce traffic delays caused by incidents; develop, print and distribute diversion route manuals; develop partnerships with local and state law enforcement organizations; and establish a State Police Traffic Incident Management Unit.	2005-07
33	X125	TRANSCOM Membership	EM	This program will provide funding for NJDOT's contribution to the costs of this multi-agency sponsored organization, which provides instant traffic and incident management information to participating transportation agencies in the Northeast New Jersey/New York area.	2005-07
34	X242	Accident Reduction Program	MC		2005-07
35	X241	Electrical Facilities	MC	This program will provide for the replacement, repair, preservation, and installation of electrical facilities along the state highway system. Included in this program are highway lighting, sign lighting, cathodic protection for bridges, road weather information systems, traffic counting/monitoring sites, and emergency call boxes.	2005-07
36	04332	Equipment (Safety-Related Equipment)	MC	Direct purchase and short-term rental of replacement or new equipment related to either work zone safety or motorist safety, including trailer mounted arrow boards, safety trucks, portable light towers, truck-mounted attenuators, portable message boards, emergency service patrol vehicles, incident management response trucks, HAR's Trailers for diversion route planning and implementation.	2005-07

NJTPA TIP

	Project #	Project	Type	Description	Related Market Package(s)
37	X196	Maintenance Management System	MC	Design and implementation of a re-engineered Maintenance Management System. The current 20-year old system requires re-engineering to update and improve support of operations and resource planning.	2005-07

Northern Transit Project

Northern Transit Projects						
	Project Name	Regionally Significant Project	Market Package	Market Package Diagram#	Timeframe (S/M/L)	Programmed Project(s)
1	NJT Bus North Fixed-Route Operations North and Conditions Reporting (APTS)	√	APTS2 Transit Fixed-Route Operations	APTS2-01	S	
2	NJT LRT (Newark City and Hudson-Bergen) Fixed-Route Operations and Conditions Reporting (APTS)	√	APTS2 Transit Fixed-Route Operations	APTS2-02, APTS2-03	S	Bus Passenger Facilities/Park and Ride DBNUM T06
3	Northern TMA Fixed-Route Operations and Conditions Reporting (APTS)	√	APTS2 Transit Fixed-Route Operations	APTS2-04	S	Bus Passenger Facilities/Park and Ride DBNUM T06
4	North New Jersey Municipal/County Fixed-Route Operations (APTS)	√	APTS2 Transit Fixed-Route Operations	APTS2-05	S	Bus Passenger Facilities/Park and Ride DBNUM T06
5	PANYNJ PATH Fixed-Route Operations (APTS)	√	APTS2 Transit Fixed-Route Operations	APTS2-06	S	Bus Passenger Facilities/Park and Ride DBNUM T06
6	Rutgers Campus Shuttle Fixed-Route and Demand Response Operations (APTS)	√	APTS2 Transit Fixed-Route Operations	APTS2-07, APTS3-4	S	
7	Private Bus/Shuttle Fixed-Route and Demand Response Operations (APTS)	√	APTS2 Transit Fixed-Route Operations	APTS2-08, APTS3-5	S	Bus Passenger Facilities/Park and Ride DBNUM T06
8	Private Ferry Fixed-Route Operations (APTS)	√	APTS2 Transit Fixed-Route Operations	APTS2-10	S	
9	NJT Bus Operations North Transit Security (APTS)	√	APTS5 Transit Security	APTS5-01	S	Security Improvements DBNUM T508
10	NJT Rail Operations Transit Security (APTS)	√	APTS5 Transit Security	APTS5-02	S	Security Improvements DBNUM T508
11	NJT LRT (Newark City and Hudson-Bergen) Transit Security (APTS)	√	APTS5 Transit Security	APTS5-03, APTS5-04	S	Security Improvements DBNUM T508

Northern Transit Projects						
	Project Name	Regionally Significant Project	Market Package	Market Package Diagram#	Timeframe (S/M/L)	Programmed Project(s)
12	Northern TMAs Transit Security (APTS)	√	APTS5 Transit Security	APTS5-05	S	Security Improvements DBNUM T508
13	North New Jersey Municipal/County Transit Security (APTS)	√	APTS5 Transit Security	APTS5-06	S	Security Improvements DBNUM T508
14	PANYNJ PATH Transit Security (APTS)	√	APTS5 Transit Security	APTS5-07	S	Security Improvements DBNUM T508
15	TRANSCOM Regional Architecture Expansion	√	APTS7 Multimodal Coordination	APTS7-2	S	
16	TRANSCOM Regional Transit Information (TRIPS123)	√	APTS8 Transit Traveler Information; APTS7 Multimodal Coordination	APTS8-08	S	
17	Private Transit/Demand Responsive Vehicle Tracking (APTS)		APTS1 Transit Vehicle Tracking	APTS1-5	M	
18	NJT Access Link Demand Responses Transit Operations (APTS)		APTS3 Demand Response Transit Operations	APTS3-1	M	Small/Special Services Program DBNUM T120
19	Northern TMAs Demand Response Transit Operations (APTS)		APTS3 Demand Response Transit Operations	APTS3-2	M	Small/Special Services Program DBNUM T120
20	North New Jersey Municipal/County Paratransit Operations (APTS)		APTS3 Demand Response Transit Operations	APTS3-3	M	Small/Special Services Program DBNUM T120
21	PANYNJ PATH Passenger and Fare Management (APTS)		APTS4 Transit Passenger and Fare Management	APTS4-2	M	Technology Improvements DBNUM T500
22	Rutgers Campus Shuttle Transit Security (APTS)		APTS5 Transit Security	APTS5-08	M	

Northern Transit Projects						
	Project Name	Regionally Significant Project	Market Package	Market Package Diagram#	Timeframe (S/M/L)	Programmed Project(s)
23	NJTPA Multimodal Coordination		APTS7 Multimodal Coordination	APTS7-1	M	
24	Northern TMA's Regional Transit Information Exchange (APTS)		APTS7 Multimodal Coordination	APTS7-2	M	
25	NJT LRT (Newark City and Hudson-Bergen) Regional Transit Information Exchange (APTS)		APTS7 Multimodal Coordination	APTS7-8, APTS7-9	M	
26	NJT Bus Operations North Transit Traveler Information (APTS)		APTS8 Transit Traveler Information	APTS8-01	M	
27	NJT Rail Operations Traveler Information (APTS)		APTS8 Transit Traveler Information	APTS8-02	M	
28	NJT LRT (Newark City and Hudson-Bergen) Transit Traveler Information (APTS)		APTS8 Transit Traveler Information	APTS8-03 and 04	M	
29	PANYNJ PATH Transit Traveler Information (APTS)		APTS8 Transit Traveler Information	APTS8-05	M	
30	North New Jersey Municipal/County Transit Traveler Information (APTS)		APTS8 Transit Traveler Information	APTS8-06	M	
31	Northern TMA Transit Traveler Information (APTS)		APTS8 Transit Traveler Information	APTS8-07	M	
32	Newark Pennsylvania Transit Traveler Information (APTS)		APTS8 Transit Traveler Information	APTS8-09	M	
33	NJT LRT Hudson-Bergen/River Vehicle Tracking (APTS)		APTS1 Transit Vehicle Tracking	APTS1-1	L	
34	NJT LRT Newark City Vehicle Tracking (APTS)		APTS1 Transit Vehicle Tracking	APTS1-1	L	

Northern Transit Projects						
	Project Name	Regionally Significant Project	Market Package	Market Package Diagram#	Timeframe (S/M/L)	Programmed Project(s)
35	North New Jersey Municipal/County Vehicle Tracking (APTS)		APTS1 Transit Vehicle Tracking	APTS1-2	L	
36	Northern TMA and Rutgers Campus Shuttle Vehicle Tracking (APTS)		APTS1 Transit Vehicle Tracking	APTS1-2, APTS1-4	L	
37	PANYNJ PATH Vehicle Tracking (APTS)		APTS1 Transit Vehicle Tracking	APTS1-3	L	
38	Universal Payment Instrument - North Jersey Fare Reciprocity Networks Passenger and Fare Management (APTS)		APTS4 Transit Passenger and Fare Management	APTS4-1	L	Technology Improvements DBNUM T500
39	Public and Private Multimodal Transit Information Exchange (APTS)		APTS7 Multimodal Coordination	APTS7-4	L	
40	NJDOT TOC and NJT Bus Operations North Transit Information Exchange (APTS)		APTS7 Multimodal Coordination	APTS7-5 APTS7-6	L	
41	NJDOT Central & NJT Bus Operations South Transit Information Exchange (APTS)		APTS7 Multimodal Coordination	APTS7-7	L	

Northern Parking Management

Northern Parking Management Projects						
	Project Name	Regionally Significant Project	Market Package	Market Package Diagram#	Timeframe (S/M/L)	Programmed Project(s)
1	NJDOT Parking Management Integration		ATMS 16 Parking Facility Management	ATMS16-10	S-M	
2	NJDEP State Parks and NPS Parking Management Integration		ATMS 16 Parking Facility Management	ATMS16-2	M	
3	NJT Parking Facilities Management		ATMS16 Parking Facility Management	ATMS16-8, ATMS16-9	M	
4	Private Park and Ride Facility Management		ATMS16 Parking Facility Management	ATMS16-11	L	

Northern ATIS and ATMS Projects

Northern ATIS and ATMS Projects

	Project Name	Regionally Significant Project	Market Package	Market Package Diagram#	Timeframe (S/M/L)	Programmed Project(s)
1	NJDOT North Traveler Information System Deployment	√	ATIS1 Broadcast Traveler Information	ATIS1-1, 2, and 6	S	Congestion Relief, Intelligent Transportation System Improvements DBNUM 02379
2	Northern Private Sector ISP Integration	√	ATIS1 Broadcast Traveler Information, ATIS2 Interactive Traveler Information	ATIS1-4 and ATIS2-01 and ATIS2-11	S	
3	TRANSCOM TRIPS123 Upgrade & Expansion	√	ATIS2 Interactive Traveler Information, ATIS5 ISB Based Route Guidance	ATIS2-01 and ATIS5-1	S	
4	PANYNJ TB/T Tunnels/Bridges Traffic Information Dissemination	√	ATMS01 Network Surveillance, ATMS04 Freeway Control, ATMS06 Traffic Information Dissemination	ATMS01-4, ATMS04-2, ATMS06-03	S	Intelligent Transportation Systems DBNUM 03305
5	PANYNJ Airports/Port Commerce Arterial Surveillance and Traffic Monitoring System	√	ATMS01 Network Surveillance, ATMS03 Surface Street Control, ATMS04 Freeway Control, ATMS05 HOV Lane Management	ATMS01-5, ATMS01-6, ATMS03-4, ATMS05-1, ATMS06-03	S	Intelligent Transportation Systems DBNUM 03305, Traffic Monitoring Systems DBNUM X66
6	NJ Transit TRANSMIT Probe Surveillance	√	ATMS02 Probe Surveillance	ATMS02-5	S	

Northern ATIS and ATMS Projects						
	Project Name	Regionally Significant Project	Market Package	Market Package Diagram#	Timeframe (S/M/L)	Programmed Project(s)
7	NJDOT North Traffic Information Dissemination	√	ATMS06 Traffic Information Dissemination, ATMS18 Reversible Lane Management	ATMS06-01, ATMS18-1	S	
8	NJDOT Central Traffic Information Dissemination	√	ATMS06 Traffic Information Dissemination	ATMS06-02	S	
9	PANYNJ Airports Traffic Information Dissemination	√	ATMS06 Traffic Information Dissemination	ATMS06-04	S	
10	NJDOT TOC North Regional Coordination	√	ATMS07 Regional Traffic Control	ATMS07-01	S	
11	NJDOT TOC Central Regional Coordination	√	ATMS07 Regional Traffic Control	ATMS07-02	S	
12	NJTA Turnpike TOC Roadway Closure Information Dissemination	√	ATMS21 Roadway Closure Information	ATMS21-2	S	
13	NJDOT Maintenance and TOC North Road Weather Integration	√	MC03 Road Weather Data Collection	MC03-1	S	Electrical Facilities DBNUM X241
14	DRJTBC Flood Monitoring System	√	MC03 Road Weather Data Collection	MC03-4	S	
15	NJDOT Central Road Weather Data Collection, Integration, and Distribution Network	√	MC03 Road Weather Data Collection, MC04 Weather Information Processing and Distribution	MC03-5, MC04-3, MC04-4	S	
16	NJDOT TOC North Winter Maintenance Management	√	MC06 Winter Maintenance	MC06-1	S	Maintenance Management System DBNUM X196

Northern ATIS and ATMS Projects

	Project Name	Regionally Significant Project	Market Package	Market Package Diagram#	Timeframe (S/M/L)	Programmed Project(s)
17	NJDOT Central Winter Maintenance Management	√	MC06 Winter Maintenance	MC06-2	S	
18	NJTA Parkway Division Winter Maintenance	√	MC06 Winter Maintenance	MC06-3	S	
19	PANYNJ TB/T Winter Maintenance Management	√	MC06 Winter Maintenance, MC07 Roadway Maintenance and Construction	MC06-4	S	
20	TRANSCOM Roadway and Winter Maintenance Management	√	MC06 Winter Maintenance, MC07 Roadway Maintenance and Construction	MC06-5, MC07-4	S	Accident Reduction Program DBNUM X242
21	DRJTBC Roadway and Winter Maintenance Management	√	MC07 Roadway Maintenance and Construction	MC07-3	S	
22	TRANSCOM Workzone Management	√	MC08 Workzone Management	MC08-1, MC08-2	S	Equipment (Safety-Related Equipment) DBNUM 04332
23	NJDOT MAGIC1 Upgrade & Expansion	√	No MP Exist for Upgrade and Expansion		S	
24	NJDOT MAGIC3 Deployment	√	No MP Exist for Deployment		S	
25	North New Jersey Municipal TOCs Development	√	No MP Exist for TOC Development		S	Traffic Operations Center (North) DBNUM X99
26	TRANSCOM TRANSMIT Upgrade & Expansion	√	No MP Exist for Upgrade and Expansion		S	

Northern ATIS and ATMS Projects

	Project Name	Regionally Significant Project	Market Package	Market Package Diagram#	Timeframe (S/M/L)	Programmed Project(s)
27	North New Jersey County Arterial Surveillance and Traffic Management System		ATMS01 Network Surveillance, ATMS03 Surface Street Control	ATMS01-1, ATMS03-1	S-M	Intelligent Transportation Systems DBNUM 03305, Traffic Monitoring Systems DBNUM X66, 'Traffic Signal Timing and Optimization DBNUM 04320
28	NJDOT MAGIC2 Deployment		No MP Exist for Deployment		S-M	
29	North New Jersey County TOCs Development		No MP Exist for TOC Development		S-M	Traffic Operations Center (North) DBNUM X99
30	North New Jersey Municipal Arterial Surveillance and Traffic Management System		ATMS01 Network Surveillance, ATMS03 Surface Street Control	ATMS01-1, ATMS03-1	M-L	Intelligent Transportation Systems DBNUM 03305, Traffic Monitoring Systems DBNUM X66, 'Traffic Signal Timing and Optimization DBNUM 04320
31	PANYNJ Port Commerce Traveler Information System Deployment		ATIS1 Broadcast Traveler Information, ATIS2 Interactive Traveler Information	ATIS2-04, 06, and 09	M	Congestion Relief, Intelligent Transportation System Improvements DBNUM 02379
32	PANYNJ Airports Traveler Information System Deployment		ATIS1 Broadcast Traveler Information, ATIS2 Interactive Traveler Information	ATIS2-05	M	
33	PANYNJ TB/T Bus Terminals Traveler Information System Deployment		ATIS1 Broadcast Traveler Information, ATIS2 Interactive Traveler Information	ATIS2-07	M	

Northern ATIS and ATMS Projects

	Project Name	Regionally Significant Project	Market Package	Market Package Diagram#	Timeframe (S/M/L)	Programmed Project(s)
34	PANYNJ Tunnels/Bridges Traveler Information System Deployment		ATIS1 Broadcast Traveler Information, ATIS2 Interactive Traveler Information	ATIS2-08	M	Congestion Relief, Intelligent Transportation System Improvements DBNUM 02379
35	DRJTBC Traffic Monitoring Systems		ATMS01 Network Surveillance, ATMS03 Surface Street Control	ATMS01-2	M	
36	Palisades Network Surveillance System		ATMS01 Network Surveillance	ATMS01-3	M	
37	PANYNJ Port Commerce Probe Surveillance		ATMS02 Probe Surveillance	ATMS02-3	M	
38	PANYNJ Bus Terminals Traffic Information Dissemination		ATMS04 Freeway Control, ATMS06 Traffic Information Dissemination	ATMS04-3, ATMS06-06	M	
39	PANYNJ Port Commerce Traffic Information Dissemination		ATMS06 Traffic Information Dissemination	ATMS06-05	M	Intelligent Transportation Systems DBNUM 03305
40	North New Jersey Municipal TOCs Traffic Information Dissemination		ATMS06 Traffic Information Dissemination	ATMS06-07	M	Congestion Relief, Intelligent Transportation System Improvements DBNUM 02379
41	North New Jersey County TOCs Traffic Information Dissemination		ATMS06 Traffic Information Dissemination	ATMS06-08	M	Intelligent Transportation Systems DBNUM 03305

Northern ATIS and ATMS Projects

	Project Name	Regionally Significant Project	Market Package	Market Package Diagram#	Timeframe (S/M/L)	Programmed Project(s)
42	DRJTBC Facility Operations Center Traffic Information Dissemination and Regional Control		ATMS06 Traffic Information Dissemination, ATMS07 Regional Traffic Control	ATMS06-09, ATMS07-08	M	
43	NJTA Turnpike Regional Traffic Control		ATMS07 Regional Traffic Control	ATMS07-05	M	
44	North New Jersey County TOCs HRI Advisory Systems		ATMS13 Standard Railroad Crossing, ATMS14 Advanced Railroad Crossing	ATMS13-1	M	Rail-Highway Grade Crossing Program, Federal DBNUM X35A1, Rail-Highway Grade Crossing Program, State DBNUM X35A
45	North New Jersey Municipal TOCs HRI Advisory Systems		ATMS13 Standard Railroad Crossing	ATMS13-1	M	Rail-Highway Grade Crossing Program, Federal DBNUM X35A1, Rail-Highway Grade Crossing Program, State DBNUM X35A
46	NJDOT TOC North Speed Monitoring and Safety Systems		ATMS19 Speed Monitoring	ATMS19-1	M	
47	North New Jersey County TOCs Drawbridge Management System		ATMS20 Drawbridge Management	ATMS20-1	M	
48	NJTPA Region Counties Road Weather Data Collection and Integration		MC03 Road Weather Data Collection	MC03-2	M	Electrical Facilities DBNUM X241
49	NJTPA Region Municipalities Road Weather Data Collection and Integration		MC03 Road Weather Data Collection	MC03-3	M	Electrical Facilities DBNUM X241

Northern ATIS and ATMS Projects

	Project Name	Regionally Significant Project	Market Package	Market Package Diagram#	Timeframe (S/M/L)	Programmed Project(s)
50	NJDOT TOC North Weather Information Distribution Network		MC04 Weather Information Processing and Distribution	MC04-1, MC04-2	M	
51	North New Jersey Municipal/County PWD Weather Information Distribution Network		MC04 Weather Information Processing and Distribution	MC04-5	M	
52	TRANSCOM Weather Information Distribution Network		MC04 Weather Information Processing and Distribution	MC04-6	M	
53	DRJTBC Weather Information Distribution Network		MC04 Weather Information Processing and Distribution	MC04-7	M	
54	DRJTBC District Operations Automated Roadway Treatment System Deployment		MC05 Roadway Automated Treatment	MC05-2	M	
55	NJDOT STOC Maintenance and Construction Activity Coordination		MC10 Maintenance and Construction Activity Coordination	MC10-1	M	
56	TRANSCOM Maintenance and Construction Activity Coordination		MC10 Maintenance and Construction Activity Coordination	MC10-2, MC10-3	M	
57	North New Jersey County TOCs Regional Traffic Control and Coordination		ATMS07 Regional Traffic Control	ATMS07-03	L	

Northern ATIS and ATMS Projects

	Project Name	Regionally Significant Project	Market Package	Market Package Diagram#	Timeframe (S/M/L)	Programmed Project(s)
58	North New Jersey Municipal TOCs Regional Traffic Control and Coordination		ATMS07 Regional Traffic Control	ATMS07-04	L	
59	NJTA Parkway Division Regional Traffic Control		ATMS07 Regional Traffic Control	ATMS07-05	L	
60	NJDOT TOC North HRI Advisory and Safety Systems		ATMS13 Standard Railroad Crossing, ATMS14 Advanced Railroad Crossing	ATMS13-2, ATMS14-1	L	Rail-Highway Grade Crossing Program, Federal DBNUM X35A1, Rail-Highway Grade Crossing Program, State DBNUM X35A
61	NJDOT Central HRI Advisory and Safety System		ATMS13 Standard Railroad Crossing, ATMS14 Advanced Railroad Crossing	ATMS13-2, ATMS14-2	L	
62	North New Jersey County TOCs HRI Advisory and Safety Systems		ATMS13 Standard Railroad Crossing, ATMS14 Advanced Railroad Crossing	ATMS14-1	L	Rail-Highway Grade Crossing Program, Federal DBNUM X35A1, Rail-Highway Grade Crossing Program, State DBNUM X35A
63	North New Jersey Municipal TOCs HRI Advisory and Safety Systems		ATMS14 Advanced Railroad Crossing	ATMS14-1	L	Rail-Highway Grade Crossing Program, Federal DBNUM X35A1, Rail-Highway Grade Crossing Program, State DBNUM X35A
64	NJTPA Region TOCs / NJDOT Railroad Operations Coordination		ATMS15 Railroad Operations Coordination	ATMS15-1	L	

Northern ATIS and ATMS Projects

	Project Name	Regionally Significant Project	Market Package	Market Package Diagram#	Timeframe (S/M/L)	Programmed Project(s)
65	North New Jersey Municipal/County PWD AVL Deployment		MC01 Maintenance and Construction Vehicle Tracking	MC01-1	L	
66	DRJTBC District Operations AVL Deployment		MC01 Maintenance and Construction Vehicle Tracking	MC01-5	L	
67	PANYNJ TB/T Maintenance AVL Deployment		MC01 Maintenance and Construction Vehicle Tracking	MC01-5	L	
68	DRJTBC District Automatic Maintenance Scheduling System		MC02 Maintenance and Construction Vehicle Maintenance	MC02-2	L	
69	North New Jersey Municipal/County PWD Automatic Maintenance Scheduling System		MC02 Maintenance and Construction Vehicle Maintenance	MC02-3	L	
70	NJTPA Region Municipal PWD Roadway and Winter Maintenance Deployment		MC06 Winter Maintenance, MC07 Roadway Maintenance and Construction	MC06-6, MC06-7, MC07-2	L	Accident Reduction Program DBNUM X242
71	North New Jersey County PWD Roadway and Winter Maintenance Deployment		MC06 Winter Maintenance, MC07 Roadway Maintenance and Construction	MC06-8, MC06-9, MC07-1	L	Accident Reduction Program DBNUM X242

Northern Information Archive Projects

Northern Information Archive Projects

	Project Name	Regionally Significant Project	Market Package	Market Package Diagram#	Timeframe (S/M/L)	Programmed Project(s)
1	NJTPA RWIS Archive Management System	√	AD3 ITS Data Warehouse	AD3-2	S	
2	NJTPA Data Archive Management System		AD1 ITS Data Mart	AD1-07, AD1-08	S-M	
3	NJTPA Regional Archive Management System		AD1 ITS Data Mart, AD3 ITS Data Warehouse	AD1-21, AD3-1	S-M	Safety Management System DBNUM X68
4	TRANSCOM Data Archive Management		AD1 ITS Data Mart	AD1-04	M	
5	ITS Data Archives Coordination System		AD1 ITS Data Mart	AD3	M	

Northern CVO Projects

Northern CVO Projects						
	Project Name	Regionally Significant Project	Market Package	Market Package Diagram#	Timeframe (S/M/L)	Programmed Project(s)
1	DRJTBC Electronic Clearance	√	CVO03 Electronic Clearance	CVO03-3	S	
2	PANYNJ Port Commerce Electronic Clearance and Processing System	√	CVO03 Electronic Clearance	CVO03-4, CVO04-1	S	
3	Other Toll Facilities Electronic Clearance Systems	√	CVO03 Electronic Clearance	CVO03-5	S	
4	Other Facilities Weigh-In-Motion Systems	√	CVO06 Weigh-In-Motion	CVO06-3	S	Rte. 78 Sec. Truck Weigh Stations (eastbound and westbound) (6J 6K) Mile posts: 4.10 - 7.00 DBNUM 860
5	PANYNJ Port Commerce HAZMAT Management	√	CVO10 HAZMAT	CVO10-2	S	
6	Commercial HAZMAT Driver Vehicles Security Management	√	CV012 CV Driver Security Authentication	CVO12-1	S	
7	Commercial Vehicle Private Terminal System Management		CVO01 Fleet Administration	CVO01-1	M	
8	DRJTBC Commercial Vehicle and Fleet Management		CVO01 Fleet Administration	CVO01-2	M	
9	Commercial Vehicle Route Plan Management		CVO01 Fleet Administration	CVO01-2, CVO01-3, CVO01-4	M	
10	PANYNJ Commercial Vehicle and Fleet Management		CVO01 Fleet Administration	CVO01-3	M	
11	Private Commercial Vehicle and Fleet Management		CVO01 Fleet Administration	CVO01-4	M	

Northern CVO Projects

	Project Name	Regionally Significant Project	Market Package	Market Package Diagram#	Timeframe (S/M/L)	Programmed Project(s)
12	DRJTBC Weigh-In-Motion System		CVO06 Weigh-In-Motion	CVO06-1	M	
13	PANYNJ Tunnels/Bridges Weigh-In-Motion System		CVO06 Weigh-In-Motion	CVO06-2	M	
14	Private HAZMAT Management		CVO10 HAZMAT	CVO10-1	M	

Northern Public Safety Projects

Northern Public Safety Projects

	Project Name	Regionally Significant Project	Market Package	Market Package Diagram#	Timeframe (S/M/L)	Programmed Project(s)
1	NJDOT North Incident Management Program	√	ATMS08 Incident Management	ATMS08-01, ATMS08-08	S	
2	North New Jersey Municipal/County TOCs Incident Management Program	√	ATMS08 Incident Management	ATMS08-02, ATMS08-03, ATMS08-11	S	
3	PANYNJ Tunnels/Bridges Incident Management Program	√	ATMS08 Incident Management	ATMS08-04	S	
4	DRJTBC Incident Management Program	√	ATMS08 Incident Management	ATMS08-05	S	
5	TRANSCOM Incident Management	√	ATMS08 Incident Management	ATMS08-06, ATMS08-07	S	TRANSCOM Membership DBNUM X125
6	NJTPA Municipalities/Counties PWD MCM Coordination	√	ATMS08 Incident Management	ATMS08-09, ATMS08-10	S	
7	NJTPA Incident and Emergency Response Coordination	√	EM01 Emergency Response Coordination	EM01-1	S	
8	North New Jersey Municipal/County EOCs Coordination	√	EM01 Emergency Response Coordination	EM01-2	S	
9	North New Jersey Public Safety Emergency Routing	√	EM02 Emergency Routing	EM02-5	S	
10	DRJTBC Emergency Routing	√	EM02 Emergency Routing	EM02-6	S	
11	PANYNJ Tunnels/Bridges Infrastructure Protection Program	√	EM05 Transportation Infrastructure Protection	EM05-6	S	

Northern Public Safety Projects

	Project Name	Regionally Significant Project	Market Package	Market Package Diagram#	Timeframe (S/M/L)	Programmed Project(s)
12	North New Jersey Regional Alerts Program	√	EM06 Wide-Area Alert	EM06-1	S	
13	North New Jersey Early Warning System	√	EM07 Early Warning System	EM07-1	S	
14	NJTPA County EOCs Disaster and Response Management	√	EM08 Disaster Response and Recovery	EM08-1, EM08-2	S	
15	NJTPA County EOCs Evacuation and Re-entry Management	√	EM09 Evacuation and Reentry Management	EM09-1, EM09-2	S	
16	National and State Parks and Local Public Safety Emergency Response Coordination		EM01 Emergency Response Coordination	EM01-3	M	
17	North NJ Municipal TOCs and North NJ Fire Integration and Emergency Routing		EM02 Emergency Routing	EM02-1	M	
18	North NJ County TOCs and North NJ Fire Integration and Emergency Routing		EM02 Emergency Routing	EM02-2	M	
19	NNDOT Central and NJTPA EMS/Fire Emergency Routing		EM02 Emergency Routing	EM02-3	M	
20	NNDOT North and NJTPA EMS/Fire Emergency Routing		EM02 Emergency Routing	EM02-3	M	

Appendix 12.A

Implementation – Project Tables

Advanced Public Transportation Systems

Region
 Project Subsection
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 Northern Transit Projects
 1
 NJT Bus North Fixed-Route Operations North and Conditions Reporting (APTS)
 APTS2 Transit Fixed-Route Operations
 APTS2-01

			Capital Cost				Annual Cost			
			unit cost	quantities	low end extension	quantities	high end extension	unit cost	low end extension	high end extension
Center Subsystems										
Transit Center Hardware	TR001		\$ 30.0		1 \$ 30.0		1 \$ 30.0	\$ -	\$ -	\$ -
Transit Center Software, Integration	TR002		\$ 1,720.0		1 \$ 1,720.0		1 \$ 1,720.0	\$ 12.0	\$ 12.0	\$ 12.0
Vehicle Location Interface	TR007		\$ 15.0		1 \$ 15.0		1 \$ 15.0	\$ -	\$ -	\$ -
Information Service Provider Hardware	IS001		\$ 49.5		1 \$ 49.5		1 \$ 49.5	\$ 1.0	\$ 1.0	\$ 1.0
Systems Integration	IS017		\$ 110.0		1 \$ 110.0		1 \$ 110.0	\$ -	\$ -	\$ -
Software Upgrade for Interactive Information	IS007		\$ 500.0		1 \$ 500.0		1 \$ 500.0	\$ 25.0	\$ 25.0	\$ 25.0
Staff										
Information Service Provider Labor	IS004		\$ -		1 \$ -		1 \$ -	\$ 250.0	\$ 250.0	\$ 250.0
Transit Vehicle Subsystems										
Driver Interface and Schedule processor	TV001		\$ 0.5	30	\$ 15.0	130	\$ 65.0	\$ 0.0100	\$ 0.3	\$ 1.3
Cell Based Communication Equipment	TV002		\$ 0.3	30	\$ 7.5	130	\$ 32.5	\$ 0.0125	\$ 0.4	\$ 1.6
GPS/DGPS for vehicle location	TV003		\$ 0.8	30	\$ 24.0	130	\$ 104.0	\$ 0.0160	\$ 0.5	\$ 2.1
Communications										
cellular communication			\$ 0.5	30	\$ 15.0	130	\$ 65.0	\$ 0.4	\$ 12.0	\$ 52.0
DS0 Communications line ³	TC001		\$ 1.0	20	\$ 20.0	40	\$ 40.0	\$ 1.2	\$ 24.0	\$ 48.0
			Subtotal		\$ 2,506.0		\$ 2,731.0		\$ 325.1	\$ 393.0
Design Development Allowance										
		25%	Subtotal		\$ 626.5		\$ 682.8		\$ 81.3	\$ 98.2
			Total		\$ 3,132.5		\$ 3,413.8		\$ 406.4	\$ 491.2

Notes:
 1 Costs are shown in thousands of dollars
 2 Assume low end = 30 buses, high end = 130 buses
 3 Assume one DS0 line for each interconnected center

Region
 Project Subsection
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 Northern Transit Projects
 2
 NJT LRT (Newark City and Hudson Bergen Fixed-Route Operations and Conditions Reporting (APTS)
 APTS2 Transit Fixed-Route Operations NJ Transit - LRT - Newark City Subway
 APTS2-02, APTS2-03

		Capital Cost				Annual Cost		
		low end		high end		low end		high end
		unit cost	quantities	extension	quantities	extension	unit cost	extension
Center Subsystems								
Transit Center Hardware	TR001	\$ 30.0	1	\$ 30.0	1	\$ 30.0	\$ -	\$ -
Transit Center Software, Integration	TR002	\$ 1,720.0	1	\$ 1,720.0	1	\$ 1,720.0	\$ 12.0	\$ 12.0
Vehicle Location Interface	TR007	\$ 15.0	1	\$ 15.0	1	\$ 15.0	\$ -	\$ -
Information Service Provider								
Hardware	IS001	\$ 49.5	1	\$ 49.5	1	\$ 49.5	\$ 1.0	\$ 1.0
Systems Integration	IS017	\$ 110.0	1	\$ 110.0	1	\$ 110.0	\$ -	\$ -
Software Upgrade for Interactive								
Information	IS007	\$ 500.0	1	\$ 500.0	1	\$ 500.0	\$ 25.0	\$ 25.0
Staff								
Information Service Provider Labor	IS004	\$ -	1	\$ -	1	\$ -	\$ 250.0	\$ 250.0
Transit Vehicle Subsystems								
Driver Interface and Schedule processor	TV001	\$ 0.5	16	\$ 8.0	45	\$ 22.5	\$ 0.0100	\$ 0.2
Cell Based Communication								
Equipment	TV002	\$ 0.3	16	\$ 4.0	45	\$ 11.3	\$ 0.0125	\$ 0.2
GPS/DGPS for vehicle location	TV003	\$ 0.8	16	\$ 12.8	45	\$ 36.0	\$ 0.0160	\$ 0.3
Communications								
cellular communication		\$ 0.5	16	\$ 8.0	45	\$ 22.5	\$ 0.4	\$ 6.4
DS0 Communications line ²	TC001	\$ 1.0	20	\$ 20.0	40	\$ 40.0	\$ 1.2	\$ 24.0
		Subtotal	\$ 2,477.3		\$ 2,556.8		\$ 319.0	\$ 355.7
Design Development Allowance								
	25%	Subtotal	\$ 619.3		\$ 639.2		\$ 79.8	\$ 88.9
		Total	\$ 3,096.6		\$ 3,195.9		\$ 398.8	\$ 444.7

Notes:
 1 Costs are shown in thousands of dollars
 2 Assume one DS0 line for each interconnected center

Region
 Project Subsection
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
Northern Transit Projects
3
Northern TMA Fixed-Route Operations and Conditions Reporting (APTS)
APTS2 Transit Fixed-Route Operations NJTPA Region - TMAs
APTS2-04

Center Subsystems

Transit Center Hardware TR001
 Transit Center Software, Integration TR002
 Vehicle Location Interface TR007
 Information Service Provider
 Hardware IS001
 Systems Integration IS017
 Software Upgrade for Interactive Information IS007

Staff

Transit Center Labor TR004

Transit Vehicle Subsystems

Driver Interface and Schedule processor TV001
 Cell Based Communication Equipment TV002
 GPS/DGPS for vehicle location TV003

Communications

cellular communication DSO Communications line² TC001

Design Development Allowance

25%

Capital Cost			Annual Cost	
unit cost	quantities	extension	unit cost	extension
\$ 30.0	1	\$ 30.0	\$ -	\$ -
\$ 1,720.0	1	\$ 1,720.0	\$ 12.0	\$ 12.0
\$ 15.0	1	\$ 15.0	\$ -	\$ -
\$ 49.5	0	\$ -	\$ 1.0	\$ -
\$ 110.0	0	\$ -	\$ -	\$ -
\$ 500.0	0	\$ -	\$ 25.0	\$ -
\$ -	1	\$ -	\$ 250.0	\$ 250.0
\$ 0.5	120	\$ 60.0	\$ 0.0100	\$ 1.2
\$ 0.3	120	\$ 30.0	\$ 0.0125	\$ 1.5
\$ 0.8	120	\$ 96.0	\$ 0.0160	\$ 1.9
\$ 0.5	120	\$ 60.0	\$ 0.4	\$ 48.0
\$ 1.0	32	\$ 32.0	\$ 1.2	\$ 38.4
Subtotal \$ 2,043.0			\$ 353.0	
Subtotal \$ 510.8			\$ 88.3	
Total \$ 2,553.8			\$ 441.3	

Notes:

- Costs are shown in thousands of dollars
- Assume 120 buses
- Assume one DSO line for each interconnected center
- Assume combined TMA assets from the three areas equal 150 buses
- Assume 80% of the TMA assets are located in the Northern Area with 10% of the assets in each of the remaining two areas.
- Assumed distribution of TMAs per Area Inventories in Table below
- Assume One Center Subsystem shared among all TMAs

TMA's	North	South	Statewide
1 Cross County Connection TMA	X	X	X
2 Greater Mercer TMA	X		
3 Hart TMA	X		
4 Hudson TMA	X		
5 KMM	X		
6 Meadowlink TMA	X		
7 Ridewise	X		
8 TransOptions TMA	X		

Region
 Project Subsection
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 Northern Transit Projects
 4
 North New Jersey Municipal/County Fixed-Route Operations (APTS)
 APTS2 Transit Fixed-Route Operations
 APTS2-05

		Capital Cost				Annual Cost				
		unit cost	quantities	low end extension	quantities	high end extension	unit cost	low end extension	high end extension	
Center Subsystems										
	Transit Center Hardware ⁴	TR001	\$ 30.0	6	\$ 180.0	13	\$ 390.0	\$ -	\$ -	\$ -
	Transit Center Software, Integration ⁴	TR002	\$ 1,720.0	6	\$ 10,320.0	13	\$ 22,360.0	\$ 12.0	\$ 72.0	\$ 156.0
	Vehicle Location Interface ⁴	TR007	\$ 15.0	6	\$ 90.0	13	\$ 195.0	\$ -	\$ -	\$ -
	Information Service Provider									
	Hardware	IS001	\$ 49.5	0	\$ -	0	\$ -	\$ 1.0	\$ -	\$ -
	Systems Integration	IS017	\$ 110.0	0	\$ -	0	\$ -	\$ -	\$ -	\$ -
	Software Upgrade for Interactive Information	IS007	\$ 500.0	0	\$ -	0	\$ -	\$ 25.0	\$ -	\$ -
Staff										
	Transit Center Labor	TR004	\$ -	1	\$ -	1	\$ -	\$ 250.0	\$ 250.0	\$ 250.0
Transit Vehicle Subsystems										
	Driver Interface and Schedule processor	TV001	\$ 0.5	30	\$ 15.0	130	\$ 65.0	\$ 0.0100	\$ 0.3	\$ 1.3
	Cell Based Communication Equipment	TV002	\$ 0.3	30	\$ 7.5	130	\$ 32.5	\$ 0.0125	\$ 0.4	\$ 1.6
	GPS/DGPS for vehicle location	TV003	\$ 0.8	30	\$ 24.0	130	\$ 104.0	\$ 0.0160	\$ 0.5	\$ 2.1
Communications										
	cellular communication		\$ 0.5	30	\$ 15.0	130	\$ 65.0	\$ 0.4	\$ 12.0	\$ 52.0
	DS0 Communications line ³	TC001	\$ 1.0	20	\$ 20.0	40	\$ 40.0	\$ 1.2	\$ 24.0	\$ 48.0
			Subtotal	\$ 10,671.5		\$ 23,251.5		\$ 359.2	\$ 511.0	
Design Development Allowance										
		25%	Subtotal	\$ 2,667.9		\$ 5,812.9		\$ 89.8	\$ 127.8	
		6								
			Total	\$ 13,339.4		\$ 29,064.4		\$ 448.9	\$ 638.8	

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Assume low end = 30 buses, high end = 130 buses
- 3 Assume one DS0 line for each interconnected center
- 4 NJTPA County/Municipalities Transit Systems - Bergen, Essex, Hudson, Hunterdon, Monmouth, Middlesex, Morris, Ocean, Passaic, Sussex, Somerset, Union, and Warren.

Region
 Project Subsection
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
Northern Transit Projects
5
PANYNJ PATH Fixed-Route Operations (APTS)
APTS2 Transit Fixed-Route Operations
APTS2-06

		Capital Cost				Annual Cost		
		low end		high end		low end		high end
		unit cost	quantities	extension	quantities	extension	unit cost	extension
Center Subsystems								
Transit Center Hardware	TR001	\$ 30.0	1	\$ 30.0	1	\$ 30.0	\$ -	\$ -
Transit Center Software, Integration	TR002	\$ 1,720.0	1	\$ 1,720.0	1	\$ 1,720.0	\$ 12.0	\$ 12.0
Vehicle Location Interface	TR007	\$ 15.0	1	\$ 15.0	1	\$ 15.0	\$ -	\$ -
Information Service Provider Hardware	IS001	\$ 49.5	1	\$ 49.5	1	\$ 49.5	\$ 1.0	\$ 1.0
Systems Integration ⁴	IS017	\$ 110.0	4	\$ 440.0	10	\$ 1,100.0	\$ -	\$ -
Software Upgrade for Interactive Information	IS007	\$ 500.0	1	\$ 500.0	1	\$ 500.0	\$ 25.0	\$ 25.0
Staff								
Information Service Provider Labor	IS004	\$ -	1	\$ -	1	\$ -	\$ 250.0	\$ 250.0
Transit Vehicle Subsystems								
Driver Interface and Schedule processor ²	TV001	\$ 0.5	30	\$ 15.0	50	\$ 25.0	\$ 0.0100	\$ 0.3
Cell Based Communication Equipment	TV002	\$ 0.3	30	\$ 7.5	50	\$ 12.5	\$ 0.0125	\$ 0.4
GPS/DGPS for vehicle location	TV003	\$ 0.8	30	\$ 24.0	50	\$ 40.0	\$ 0.0160	\$ 0.5
Communications								
cellular communication ⁵		\$ 0.5	30	\$ 15.0	50	\$ 25.0	\$ 0.4	\$ 12.0
DSO Communications line ³	TC001	\$ 1.0	3	\$ 3.0	3	\$ 3.0	\$ 1.2	\$ 3.6
		Subtotal		\$ 2,819.0		\$ 3,520.0	\$ 304.7	\$ 313.5
Design Development Allowance								
	25%	Subtotal		\$ 704.8		\$ 880.0	\$ 76.2	\$ 78.4
		Total		\$ 3,523.8		\$ 4,400.0	\$ 380.9	\$ 391.9

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Assume low end = 30 PATH Vehicles, high end = 50 PATH Vehicles
- 3 Assume one DSO line for each interconnected center: PATH TIS, TRANSCOM, PATH Ops
- 4 Assume low end = 4 ISP to integrate, high end = 10 ISP to integrate
- 5 These Items are used for cost purposes only, other technology not listed in the cost worksheets will be used.

Region
 Project Subsection
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
Northern Transit Projects
6
Rutgers Campus Shuttle Fixed-Route and Demand Response Operations (APTS)
APTS2 Transit Fixed-Route Operations
APTS2-07, APTS3-4

Center Subsystems

Transit Center Hardware³ TR001
 Transit Center Software,
 Integration³ TR002
 Vehicle Location Interface² TR007
 Information Service Provider
 Hardware IS001
 Systems Integration IS017
 Software Upgrade for Interactive
 Information IS007

Staff

Transit Center Labor TR004

Transit Vehicle Subsystems²

Driver Interface and Schedule
 processor² TV001
 Cell Based Communication
 Equipment TV002
 GPS/DGPS for vehicle location TV003

Communications²

cellular communication
 DS0 Communications line³ TC001

Design Development Allowance

25%

Capital Cost			Annual Cost		
unit cost	quantities	extension	unit cost	extension	
\$ 30.0	1	\$ 30.0	\$ -	\$ -	
\$ 1,720.0	1	\$ 1,720.0	\$ 12.0	\$ 12.0	
\$ 15.0	0	\$ -	\$ -	\$ -	
\$ 49.5	0	\$ -	\$ 1.0	\$ -	
\$ 110.0	0	\$ -	\$ -	\$ -	
\$ 500.0	0	\$ -	\$ 25.0	\$ -	
\$ -	1	\$ -	\$ 250.0	\$ 250.0	
\$ 0.5	20	\$ 10.0	\$ 0.0100	\$ 0.2	
\$ 0.3	20	\$ 5.0	\$ 0.0125	\$ 0.3	
\$ 0.8	20	\$ 16.0	\$ 0.0160	\$ 0.3	
\$ 0.5	20	\$ 10.0	\$ 0.4	\$ 8.0	
\$ 1.0	2	\$ 2.0	\$ 1.2	\$ 2.4	
Subtotal \$ 1,793.0			\$ 273.2		
Subtotal \$ 448.3			\$ 68.3		
Total \$ 2,241.3			\$ 341.5		

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Assume 20 buses
- 3 Assume one DS0 line for each interconnected center
- 4 Assume cost associated with links to and from other TMC's are borne by other projects

Region
 Project Subsection
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 Northern Transit Projects
 7
Private Bus/Shuttle Fixed Route and Demand Response Operations (APTS)
APTS2 Transit Fixed-Route Operations
APTS2-08, APTS3-5

			Capital Cost				Annual Cost			
			unit cost	quantities	low end extension	quantities	high end extension	unit cost	low end extension	high end extension
<u>Private Bus/Shuttle Operations</u>										
<u>Center Subsystems</u>										
	Transit Center Hardware ²	TR001	\$ 30.0	15	\$ 450.0	30	\$ 900.0	\$ -	\$ -	\$ -
	Transit Center Software, Integration ²	TR002	\$ 1,720.0	15	\$ 25,800.0	30	\$ 51,600.0	\$ 12.0	\$ 180.0	\$ 360.0
	Vehicle Location Interface ²	TR007	\$ 15.0	15	\$ 225.0	30	\$ 450.0	\$ -	\$ -	\$ -
	Information Service Provider Hardware	IS001	\$ 49.5	0	\$ -	0	\$ -	\$ 1.0	\$ -	\$ -
	Systems Integration ³	IS017	\$ 110.0	0	\$ -	0	\$ -	\$ -	\$ -	\$ -
	Software Upgrade for Interactive Information	IS007	\$ 500.0	0	\$ -	0	\$ -	\$ 25.0	\$ -	\$ -
<u>Staff</u>										
	Information Service Provider Labor	IS004	\$ -	0	\$ -	0	\$ -	\$ 250.0	\$ -	\$ -
<u>Transit Vehicle Subsystems</u>										
	Driver Interface and Schedule processor ⁴	TV001	\$ 0.5	150	\$ 75.0	300	\$ 150.0	\$ 0.0100	\$ 1.5	\$ 3.0
	Cell Based Communication Equipment	TV002	\$ 0.3	150	\$ 37.5	300	\$ 75.0	\$ 0.0125	\$ 1.9	\$ 3.8
	GPS/DGPS for vehicle location	TV003	\$ 0.8	150	\$ 120.0	300	\$ 240.0	\$ 0.0160	\$ 2.4	\$ 4.8
<u>Communications</u>										
	cellular communication		\$ 0.5	150	\$ 75.0	300	\$ 150.0	\$ 0.4	\$ 60.0	\$ 120.0
	DS0 Communications line ⁵	TC001	\$ 1.0	15	\$ 15.0	30	\$ 30.0	\$ 1.2	\$ 18.0	\$ 36.0
<u>Private Demand Response Operations⁶</u>										
<u>Center Subsystems</u>										
	Transit Center Hardware ⁷	TR001	\$ 30.0	5	\$ 150.0	10	\$ 300.0	\$ -	\$ -	\$ -
	Transit Center Software, Integration ⁷	TR002	\$ 1,720.0	5	\$ 8,600.0	10	\$ 17,200.0	\$ 12.0	\$ 60.0	\$ 120.0
	Vehicle Location Interface ⁷	TR007	\$ 15.0	5	\$ 75.0	10	\$ 150.0	\$ -	\$ -	\$ -
	Information Service Provider Hardware	IS001	\$ 49.5	1	\$ 49.5	1	\$ 49.5	\$ 1.0	\$ 1.0	\$ 1.0
	Systems Integration	IS017	\$ 110.0	1	\$ 110.0	1	\$ 110.0	\$ -	\$ -	\$ -

Project Name
 Market Package
 Market Package Diagram No.

Private Bus/Shuttle Fixed Route and Demand Response Operations (APTS)
APTS2 Transit Fixed-Route Operations
APTS2-08, APTS3-5

		Capital Cost				Annual Cost			
Software Upgrade for Interactive Information	IS007	\$ 500.0	1	\$ 500.0	1	\$ 500.0	\$ 25.0	\$ 25.0	\$ 25.0
<u>Transit Vehicle Subsystems</u>									
Driver Interface and Schedule processor ⁷	TV001	\$ 0.5	50	\$ 25.0	100	\$ 50.0	\$ 0.0100	\$ 0.5	\$ 1.0
Cell Based Communication Equipment	TV002	\$ 0.3	50	\$ 12.5	100	\$ 25.0	\$ 0.0125	\$ 0.6	\$ 1.3
GPS/DGPS for vehicle location	TV003	\$ 0.8	50	\$ 40.0	100	\$ 80.0	\$ 0.0160	\$ 0.8	\$ 1.6
<u>Communications</u>									
cellular communication		\$ 0.5	50	\$ 25.0	100	\$ 50.0	\$ 0.4	\$ 20.0	\$ 40.0
DS0 Communications line ⁸	TC001	\$ 1.0	6	\$ 6.0	12	\$ 12.0	\$ 1.2	\$ 7.2	\$ 14.4
		Subtotal	\$ 36,390.5		\$ 72,121.5		\$ 378.9	\$ 731.8	
<u>Design Development Allowance</u>									
		Subtotal	\$ 9,097.6		\$ 18,030.4		\$ 94.7	\$ 182.9	
		Total	\$ 45,488.1		\$ 90,151.9		\$ 473.6	\$ 914.7	

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Assume low end = 15 Private Bus/Shuttle Operators, high end = 30 Private Bus/Shuttle Operators
- 3 Assume 2 ISP to integrate along with NJDOT 511 and TRANSCOM (done by other projects)
- 4 Assume low end = 15 Operators with 10 veh each, high end = 30 Operators with 10 veh each
- 5 Assume one DS0 line for each interconnected center
- 6 Assume the Private Demand Response Operators are those operators who are contracted to provide additional transit service when extra capacity is required and these are different from the Private Bus/Shuttle Operators.
- 7 Assume low end = 5 Private Demand Response Operators, high end = 10 Private Demand Response Operators, both with an average of 10 vehicles each.
- 8 Assume one DS0 line for each interconnected center

Region
 Project Subsection
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
Northern Transit Projects
8
Private Ferry Fixed-Route Operations
APTS2 Transit Fixed-Route Operations
APTS2-10

	Capital Cost				Annual Cost			
	unit cost	quantities	low end extension	quantities	high end extension	unit cost	low end extension	high end extension
Center Subsystems								
Transit Center Hardware ²	TR001	\$ 30.0	2 \$ 60.0	6	\$ 180.0	\$ -	\$ -	\$ -
Transit Center Software, Integration	TR002	\$ 1,720.0	2 \$ 3,440.0	6	\$ 10,320.0	\$ 12.0	\$ 24.0	\$ 72.0
Vehicle Location Interface ⁶	TR007	\$ 15.0	8 \$ 120.0	12	\$ 180.0	\$ -	\$ -	\$ -
Information Service Provider Hardware ⁴	IS001	\$ 49.5	0 \$ -	0	\$ -	\$ 1.0	\$ -	\$ -
Systems Integration ⁴	IS017	\$ 110.0	0 \$ -	0	\$ -	\$ -	\$ -	\$ -
Software Upgrade for Interactive Information	IS007	\$ 500.0	0 \$ -	0	\$ -	\$ 25.0	\$ -	\$ -
Staff								
Information Service Provider Labor	IS004	\$ -	0 \$ -	0	\$ -	\$ 250.0	\$ -	\$ -
Transit Vehicle Subsystems								
Driver Interface and Schedule processor ⁵	TV001	\$ 0.5	10 \$ 5.0	40	\$ 20.0	\$ 0.0100	\$ 0.1	\$ 0.4
Cell Based Communication Equipment ³	TV002	\$ 0.3	0 \$ -	0	\$ -	\$ 0.0125	\$ -	\$ -
GPS/DGPS for vehicle location	TV003	\$ 0.8	10 \$ 8.0	40	\$ 32.0	\$ 0.0160	\$ 0.2	\$ 0.6
Communications								
cellular communication ³		\$ 0.5	0 \$ -	0	\$ -	\$ 0.4	\$ -	\$ -
DSO Communications line ⁶	TC001	\$ 1.0	8 \$ 8.0	12	\$ 12.0	\$ 1.2	\$ 9.6	\$ 14.4
		Subtotal	\$ 3,641.0		\$ 10,744.0		\$ 33.9	\$ 87.4
Design Development Allowance								
	25%	Subtotal	\$ 910.3		\$ 2,686.0		\$ 8.5	\$ 21.9
		Total	\$ 4,551.3		\$ 13,430.0		\$ 42.3	\$ 109.3

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Assume low end = 2 Private Ferry Operators, high end = 6 Private Ferry Operators
- 3 Assume System uses Existing Wireless Communications
- 4 Assume Information Service Providers provided in other projects
- 5 Assume low end = 10 Private Ferries, high end = 40 Private Ferries

Region **North**
 Project Subsection **Northern Transit Projects**
 Project Number **9**
 Project Name **NJT Bus Operations North Transit Security (APTS)**
 Market Package **APTSS Transit Security**
 Market Package Diagram No. **APTSS-01**

	Capital Cost					Annual Cost		
	unit cost	quantities	low end extension	high end quantities	high end extension	unit cost	low end extension	high end extension
Center Subsystems								
Transit Center Hardware ²	TR001	-	-	-	-	-	-	-
Transit Center Software, Integration ³	TR002	-	-	-	-	-	-	-
Vehicle Location Interface ⁴	TR007	-	-	-	-	-	-	-
Information Service Provider Hardware ⁵	IS001	-	-	-	-	-	-	-
Systems Integration ⁶	IS017	-	-	-	-	-	-	-
Software Upgrade for Interactive Information ⁷	IS007	-	-	-	-	-	-	-
Emergency Management								
Emergency Response Hardware ⁸	EM001	\$ 30.0	3 \$ 90.0	3 \$ 90.0	\$ 0.6	\$ 1.8	\$ 1.8	
Emergency Response Software, Integration ⁹	EM002	\$ 150.0	3 \$ 450.0	3 \$ 450.0	\$ 3.5	\$ 10.5	\$ 10.5	
Staff								
Information Service Provider Labor ¹⁰	IS004	-	-	-	-	-	-	-
Transit Vehicle Subsystems								
Driver Interface and Schedule processor ¹	TV001	-	-	-	-	-	-	-
Cell Based Communication Equipment ²	TV002	-	-	-	-	-	-	-
GPS/DGPS for vehicle location ³	TV003	-	-	-	-	-	-	-
Security Package ⁴	TV006	\$ 7.0	30 \$ 210.0	130 \$ 910.0	\$ 0.265	\$ 8.0	\$ 34.5	
Signal Preemption Processor ⁵	TV004	\$ 0.6	30 \$ 18.0	130 \$ 78.0	\$ 0.010	\$ 0.3	\$ 1.3	
Preemption / Priority Transponder ⁶	-	\$ 0.075	30 \$ 2.3	130 \$ 9.8	-	-	-	
Remote Traveler Support								
Hardware, Software for Traffic Surveillance ⁷	TM003	\$ 165.0	1 \$ 165.0	1 \$ 165.0	\$ 8.250	\$ 8.250	\$ 8.250	
Integration for Traffic Surveillance ⁸	TM032	\$ 225.0	1 \$ 225.0	1 \$ 225.0	\$ 13.750	\$ 13.750	\$ 13.750	
Passive Acoustic Sensor ^{9,10}	-	\$ 8.0	100 \$ 800.0	200 \$ 1,600.0	\$ 0.400	\$ 40.0	\$ 80.0	
Communications								
Wireless Communications, High Usage ¹	TC006	\$ 1.0	100 \$ 100.0	200 \$ 200.0	\$ 1.8000	\$ 180.0	\$ 360.0	
DSO Communications line ¹⁰	TC001	\$ 1.0	2 \$ 2.0	4 \$ 4.0	\$ 1.2	\$ 2.4	\$ 4.8	
			Subtotal \$ 2,062.3	\$ 3,731.8	\$ 265.0	\$ 514.9		
Design Development Allowance								
		25%	Subtotal \$ 515.6	\$ 932.9	\$ 66.2	\$ 128.7		
			Total \$ 2,577.8	\$ 4,664.7	\$ 331.2	\$ 643.6		

- Notes:**
- Costs are shown in thousands of dollars
 - Cost for these items have been programed in Northern Transit Project 1 (NJT Bus North Fixed-Route Operations North and Conditions Reporting (APTS))
 - Assume Emergency Management is for DVRPC Regional Public Safety Dispatch, NJT Police Dispatch and NJTPA Regional Public Safety Dispatch with NJT Rail Operations Center Sy
 - Assume existing staff will perform necessary operations as necessary
 - Signal Preemption Processor and Transponder cost information used for remote vehicle disable system
 - Traffic Surveillance Hardware and Software cost used for Secure Area Sensor Data
 - Number of sensors developed from 2003 NJ Transit Facts Sheet (Passenger Facilities)
 - Line item information taken from "Roadside Detection" section of ITS Unit Costs Database, use to estimate Security Sensor Cost
 - Assume low end = 100 passive acoustic sensors, high end = 200 passive acoustic sensors
 - Assume one DSO line for each interconnected center (only 2 to 4 reqd in addition to project 1)

Region
 Project Subsection
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
Northern Transit Projects
10
NJT Rail Operations Transit Security (APTS)
APTS5 Transit Security
APTS5-02

Center Subsystems

Transit Center Hardware TR001
 Transit Center Software, Integration TR002
 Information Service Provider
 Hardware² IS001
 Systems Integration³ IS017
 Software Upgrade for Interactive Information³ IS007

Emergency Management

Emergency Response Hardware⁴ EM001
 Emergency Response Software, Integration⁴ EM002

Staff

Information Service Provider Labor⁵ IS004

Remote Traveler Support⁶

Communications⁷

DS0 Communications line TC001

Design Development Allowance

25%

Capital Cost			Annual Cost		
unit cost	quantities	extension	unit cost	extension	
\$ 30.0		0 \$ -	-	-	
\$ 1,720.0		0 \$ -	\$ 12.0	\$ -	
-	-	-	-	-	
\$ 110.0		0 \$ -	\$ -	\$ -	
\$ 500.0		0 \$ -	\$ 25.0	\$ -	
\$ 30.0	2	\$ 60.0	\$ 0.6	\$ 1.2	
\$ 150.0	2	\$ 300.0	\$ 3.5	\$ 7.0	
\$ -	-	-	-	-	
\$ 1.0	1	\$ 1.0	\$ 1.2	\$ 1.2	
Subtotal			\$ 361.0	\$ 9.4	
Subtotal			\$ 90.3	\$ 2.4	
Total			\$ 451.3	\$ 11.8	

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Assume Existing Servers and Workstations from will be sufficient to operate system
- 3 Assume System integration is for NJT Corporate Customer Info Center Systems and TRANSCOM with NJT Rail Operations Center Systems
- 4 Assume Emergency Management is for NJT Police Dispatch and NJTPA Regional Public Safety Dispatch with NJT Rail Operations Center Systems
- 5 Assume existing staff will perform necessary operations as necessary
- 6 Assume Remote Traveler Support costs are borne by other projects
- 7 Assume one DS0 line for each interconnected center (only NJT Rail reqd in addition to project 1 & 9)

Region North
 Project Subsection Northern Transit Projects
 Project Number 11
 Project Name NJT LRT (Newark City and Hudson Bergen) Transit Security (APTS)
 Market Package APTSS Transit Security
 Market Package Diagram No. APTSS-03, APTSS-04

	Capital Cost				Annual Cost			
	unit cost	quantities	low end extension	high end extension	unit cost	low end extension	high end extension	
Center Subsystems								
Transit Center Hardware ²	TR001	-	-	-	-	-	-	-
Transit Center Software, Integration ²	TR002	-	-	-	-	-	-	-
Vehicle Location Interface ²	TR007	-	-	-	-	-	-	-
Information Service Provider Hardware ²	IS001	-	-	-	-	-	-	-
Systems Integration ²	IS017	-	-	-	-	-	-	-
Software Upgrade for Interactive Information ²	IS007	-	-	-	-	-	-	-
Emergency Management								
Emergency Response Hardware ³	EM001	\$ 30.0	2 \$ 60.0	2 \$ 60.0	\$ 0.6	\$ 1.2	\$ 1.2	
Emergency Response Software, Integration ³	EM002	\$ 150.0	2 \$ 300.0	2 \$ 300.0	\$ 3.5	\$ 7.0	\$ 7.0	
Staff								
Information Service Provider Labor ⁴	IS004	-	-	-	-	-	-	-
Transit Vehicle Subsystems								
Driver Interface and Schedule processor ⁵	TV001	-	-	-	-	-	-	-
Cell Based Communication Equipment ⁵	TV002	-	-	-	-	-	-	-
GPS/DGPS for vehicle locator ⁵	TV003	-	-	-	-	-	-	-
Security Package ⁵	TV006	\$ 7.0	16 \$ 112.0	45 \$ 315.0	\$ 0.265	\$ 4.2	\$ 11.9	
Remote Traveler Support								
Hardware, Software for Traffic Surveillance ⁶	TM003	\$ 165.0	1 \$ 165.0	1 \$ 165.0	\$ 8,250	\$ 8,250	\$ 8,250	
Integration for Traffic Surveillance ⁶	TM032	\$ 225.0	1 \$ 225.0	1 \$ 225.0	\$ 13,750	\$ 13,750	\$ 13,750	
Passive Acoustic Sensor ^{8,9}	-	\$ 8.0	56 \$ 448.0	112 \$ 896.0	\$ 0.400	\$ 22.4	\$ 44.8	
CCTV Camera ¹⁰	RM001	\$ 5,000	112 \$ 560.0	168 \$ 840.0	\$ 0.250	\$ 28.0	\$ 42.0	
Integration of Camera with Existing Systems	RM002	\$ 2,500	112 \$ 280.0	168 \$ 420.0	-	-	-	
Communications								
Wireless Communications, High Usage ¹¹	TC006	\$ 1.0	16 \$ 16.0	45 \$ 45.0	\$ 1,800.0	\$ 28.8	\$ 81.0	
Wireless Communications, High Usage ¹²	TC006	\$ 1.0	168 \$ 168.0	280 \$ 280.0	\$ 1,800.0	\$ 302.4	\$ 504.0	
DSO Communications line ¹³	TC001	\$ 1.0	0 \$ -	0 \$ -	\$ 1.2	\$ -	\$ -	
			Subtotal \$ 2,334.0	\$ 3,546.0	\$ 416.0	\$ 713.9		
Design Development Allowance								
			Subtotal \$ 583.5	\$ 886.5	\$ 104.0	\$ 178.5		
			Total \$ 2,917.5	\$ 4,432.5	\$ 520.1	\$ 892.4		

- Notes:**
- 1 Costs are shown in thousands of dollars
 - 2 Cost for these items have been programmed in Northern Transit Project 2 (NJT LRT (Newark City and Hudson Bergen) Fixed-Route Operations and Conditions Reporting (APTS))
 - 3 Assume Emergency Management is for NJT Police Dispatch and NJTPA Regional Public Safety Dispatch connection with NJT LRT Hudson Bergen Operations Center Systems
 - 4 Assume existing staff will perform necessary operations as necessary
 - 5 From NJT Fact Sheet, 16 LRT Owned and Operated currently and 29 expected to be Owned and Operated in the near future.
 - 6 Traffic Surveillance Hardware and Software cost used for Secure Area Sensor Data
 - 7 Number of sensors developed from 2003 NJ Transit Facts Sheet (Passenger Facilities)
 - 8 Line item information taken from "Roadside Detection" section of ITS Unit Costs Database
 - 9 Assume low end = 56 passive acoustic sensors (assumes 2 / station), high end = 112 passive acoustic sensors (assumes 4 / station)
 - 10 From NJT Fact sheet, 28 LRT Station, Assume low end = 4 cameras / station, high end = 6 cameras / station
 - 11 Assume Wireless Communication Equipment is for LRT Vehicles
 - 12 Assume Wireless Communication Equipment is for Acoustic Sensors and Cameras
 - 13 Costs for center to center comm already addressed in earlier APTS projects

Region
 Project Subsection
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
Northern Transit Projects
12
Northern TMAs Transit Security (APTS)
APTS5 Transit Security
APTS5-05

	Capital Cost					Annual Cost		
	unit cost	quantities	low end extension	quantities	high end extension	unit cost	low end extension	high end extension
Center Subsystems								
Transit Center Hardware ²	TR001	-	-	-	-	-	-	-
Transit Center Software, Integration ²	TR002	-	-	-	-	-	-	-
Vehicle Location Interface ²	TR007	-	-	-	-	-	-	-
Information Service Provider Hardware ⁶	IS001	\$ 49.5	0 \$	-	0 \$	-	\$ 1.0	\$ -
Systems Integration ⁶	IS017	\$ 110.0	0 \$	-	0 \$	-	-	-
Software Upgrade for Interactive Information ⁶	IS007	\$ 500.0	0 \$	-	0 \$	-	\$ 25.0	\$ -
Emergency Management								
Emergency Response Hardware ³	EM001	\$ 30.0	2 \$	60.0	2 \$	60.0	\$ 0.6	\$ 1.2
Emergency Response Software, Integration ³	EM002	\$ 150.0	2 \$	300.0	2 \$	300.0	\$ 3.5	\$ 7.0
Staff								
Information Service Provider Labor ⁴	IS004	-	-	-	-	-	-	-
Transit Vehicle Subsystems								
Driver Interface and Schedule processor ²	TV001	-	-	-	-	-	-	-
Cell Based Communication Equipment ²	TV002	-	-	-	-	-	-	-
GPS/DGPS for vehicle location ²	TV003	-	-	-	-	-	-	-
Security Package ⁵	TV006	\$ 7.0	30 \$	210.0	50 \$	350.0	\$ 0.265	\$ 8.0
Communications⁸								
Wireless Communications, High Usage ⁷	TC006	\$ 1.0	30 \$	30.0	50 \$	50.0	\$ 1.8000	\$ 54.0
		Subtotal		\$ 600.0	\$ 760.0		\$ 70.2	\$ 111.5
Design Development Allowance								
		Subtotal		\$ 150.0	\$ 190.0		\$ 17.5	\$ 27.9
		Total		\$ 750.0	\$ 950.0		\$ 87.7	\$ 139.3

- Notes:**
- 1 Costs are shown in thousands of dollars
 - 2 Cost for these items have been programed in Northern Transit Project 3 (Northern TMA Fixed-Route Operations and Conditions Reporting (APTS))
 - 3 Assume Emergency Management is for NJSP/NJDOT Statewide Dispatch Center and NJTPA Regional Public Safety Dispatch connection with NJTPA Regional TMA System
 - 4 Assume existing staff will perform necessary operations as necessary
 - 5 Same estimate for number of vehicles as used in project 3.
 - 6 All Information Service Provider connections covered in other projects
 - 7 Assume Wireless Communication Equipment is for TMA Vehicles
 - 8 Costs for center to center comm already addressed in earlier APTS projects

Region
 Project Subsection
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
Northern Transit Projects
13
North New Jersey Municipal/County Transit Security (APTS)
APTS5 Transit Security
APTS5-06

	Capital Cost					Annual Cost		
	unit cost	quantities	low end extension	quantities	high end extension	unit cost	low end extension	high end extension
Center Subsystems								
Transit Center Hardware ²	TR001	-	-	-	-	-	-	-
Transit Center Software, Integration ²	TR002	-	-	-	-	-	-	-
Vehicle Location Interface ²	TR007	-	-	-	-	-	-	-
Information Service Provider Hardware ⁶	IS001	\$ 49.5	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Systems Integration ⁶	IS017	\$ 110.0	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Software Upgrade for Interactive Information ⁶	IS007	\$ 500.0	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Emergency Management								
Emergency Response Hardware ³	EM001	\$ 30.0	6	\$ 180.0	13	\$ 390.0	\$ 0.6	\$ 3.6
Emergency Response Software, Integration ³	EM002	\$ 150.0	6	\$ 900.0	13	\$ 1,950.0	\$ 3.5	\$ 21.0
Staff								
Information Service Provider Labor ⁴	IS004	-	-	-	-	-	-	-
Transit Vehicle Subsystems								
Driver Interface and Schedule processor ²	TV001	-	-	-	-	-	-	-
Cell Based Communication Equipment ²	TV002	-	-	-	-	-	-	-
GPS/DGPS for vehicle location ²	TV003	-	-	-	-	-	-	-
Security Package ⁵	TV006	\$ 7.0	30	\$ 210.0	130	\$ 910.0	\$ 0.265	\$ 8.0
Communications⁸								
Wireless Communications, High Usage ⁷	TC006	\$ 1.0	30	\$ 30.0	130	\$ 130.0	\$ 1.8000	\$ 54.0
		Subtotal		\$ 1,320.0	\$ 3,380.0		\$ 86.6	\$ 321.8
Design Development Allowance								
		Subtotal		\$ 330.0	\$ 845.0		\$ 21.6	\$ 80.4
		Total		\$ 1,650.0	\$ 4,225.0		\$ 108.2	\$ 402.2

- Notes:**
- 1 Costs are shown in thousands of dollars
 - 2 Cost for these items have been programed in Northern Transit Project 4 (North New Jersey Municipal/County Fixed-Route Operations (APTS))
 - 3 Assume not all Counties/Municipalities will be deploying equipment.
 - 4 Assume existing staff will perform necessary operations as necessary
 - 5 Same estimate for number of vehicles as used in project 4.
 - 6 All Information Service Provider connections covered in other projects.
 - 7 Assume Wireless Communication Equipment is for Transit Vehicles
 - 8 Costs for center to center comm already addressed in earlier APTS projects

Region	North
Project Subsection	Northern Transit Projects
Project Number	14
Project Name	PANYNJ PATH Transit Security (APTS)
Market Package	APTSS Transit Security
Market Package Diagram No.	APTSS-07

	Capital Cost					Annual Cost		
	unit cost	quantities	low end extension	high end quantities	high end extension	unit cost	low end extension	high end extension
Center Subsystems								
Transit Center Hardware ² TR001	-	-	-	-	-	-	-	-
Transit Center Software, Integration ³ TR002	-	-	-	-	-	-	-	-
Vehicle Location Interface ⁴ TR007	-	-	-	-	-	-	-	-
Information Service Provider Hardware ⁵ IS001	-	-	-	-	-	-	-	-
Systems Integration ⁶ IS017	-	-	-	-	-	-	-	-
Software Upgrade for Interactive Informatio ⁷ IS007	-	-	-	-	-	-	-	-
Emergency Management								
Emergency Response Hardware ⁸ EM001	\$ 30.0	1	\$ 30.0	1	\$ 30.0	\$ 0.6	\$ 0.6	\$ 0.6
Emergency Response Software, Integration ⁹ EM002	\$ 150.0	1	\$ 150.0	1	\$ 150.0	\$ 3.5	\$ 3.5	\$ 3.5
Staff								
Information Service Provider Labor ¹⁰ IS004	-	-	-	-	-	-	-	-
Transit Vehicle Subsystems								
Driver Interface and Schedule processor ¹¹ TV001	-	-	-	-	-	-	-	-
Cell Based Communication Equipment ¹² TV002	-	-	-	-	-	-	-	-
GPS/DGPS for vehicle location ¹³ TV003	-	-	-	-	-	-	-	-
Security Package ¹⁴ TV006	\$ 7.0	30	\$ 210.0	50	\$ 350.0	\$ 0.265	\$ 8.0	\$ 13.3
Remote Traveler Support								
Hardware, Software for Traffic Surveillance ¹⁵ TM003	\$ 165.0	1	\$ 165.0	1	\$ 165.0	\$ 8,250	\$ 8,250	\$ 8,250
Integration for Traffic Surveillance ¹⁶ TM032	\$ 225.0	1	\$ 225.0	1	\$ 225.0	\$ 13,750	\$ 13,750	\$ 13,750
Passive Acoustic Sensor ¹⁷ -	\$ 8.0	50	\$ 400.0	100	\$ 800.0	\$ 0.400	\$ 20.0	\$ 40.0
CCTV Camera ¹⁸ RM001	\$ 5,000	50	\$ 250,000	100	\$ 500,000	\$ 0.250	\$ 12.5	\$ 25.0
Integration of Camera with Existing Systems RM002	\$ 2,500	50	\$ 125,000	100	\$ 250,000	-	-	-
Communications								
Wireless Communications, High Usage ¹⁹ TC006	\$ 1.0	30	\$ 30.0	50	\$ 50.0	\$ 1,800.0	\$ 54.0	\$ 90.0
DSO Communications line ¹⁰ TC001	\$ 1.0	1	\$ 1.0	2	\$ 2.0	\$ 1.2	\$ 1.2	\$ 2.4
DS1 Communications line ¹¹ TC002	\$ 1.0	13	\$ 13.0	20	\$ 20.0	\$ 8.4	\$ 109.2	\$ 168.0
			\$ 1,999.0		\$ 2,542.0		\$ 231.0	\$ 364.8
Design Development Allowance 25%			\$ 399.8		\$ 635.5		\$ 57.7	\$ 91.2
Total			\$ 1,998.8		\$ 3,177.5		\$ 288.7	\$ 455.9

- Notes:**
- Costs are shown in thousands of dollars
 - Cost for these items have been programed in Northern Transit Project 5 (North New Jersey Municipal/County Fixed-Route Operations (APTS))
 - Assume Emergency Management is for NJSP/NJDOT Statewide Dispatch Center and NJTPA Regional Public Safety Dispatch connection with NJTPA Counties/Municipalities Transit Systems (2 Dispatch centers X 13 Counties/Municipalities = 26)
 - Assume existing staff will perform necessary operations as necessary
 - Same estimate for number of vehicles as used in project 4. (placeholder value)
 - Traffic Surveillance Hardware and Software cost used for Secure Area Sensor Data
 - Number of sensors estimated (placeholder value)
 - Line item information taken from "Roadside Detection" section of ITS Unit Costs Database
 - Number of cameras estimated (placeholder value)
 - Additional DSO lines for PAPD 211
 - DS1 lines for 13 PATH stations - CCTV links

Region
 Project Subsection
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
Northern Transit Projects
15
TRANSCOM Regional Architecture Expansion
APTS7 Multimodal Coordination
APTS7-2

		Capital Cost				Annual Cost			
		low end		high end		low end		high end	
		unit cost	quantities	extension	quantities	extension	unit cost	extension	extension
Center Subsystems									
	Transit Center Hardware TR001	\$ 30.0	1	\$ 30.0	1	\$ 30.0	\$ -	\$ -	\$ -
	Software, Integration for Regional Control	\$ 440.0	21	\$ 9,240.0	35	\$ 15,400.0	\$ -	\$ -	\$ -
Staff									
	Information Service Provider Labor IS004	\$ -	1	\$ -	1	\$ -	\$ 250.0	\$ 250.0	\$ 250.0
Communications									
	DS0 Communications line ³ TC001	\$ 1.0	9	\$ 9.0	15	\$ 15.0	\$ 1.2	\$ 10.8	\$ 18.0
		Subtotal		\$ 9,279.0	\$ 15,445.0		\$ 260.8		\$ 268.0
Design Development Allowance	25%	Subtotal		\$ 2,319.8	\$ 3,861.3		\$ 65.2		\$ 67.0
		Total		\$ 11,598.8	\$ 19,306.3		\$ 326.0		\$ 335.0

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Assume low end = 21 systems to integrate, high end = 35 systems to integrate
- 3 Assume one DS0 line for each interconnected center (only 9-15 reqd)

Region
 Project Subsection
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 Northern Transit Projects
 16
 TRANSCOM Regional Transit Information (TRIPS 123)
 APTS8 Transit Traveler Information, APTS7 Multimodal Coordination
 APTS8-08

Center Subsystems

Transit Center Hardware⁴ TR001
 Transit Center Software, Integration
 Information Service Provider TR002
 Hardware² IS001
 Systems Integration IS017

Remote Location

Informational Kiosk⁵ RM003
 Integration of Kiosk with existing
 Systems⁶ RM004

Staff

Information Service Provider Labor IS004

Communications

DS0 Communications line³ TC001

Design Development Allowance

25%

Capital Cost						Annual Cost		
unit cost	quantities	low end extension	quantities	high end extension	unit cost	low end extension	high end extension	
\$ 30.0		0 \$ -		0 \$ -	\$ -	\$ -	\$ -	
\$ 1,720.0		0 \$ -		0 \$ -	\$ 12.0	\$ -	\$ -	
\$ 49.5	1	\$ 49.5	1	\$ 49.5	\$ 0.990	\$ 0.990	\$ 1.0	
\$ 110.0	1	\$ 110.0	1	\$ 110.0	\$ -	\$ -	\$ -	
\$ 50.0	-	-	-	-	\$ 5.0	-	-	
\$ 27.4	100	\$ 2,740.0	200	\$ 5,480.0	\$ -	\$ -	\$ -	
\$ -	1	\$ -	1	\$ -	\$ 250.0	\$ 250.0	\$ 250.0	
\$ 1.0	2	\$ 2.0	3	\$ 3.0	\$ 1.2	\$ 2.4	\$ 3.6	
Subtotal		\$ 2,901.5	\$ 5,642.5		\$ 253.4		\$ 254.6	
Subtotal		\$ 725.4	\$ 1,410.6		\$ 63.3		\$ 63.6	
Total		\$ 3,626.9	\$ 7,053.1		\$ 316.7		\$ 318.2	

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Assume One ISP systems to integrate
- 3 Assume additional DS0 lines for 2 -3 centers
- 4 Assume this is provided in another project
- 5 Assume this project uses the existing transcom kiosk hardware
- 6 Assume this cost is for upgrading the existing kiosks with this new functionality

Project Number		Capital Cost						Annual Cost			
		Construction / Deployment	Engineering			Subtotal	Escalation 2-1/2 years at 4% per year	Total	Subtotal	Escalation 2-1/2 years at 4% per year	Total
			Design	Construction Support	Construction Inspection						
Project Name		10%	2%	10%		10%		10%			
1		NJT Bus North Fixed-Route Operations North and Conditions Reporting (APTS)									
	high end	\$ 3,413.8	\$ 341	\$ 68	\$ 341	\$ 4,165	\$ 416	\$ 4,581	\$ 491	\$ 49	\$ 540
	low end	\$ 3,132.5	\$ 313	\$ 63	\$ 313	\$ 3,822	\$ 382	\$ 4,204	\$ 406	\$ 41	\$ 447
2		NJT LRT (Newark City and Hudson Bergen Fixed-Route Operations and Conditions Reporting (APTS))									
	high end	\$ 3,195.9	\$ 320	\$ 64	\$ 320	\$ 3,899	\$ 390	\$ 4,289	\$ 445	\$ 44	\$ 489
	low end	\$ 3,195.9	\$ 320	\$ 64	\$ 320	\$ 3,899	\$ 390	\$ 4,289	\$ 399	\$ 40	\$ 439
3		Northern TMA Fixed-Route Operations and Conditions Reporting (APTS)									
	high end	\$ 2,553.8	\$ 255	\$ 51	\$ 255	\$ 3,116	\$ 312	\$ 3,427	\$ 441	\$ 44	\$ 485
	low end	\$ -	-	-	-	-	-	-	\$ -	-	-
4		North New Jersey Municipal/County Fixed-Route Operations (APTS)									
	high end	\$ 29,064.4	\$ 2,906	\$ 581	\$ 2,906	\$ 35,459	\$ 3,546	\$ 39,004	\$ 639	\$ 64	\$ 703
	low end	\$ 13,339.4	\$ 1,334	\$ 267	\$ 1,334	\$ 16,274	\$ 1,627	\$ 17,901	\$ 449	\$ 45	\$ 494
5		PANYNJ PATH Fixed-Route Operations (APTS)									
	high end	\$ 4,400.0	\$ 440	\$ 88	\$ 440	\$ 5,368	\$ 537	\$ 5,905	\$ 392	\$ 39	\$ 431
	low end	\$ 3,523.8	\$ 352	\$ 70	\$ 352	\$ 4,299	\$ 430	\$ 4,729	\$ 381	\$ 38	\$ 419
6		Rutgers Campus Shuttle Fixed-Route and Demand Response Operations (APTS)									
	high end	\$ 2,241.3	\$ 224	\$ 45	\$ 224	\$ 2,734	\$ 273	\$ 3,008	\$ 341	\$ 34	\$ 376
	low end	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
7		Private Bus/Shuttle Fixed Route and Demand Response Operations (APTS)									
	high end	\$ 90,151.9	\$ 9,015	\$ 1,803	\$ 9,015	\$ 109,985	\$ 10,999	\$ 120,984	\$ 915	\$ 91	\$ 1,006
	low end	\$ 45,488.1	\$ 4,549	\$ 910	\$ 4,549	\$ 55,496	\$ 5,550	\$ 61,045	\$ 474	\$ 47	\$ 521

Project Number		Capital Cost					Annual Cost					
		Construction / Deployment	Engineering			Subtotal	Escalation 2-1/2 years at 4% per year	Total	Subtotal	Escalation 2-1/2 years at 4% per year	Total	
			Design	Construction Support	Construction Inspection							
Project Name	10%	2%	10%		10%		10%					
8	high end	Private Ferry Fixed-Route Operations										
	low end	\$ 13,430.0	\$ 1,343	\$ 269	\$ 1,343	\$ 16,385	\$ 1,638	\$ 18,023	\$ 109	\$ 11	\$ 120	
9	high end	NJT Bus Operations North Transit Security (APTS)										
	low end	\$ 4,551.3	\$ 455	\$ 91	\$ 455	\$ 5,553	\$ 555	\$ 6,108	\$ 42	\$ 4	\$ 47	
9	high end	NJT Bus Operations North Transit Security (APTS)										
	low end	\$ 4,664.7	\$ 466	\$ 93	\$ 466	\$ 5,691	\$ 569	\$ 6,260	\$ 644	\$ 64	\$ 708	
10	high end	NJT Rail Operations Transit Security (APTS)										
	low end	\$ 2,577.8	\$ 258	\$ 52	\$ 258	\$ 3,145	\$ 314	\$ 3,459	\$ 331	\$ 33	\$ 364	
10	high end	NJT Rail Operations Transit Security (APTS)										
	low end	\$ 451.3	\$ 45	\$ 9	\$ 45	\$ 551	\$ 55	\$ 606	\$ 12	\$ 1	\$ 13	
11	high end	NJT LRT (Newark City and Hudson Bergen) Transit Security (APTS)										
	low end	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	
11	high end	NJT LRT (Newark City and Hudson Bergen) Transit Security (APTS)										
	low end	\$ 4,432.5	\$ 443	\$ 89	\$ 443	\$ 5,408	\$ 541	\$ 5,948	\$ 892	\$ 89	\$ 982	
12	high end	Northern TMAs Transit Security (APTS)										
	low end	\$ 2,917.5	\$ 292	\$ 58	\$ 292	\$ 3,559	\$ 356	\$ 3,915	\$ 520	\$ 52	\$ 572	
12	high end	Northern TMAs Transit Security (APTS)										
	low end	\$ 950.0	\$ 95	\$ 19	\$ 95	\$ 1,159	\$ 116	\$ 1,275	\$ 139	\$ 14	\$ 153	
13	high end	North New Jersey Municipal/County Transit Security (APTS)										
	low end	\$ 750.0	\$ 75	\$ 15	\$ 75	\$ 915	\$ 92	\$ 1,007	\$ 88	\$ 9	\$ 96	
13	high end	North New Jersey Municipal/County Transit Security (APTS)										
	low end	\$ 4,225.0	\$ 423	\$ 85	\$ 423	\$ 5,155	\$ 515	\$ 5,670	\$ 402	\$ 40	\$ 442	
14	high end	PANYNJ PATH Transit Security (APTS)										
	low end	\$ 1,650.0	\$ 165	\$ 33	\$ 165	\$ 2,013	\$ 201	\$ 2,214	\$ 108	\$ 11	\$ 119	
14	high end	PANYNJ PATH Transit Security (APTS)										
	low end	\$ 3,177.5	\$ 318	\$ 64	\$ 318	\$ 3,877	\$ 388	\$ 4,264	\$ 456	\$ 46	\$ 502	
14	high end	PANYNJ PATH Transit Security (APTS)										
	low end	\$ 1,998.8	\$ 200	\$ 40	\$ 200	\$ 2,438	\$ 244	\$ 2,682	\$ 289	\$ 29	\$ 318	

Project Number		Construction / Deployment	Capital Cost					Annual Cost			
			Design	Engineering		Subtotal	Escalation 2-1/2 years at 4% per year	Total	Subtotal	Escalation 2-1/2 years at 4% per year	Total
				Construction Support	Construction Inspection						
Project Name		10%	2%	10%		10%			10%		
15		TRANSCOM Regional Architecture Expansion									
	high end	\$ 19,306.3	\$ 1,931	\$ 386	\$ 1,931	\$ 23,554	\$ 2,355	\$ 25,909	\$ 335	\$ 34	\$ 369
	low end	\$ 11,598.8	\$ 1,160	\$ 232	\$ 1,160	\$ 14,150	\$ 1,415	\$ 15,566	\$ 326	\$ 33	\$ 359
16		TRANSCOM Regional Transit Information (TRIPS 123)									
	high end	\$ 7,053.1	\$ 705	\$ 141	\$ 705	\$ 8,605	\$ 860	\$ 9,465	\$ 318	\$ 32	\$ 350
	low end	\$ 3,626.9	\$ 363	\$ 73	\$ 363	\$ 4,425	\$ 442	\$ 4,867	\$ 317	\$ 32	\$ 348
Total											
	high end	\$ 192,711	\$ 19,271	\$ 3,854	\$ 19,271	\$ 235,108	\$ 23,511	\$ 258,618	\$ 6,972	697.17	\$ 7,669
	low end	\$ 98,351	\$ 9,835	\$ 1,967	\$ 9,835	\$ 119,988	\$ 11,999	\$ 131,987	\$ 4,130	412.95	\$ 4,542

Table 12-2. NJTPA – APTS - Short Term Project Benefit Summary

Project Number	Project Name	Program Area	SubArea	Expected Benefit Types (Goal Area)	Referenced Study
1	NJT Bus North Fixed-Route Operations North and Conditions Reporting (APTS)	Transit Management Systems	Fleet Management: AVL/CAD	- Productivity - Customer Satisfaction - Mobility	81, 12
			Information Dissemination : Internet/Wireless/Phone	- Customer Satisfaction	84
2	NJT LRT (Newark City and Hudson Bergen Fixed-Route Operations and Conditions Reporting (APTS)	Transit Management Systems	Fleet Management: AVL/CAD	- Productivity - Customer Satisfaction - Mobility	81, 12
			Information Dissemination : Internet/Wireless/Phone	- Customer Satisfaction	84
3	Northern TMA Fixed-Route Operations and Conditions Reporting (APTS)	Transit Management Systems	Fleet Management: AVL/CAD	- Productivity - Customer Satisfaction - Mobility	81, 12
			Information Dissemination : Internet/Wireless/Phone	- Customer Satisfaction	84
4	North New Jersey Municipal/County Fixed-Route Operations (APTS)	Transit Management Systems	Fleet Management: AVL/CAD	- Productivity - Customer Satisfaction - Mobility	81, 12
5	PANYNJ PATH Fixed-Route Operations (APTS)	Transit Management Systems	Fleet Management: AVL/CAD	- Productivity - Customer Satisfaction - Mobility	81, 12
			Information Dissemination : Internet/Wireless/Phone	- Customer Satisfaction	84
6	Rutgers Campus Shuttle Fixed-Route and Demand Response Operations (APTS)	Transit Management Systems	Fleet Management: AVL/CAD	- Productivity - Customer Satisfaction - Mobility	81, 12
			Transit Demand Management: Dynamic Routing/Scheduling	-Mobility - Productivity -Customer Satisfaction	78, 79
7	Private Bus/Shuttle Fixed Route and Demand Response Operations (APTS)	Transit Management Systems	Fleet Management: AVL/CAD	- Productivity - Customer Satisfaction - Mobility	81, 12
			Transit Demand Management: Dynamic Routing/Scheduling	-Mobility - Productivity -Customer Satisfaction	78, 79
8	Private Ferry Fixed-Route Operations	Transit Management Systems	Fleet Management: AVL/CAD	- Productivity - Customer Satisfaction - Mobility	81, 12
9	NJT Bus Operations North Transit Security (APTS)	Transit Management Systems	Safety and Security: On-Vehicle Surveillance	- Customer Satisfaction	76
		Driver Assistance Systems	Safety and Security: Facility Surveillance On-board Monitoring: Safety and Security Safety Event Recorders	- Customer Satisfaction - no data to report - no data to report	76
10	NJT Rail Operations Transit Security (APTS)	Transit Management Systems	Safety and Security: On-Vehicle Surveillance	- Customer Satisfaction	76
		Driver Assistance Systems	Safety and Security: Facility Surveillance On-board Monitoring: Safety and Security Safety Event Recorders	- Customer Satisfaction - no data to report - no data to report	76
11	NJT LRT (Newark City and Hudson Bergen) Transit Security (APTS)	Transit Management Systems	Safety and Security: On-Vehicle Surveillance	- Customer Satisfaction	76
		Driver Assistance Systems	Safety and Security: Facility Surveillance On-board Monitoring: Safety and Security Safety Event Recorders	- Customer Satisfaction - no data to report - no data to report	76

Project Number	Project Name	Program Area	SubArea	Expected Benefit Types (Goal Area)	Referenced Study
12	Northern TMAs Transit Security (APTS)	Transit Management Systems	Safety and Security:On-Vehicle Surveillance	- Customer Satisfaction	76
		Driver Assistance Systems	Safety and Security: Facility Surveillance On-board Monitoring: Safety and Security Safety Event Recorders	- Customer Satisfaction - no data to report - no data to report	76
13	North New Jersey Municipal/County Transit Security (APTS)	Transit Management Systems	Safety and Security:On-Vehicle Surveillance	- Customer Satisfaction	76
		Driver Assistance Systems	Safety and Security: Facility Surveillance On-board Monitoring: Safety and Security Safety Event Recorders	- Customer Satisfaction - no data to report - no data to report	76
14	PANYNJ PATH Transit Security (APTS)	Transit Management Systems	Safety and Security:On-Vehicle Surveillance	- Customer Satisfaction	76
		Driver Assistance Systems	Safety and Security: Facility Surveillance On-board Monitoring: Safety and Security Safety Event Recorders	- Customer Satisfaction - no data to report - no data to report	76
15	TRANSCOM Regional Architecture Expansion	Traveler Information	Information Dissemination : Internet/Wireless/Phone Transit Demand Management : Service Coordination	- Customer Satisfaction	84
				- Productivity	51
16	TRANSCOM Regional Transit Information (TRIPS 123)	Transit Management Systems	Information Dissemination : Internet/Wireless/Phone	- Customer Satisfaction	84

Appendix 12.B

Implementation – Project Tables

Advanced Traffic Information Systems and

Advanced Traffic Management Systems

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 1
 NJDOT North Traveler Information System Development
 ATIS Broadcast Traveler Information
 ATIS1-1, ATIS1-2, **ATIS1-6**

Center Subsystems

ISP Hardware IS001
 ISP Software, Integration IS002
 System Integration IS017
 FM Subcarrier IS005
 ISP Basic Facilities Comm. for large area IS019

Staff

Labor for Traffic Information
 Dissemination TM024

Communications

DS0 Communications line² TM001

Design Development Allowance

25%

Capital Cost						Annual Cost			
		low end		high end		low end		high end	
unit cost	quantities	extension		quantities	extension	unit cost	extension	extension	
\$ 49.5	1	\$ 49.5		1	\$ 49.5	\$ 1.0	\$ 1.0	\$ 1.0	
\$ 550.0	1	\$ 550.0		1	\$ 550.0	\$ 27.5	\$ 27.5	\$ 27.5	
\$ 110.0	6	\$ 660.0		8	\$ 880.0	\$ 5.5	\$ 33.0	\$ 44.0	
	1			1	\$ -	\$ 240.0	\$ 240.0	\$ 240.0	
\$ 4,000.0	1	\$ 4,000.0		1	\$ 4,000.0	\$ 600.0	\$ 600.0	\$ 600.0	
	1	\$ -		1	\$ -	\$ 110.0	\$ 110.0	\$ 110.0	
\$ 1.0	6	\$ 6.0		8	\$ 8.0	\$ 1.2	\$ 7.2	\$ 9.6	
Subtotal		\$ 5,265.5			\$ 5,487.5		\$ 1,018.7	\$ 1,032.1	
Subtotal		\$ 1,316.4			\$ 1,371.9		\$ 254.7	\$ 258.0	
Total		\$ 6,581.9			\$ 6,859.4		\$ 1,273.4	\$ 1,290.1	

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Assume DS-0 communication lines for Centers, Integration: NJDOT 511, NJDOT C TIS, NJDOT N TIS, NJDOT S TIS

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 2
 North Private Sector ISP Integration
 ATIS Broadcast Traveler Information, ATIS2 Interactive Traveler Information
 ATIS1-4, ATIS2-01, ATIS2-11

			Capital Cost				Annual Cost			
			unit cost	quantities	low end extension	quantities	high end extension	unit cost	low end extension	high end extension
Center Subsystems										
	FM Subcarrier ³	IS005			2		2	\$ 240.0	\$ 480.0	\$ 480.0
	Information Service Provider									
	Hardware ⁴	IS001	\$ 49.5	\$ 3.0	\$ 148.5	\$ 3.0	\$ 148.5	\$ 1.0	\$ 3.0	\$ 3.0
	Systems Integration ⁴	IS017	\$ 110.0	\$ 3.0	\$ 330.0	\$ 3.0	\$ 330.0	-	-	-
	Software Upgrade for Interactive Information ⁴	IS007	\$ 500.0	\$ 3.0	\$ 1,500.0	\$ 3.0	\$ 1,500.0	\$ 25.0	\$ 75.0	\$ 75.0
Remote Locations										
	Kiosk Upgrade for Interactive Usage ⁶	RM005	\$ 8.0	\$ 20.0	\$ 160.0	\$ 40.0	\$ 320.0	\$ 0.8	\$ 16.0	\$ 32.0
	Kiosk Software Upgrade for Interactive Usage ⁶	RM006	\$ 12.0	\$ 1.0	\$ 12.0	\$ 1.0	\$ 12.0	-	-	-
Media										
	Cable TV Traffic Channel Hardware ⁴		\$ 19.0	\$ 3.0	\$ 57.0	\$ 3.0	\$ 57.0	-	-	-
Staff										
	ISP Labor	IS004			1		1	\$ 250.0	\$ 250.0	\$ 250.0
Personal Information Access⁵										
Communications										
	DSO Communications line ⁷	TM001	\$ 1.0	15	\$ 15.0	23	\$ 23.0	\$ 1.2	\$ 18.0	\$ 27.6
			Subtotal		\$ 2,222.5	\$ 2,390.5		\$ 842.0		\$ 867.6
			Subtotal		\$ 555.6	\$ 597.6		\$ 210.5		\$ 216.9
			Total		\$ 2,778.1	\$ 2,988.1		\$ 1,052.5		\$ 1,084.5

25%

Notes:

1 Costs are shown in thousands of dollars

3 For Private ISP Broadcasts to vehicles

4 ISP for Private ISPs and TRANSCOM

5 Assume communication cost for providing Personal Information Access are borne by Travelers

6 Assume existing Kiosks are used

7 Assume one DS-0 comm. line for each interconnected center: NJDOT 511, NJDOT C TIS, NJDOT N TIS, NJDOT S TIS, NJDOT Web, TRIPS123, Transcom, Private comm. veh (say 4-8), Private ISP (say 4-8).

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 3
 TRANSCOM TRIPS123 Upgrade and expansion
 ATIS Broadcast Traveler Information, ATIS2 Interactive Traveler Information
 ATIS2-01, ATIS5-1

		Capital Cost						Annual Cost			
		low end			high end			low end		high end	
		unit cost	quantities	extension	quantities	extension	unit cost	extension	extension	extension	
Center Subsystems											
Fleet Center Hardware ²	FM001	\$ 30.0	1	\$ 30.0	1	\$ 30.0	\$ 0.6	\$ 0.6	\$ 0.6	\$ 0.6	
Fleet Center Software, Integration	FM002	\$ 500.0	1	\$ 500.0	1	\$ 500.0	\$ -	\$ -	\$ -	\$ -	
FM Subcarrier ³	IS005		1		1		\$ 240.0	\$ 240.0	\$ 240.0	\$ 240.0	
Information Service Provider Hardware ⁴	IS001	\$ 49.5	0	\$ -	\$ -	\$ -	\$ 1.0	\$ -	\$ -	\$ -	
Systems Integration ⁴	IS017	\$ 110.0	3	\$ 330.0	\$ 3.0	\$ 330.0	-	-	-	-	
Software Upgrade for Interactive Information ⁴	IS007	\$ 500.0	1	\$ 500.0	\$ 1.0	\$ 500.0	\$ 25.0	\$ 25.0	\$ 25.0	\$ 25.0	
Remote Locations											
Kiosk Upgrade for Interactive Usage ⁵	RM005	\$ 8.0	0	\$ -	0	\$ -	\$ 0.8	\$ -	\$ -	\$ -	
Kiosk Software Upgrade for Interactive Usage ⁵	RM006	\$ 12.0	0	\$ -	0	\$ -	-	-	-	-	
Media											
Cable TV Traffic Channel Hardware ⁸		\$ 19.0	\$ -	\$ -	\$ -	\$ -	-	-	-	-	
Staff											
Labor for Traffic Information Dissemination	TM024		0		1		\$ 110.0	\$ -	\$ 110.0	\$ 110.0	
Personal Information Access⁵											
Communications											
DS0 Communications line ⁷	TM001	\$ 1.0	1	\$ 1.0	3	\$ 3.0	\$ 1.2	\$ 1.2	\$ 3.6	\$ 3.6	
		Subtotal	\$ 1,361.0		\$ 1,363.0		\$ 266.8		\$ 379.2		
Design Development Allowance	25%	Subtotal	\$ 340.3		\$ 340.8		\$ 66.7		\$ 94.8		
		Total	\$ 1,701.3		\$ 1,703.8		\$ 333.5		\$ 474.0		

Notes:

- 1 Costs are shown in thousands of dollars
- 2 cost for integration with fleet mgt and broadcast to media
- 3 assume cost to address TRIPS123 broadcast to vehicles
- 4 ISPs for TRANSCOM and NJT Transit provided in other projects; integration for NJT ISP, TRIPS 123, Transcom Comm. Servers
- 5 Assume communication cost for providing Personal Information Access are borne by other projects
- 6 Assume Kiosks upgrades covered in project #2
- 7 Assume one DS0 for each interconnected center: NJT ISP = 1; others addressed by project 2.
- 8 Link with media for TRANSCOM provided in project #2

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 4
 PANYNJ TB-T Tunnel/Bridges Traffic Information Dissemination
 Network Surveillance, Freeway Control, Traffic Information Dissemination
 ATMS01-4, ATMS04-2, ATMS06-3

	Capital Cost				Annual Cost		
	unit cost	quantities	low end extension	high end extension	unit cost	low end extension	high end extension
Center Subsystems							
Information Service Provider							
Hardware ² IS001	\$ 49.5	1	\$ 49.5	1	\$ 49.5	\$ 1.0	\$ 1.0
Systems Integration ² IS017	\$ 110.0	1	\$ 110.0	1	\$ 110.0	-	-
Hardware/Software for Traffic Surveillance Detection existing ³ TM003	\$ 165.0	4	\$ 660.0	6	\$ 990.0	\$ 8.3	\$ 33.0
Hardware for Freeway Control ³ TM005	\$ 30.0	4	\$ 120.0	6	\$ 180.0	\$ 1.0	\$ 4.0
Software, Integration for Freeway Control ³ TM007	\$ 220.0	4	\$ 880.0	6	\$ 1,320.0	\$ -	\$ -
Hardware for Incident Detection ³ TM014	\$ 119.3	4	\$ 477.2	6	\$ 715.8	\$ 6.0	\$ 6.0
Integration for Incident Detection ³ TM025	\$ 110.0	4	\$ 440.0	6	\$ 660.0	\$ 5.5	\$ 5.5
Software for Incident Detection ³ TM015	\$ 110.0	4	\$ 440.0	6	\$ 660.0	\$ 5.5	\$ 5.5
Roadside Detection							
Roadside Probe Beacon RS020	\$ 5.0	10	\$ 50.0	20	\$ 100.0	\$ 0.8	\$ 8.0
Wireline to Roadside Message sign ⁷ RS013	\$ 75.0	10	\$ 750.0	20	\$ 1,500.0	\$ 3.8	\$ 37.5
Roadside Information							
Variable Message Sign RS015	\$ 120.0	10	\$ 1,200.0	20	\$ 2,400.0	\$ 6.0	\$ 60.0
Variable Message Sign Tower RS016	\$ 125.0	10	\$ 1,250.0	20	\$ 2,500.0	\$ -	\$ -
HAR RS017	\$ 32.0	2	\$ 64.0	4	\$ 128.0	\$ 1.0	\$ 2.0
HAR sign	\$ 5.0	4	\$ 20.0	8	\$ 40.0	\$ 0.3	\$ 1.0
Wireline to Roadside Message sign RS013	\$ 75.0	26	\$ 1,950.0	52	\$ 3,900.0	\$ 3.8	\$ 97.5
Media							
Cable TV Traffic Channel Hardware ⁴	\$ 19.0	1	\$ 19.0	1	\$ 19.0	-	-
Communications⁵							
DSO Communications line ⁷ TM001	\$ 1.0	6	\$ 6.0	8	\$ 8.0	\$ 1.2	\$ 7.2
Staff⁶							
Labor for Traffic Information Dissemination TM024		4		6		\$ 110.00	\$ 440.00
			\$ 8,486	\$ 15,280		\$ 691	\$ 1,138
Design Development Allowance 25%							
			\$ 2,121	\$ 3,820		\$ 173	\$ 285
			\$ 10,607	\$ 19,100		\$ 864	\$ 1,423

- Notes:**
- 1 Costs are shown in thousands of dollars
 - 2 Assume single ISP for PANYNJ TB/T Tunnels/Bridges
 - 3 systems at PANYNJ Bridge/Tunnel Operations Centers
 - 4 Assume cost for link to media
 - 5 Communication link costs between Operations Center and field equipment addressed by item RS013.
 - 6 Assume additional PANYNJ Staff at Bridge/Tunnel Operations Centers
 - 7 Center interconnect costs by TM001. (6) Bridges/Tunnels + PANYNJ CRD; other centers covered by project 2.

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 5
 PANYNJ Airport/Ports Commerce Arterial Surveillance and Traffic Monitoring System
 Network Surveillance, Surface Street Control, HOV Lane Management, Traffic Information Dissemination
 ATMS01-5, ATMS01-6, ATMS03-4, ATMS05-1, ATMS06- 4

	Capital Cost				Annual Cost				
	unit cost	low end		high end		unit cost	low end		high end
		quantities	extension	quantities	extension		extension	extension	
Center Subsystems									
Information Service Provider									
Hardware ²	IS001	\$ 49.5	2 \$ 99.0	1 \$ 49.5	\$ 1.0	\$ 2.0	\$ 1.0		
Systems Integration ²	IS017	\$ 110.0	2 \$ 220.0	1 \$ 110.0					
Integration for Traffic Surveillance ⁹	TM032	\$ 275.0	1 \$ 275.0	2 \$ 550.0	\$ 13.8				
Hardware/Software for Traffic Surveillance Detector ¹⁰	TM003	\$ 165.0	1 \$ 165.0	2 \$ 330.0	\$ 8.3	\$ 8.3	\$ 16.5		
Hardware for Freeway Control Software, Integration for Freeway Control ³	TM005	\$ 30.0	1 \$ 30.0	2 \$ 60.0	\$ 1.0	\$ 1.0	\$ 2.0		
Control ⁴	TM007	\$ 220.0	1 \$ 220.0	2 \$ 440.0					
Software for Lane Control	RS011	\$ 50.0	1 \$ 50.0	2 \$ 100.0	\$ 5.0	\$ 5.0	\$ 10.0		
Hardware for Traffic Information Dissemination ³	TM021	\$ 10.0	1 \$ 10.0	2 \$ 20.0	\$ 0.5	\$ 0.5	\$ 1.0		
Software for Traffic Information Dissemination ³	TM022	\$ 22.0	1 \$ 22.0	2 \$ 44.0	\$ 1.1	\$ 1.1	\$ 2.2		
Integration for Traffic Information Dissemination ³	TM023	\$ 110.0	1 \$ 110.0	2 \$ 220.0	\$ 5.5	\$ 5.5	\$ 11.0		
Roadside Detection									
Passive Acoustic Sensor on Corridor ⁴		\$ 8.0	10 \$ 80.0	20 \$ 160.0	\$ 0.4	\$ 4.0	\$ 8.0		
Roadside Probe Beacon	RS020	\$ 5.0	10 \$ 50.0	20 \$ 100.0	\$ 0.8	\$ 8.0	\$ 16.0		
Wireline to Roadside Message sign ⁷	RS013	\$ 75.0	20 \$ 1,500.0	40 \$ 3,000.0	\$ 3.8	\$ 75.0	\$ 150.0		
Roadside Control									
Variable Message Sign	RS015	\$ 120.0	4 \$ 480.0	8 \$ 960.0	\$ 6.0	\$ 24.0	\$ 48.0		
Variable Message Sign Tower	RS016	\$ 125.0	4 \$ 500.0	8 \$ 1,000.0					
HAR	RS017	\$ 32.0	1 \$ 32.0	2 \$ 64.0	\$ 1.0	\$ 1.0	\$ 2.0		
HAR sign		\$ 5.0	2 \$ 10.0	4 \$ 20.0	\$ 0.3	\$ 0.5	\$ 1.0		
Lane Control Gates ⁵	RS012	\$ 150.0	2 \$ 300.0	4 \$ 600.0	\$ 3.0	\$ 6.0	\$ 12.0		
Fixed Lane Signal	RS009	\$ 8.0	8 \$ 64.0	16 \$ 128.0	\$ 0.8	\$ 6.4	\$ 12.8		
Wireline to Roadside Message sign ⁷	RS013	\$ 75.0	21 \$ 1,575.0	42 \$ 3,150.0	\$ 3.8	\$ 78.8	\$ 157.5		
Communications⁶									
DSO Communications line ⁵	TM001	\$ 1.0	8 \$ 8.0	10 \$ 10.0	\$ 1.2	\$ 9.6	\$ 12.0		
Staff⁸									
Labor for Traffic Information Dissemination ³	TM024		1	2	\$ 110.00	\$ 110.0	\$ 220		
		Subtotal	\$ 5,800.0	\$ 11,115.5	\$ 236.6	\$ 463.0			
Design Development Allowance⁹									
25%		Subtotal	\$ 1,450.0	\$ 2,778.9	\$ 59.2	\$ 115.6			
		Total	\$ 7,250.0	\$ 13,894.4	\$ 295.8	\$ 578.8			

Notes:

- 1 Costs are shown in thousands of dollars
- 2 ISP for PANYNJ Airports and Port Commerce
- 3 For Airports Operations Center, Port Commerce Ops Center
- 4 For Freeway Control status and traffic flow
- 5 Assume one DSO for each interconnected Center: PANYNJ FIRST, PANYNJ Port Comm. Ops, NITPA Mun (2-4); PANYNJ PAPD 211; PANYNJ Airport Comm. Desk; PANYNJ Airport TIS; Transmit Agencies
- 6 Traffic Flow Sensor Control for PANYNJ Airports and Port Commerce
- 7 Assume RS013 cost for new field equipment communications.
- 8 Assume staff for Port Commerce Ops and Airport Ops due to additional workload
- 10 Assume add surveillance function to existing traffic signal system

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 6
 NJ Transit TRANSMIT Probe Surveillance
 Probe Surveillance
 ATMS02-5

Center Subsystems

Software Upgrade for Probe Information Collection IS018
 Hardware for Probe Information Collection⁶ IS018
 Software for Probe Information Collection TM034
 Integration for Probe Information Collection TM035

Vehicle on Board

Active Tag³

Roadside Information

Roadside Beacon⁴ CC004
 Wireline to Roadside Beacon⁴ CC005

Staff⁵

Communications

DS0 Communications line² TM001

Design Development Allowance

25%

Capital Cost						Annual Cost		
unit cost	quantities	low end extension	high end quantities	high end extension	unit cost	low end extension	high end extension	
\$ 500.0	1	\$ 500.0	1	\$ 500.0	\$ 25.0	\$ 25.0	\$ 25.0	
\$ 22.0	1	\$ 22.0	1	\$ 22.0	\$ 2.2	\$ 2.2	\$ 2.2	
\$ 165.0	1	\$ 165.0	1	\$ 165.0	\$ 16.5	\$ 16.5	\$ 16.5	
	0.05	\$ 6.5	200	\$ 10.0	0.005	\$ 0.7	\$ 1.0	
\$ 8.0	20	\$ 160.0	40	\$ 320.0	\$ 0.8	\$ 16.0	\$ 32.0	
\$ 20.0	20	\$ 400.0	49	\$ 980.0	\$ 0.8	\$ 16.0	\$ 39.2	
\$ 1.0	5	\$ 5.0	7	\$ 7.0	\$ 1.2	\$ 6.0	\$ 8.4	
Subtotal		\$ 1,258.5	\$ 2,004.0		\$ 82.4		\$ 124.3	
Subtotal		\$ 314.6	\$ 501.0		\$ 20.6		\$ 31.1	
Total		\$ 1,573.1	\$ 2,505.0		\$ 102.9		\$ 155.4	

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Assume one DS0 for each interconnected Center: NJT Bus PABT Ops; Transmit; NJT Bus Ops N; Priv Long Dist Bus Ops (assume 2-4)
- 3 Assume Active Tag is used by the Beacon to Identify the Vehicle
- 4 Assume this technology or something similar used
- 5 Assume existing Operations Center Staff can assume additional workload
- 6 Upgrade for the Information Service Provider Software

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 7
 NJDOT North Traffic Information Dissemination
 Traffic Information Dissemination, Reversible Lane Management
 ATMS06-01, ATMS18-1

	Capital Cost					Annual Cost		
	unit cost	quantities	low end extension	quantities	high end extension	unit cost	low end extension	high end extension
Center Subsystems								
Information Service Provider								
Hardware ²	IS001	\$ 49.5	1 \$	49.5	1 \$	49.5	\$ 1.0	\$ 1.0
Systems Integration ²	IS017	\$ 110.0	1 \$	110.0	1 \$	110.0	\$ -	\$ -
Hardware for Traffic Information Dissemination ¹⁰	TM021	\$ 10.0	0 \$	-	0 \$	-	\$ 0.5	\$ -
Software for Traffic Information Dissemination ¹⁰	TM022	\$ 22.0	0 \$	-	0 \$	-	\$ 1.1	\$ -
Integration for Traffic Information Dissemination ¹⁰	TM023	\$ 110.0	1 \$	110.0	1 \$	110.0	\$ 5.5	\$ 5.5
Hardware for Lane Control ⁸	TM008	\$ 6.6	1 \$	6.6	1 \$	6.6	\$ 0.3	\$ 0.33
Software, Integration for Lane Control ⁸	TM009	\$ 275.0	1 \$	275.0	1 \$	275.0	\$ 13.8	\$ 13.75
Integration for Traffic Surveillance ⁹	TM032	\$ 275.0	2 \$	550.0	4 \$	1,100.0	\$ 13.8	\$ 27.50
Media³								
Maintenance and Construction Management								
Software Upgrade for Interagency Information Exchange ⁴	CA005	\$ 40.0	1 \$	40.0	1 \$	40.0	\$ 0.8	\$ 0.8
Roadside Subsystems⁵								
Roadside Control								
Ramp Meter ⁵	RS006	\$ 50.0	8 \$	400.0	16 \$	800.0	\$ 3.5	\$ 28.0
Lane Control Gates ⁵	RS012	\$ 150.0	1 \$	150.0	1 \$	150.0	\$ 3.0	\$ 3.0
Fixed Lane Signal ⁵	RS009	\$ 8.0	8 \$	64.0	16 \$	128.0	\$ 0.8	\$ 6.4
Wireline to Roadside Beacon ⁷	CC005	\$ 20.0	17 \$	340.0	33 \$	660.0	\$ 0.8	\$ 13.6
Variable Message Sign	RS015	\$ 120.0	4 \$	480.0	8 \$	960.0	\$ 6.0	\$ 24.0
Variable Message Sign Tower	RS016	\$ 125.0	4 \$	500.0	8 \$	1,000.0	\$ -	\$ -
Wireline to Roadside Message sign ⁷	RS013	\$ 75.0	8 \$	600.0	16 \$	1,200.0	\$ 3.8	\$ 30.0
Staff								
Labor for Traffic Information Dissemination	TM024		1		2		\$ 110.0	\$ 110.0
Communications								
DSO Communications line ⁶	TM001	\$ 1.0	2 \$	2.0	4 \$	4.0	\$ 1.2	\$ 2.4
		Subtotal	\$ 3,677.1	\$ 6,593.1			\$ 266.3	\$ 507.4
Design Development Allowance								
		Subtotal	\$ 919.3	\$ 1,648.3			\$ 66.6	\$ 126.8
		Total	\$ 4,596.4	\$ 8,241.4			\$ 332.9	\$ 634.2

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Cost for ISP for NJDOT N TIS
- 3 Assume Print and Broadcast Media request borne by other projects
- 4 Assume this Software package or one similar would be used for NJDOT to share construction and maintenance information
- 5 Roadside Control equipment for Reversible Lane Management
- 6 Assume one DSO for each interconnected center: NJDOT CM; NJDOT Maint.; TMA TIS
- 7 cost for comm. to field devices
- 8 Add Lane Control function at NJDOT N TOC
- 9 Integration of Traffic Surveillance at NJDOT CM; NJDOT Maint.; TMA TIS
- 10 assume integrate new VMS into existing TID subsystem at NJDOT N TOC

Region
Project Number
Project Name
Market Package
Market Package Diagram No.

North
8
NJDOT Central Traffic Information Dissemination
Traffic Information Dissemination
ATMS06-02

	Capital Cost					Annual Cost			
	unit cost	quantities	low end extension	quantities	high end extension	unit cost	low end extension	high end extension	
Center Subsystems									
Information Service Provider									
Hardware ²	IS001	\$ 49.5	1 \$	49.5	1 \$	49.5	\$ 1.0	\$ 1.0	\$ 1.0
Systems Integration ²	IS017	\$ 110.0	1 \$	110.0	1 \$	110.0			
Hardware for Traffic Information Dissemination ¹⁰	TM021	\$ 10.0	1 \$	10.0	1 \$	10.0	\$ 0.5	\$ 0.5	\$ 0.5
Software for Traffic Information Dissemination ¹⁰	TM022	\$ 22.0	1 \$	22.0	1 \$	22.0	\$ 1.1	\$ 1.1	\$ 1.1
Integration for Traffic Information Dissemination ¹⁰	TM023	\$ 110.0	1 \$	110.0	1 \$	110.0	\$ 5.5	\$ 5.5	\$ 5.5
Integration for Traffic Surveillance ⁹	TM032	\$ 275.0	2 \$	550.0	4 \$	1,100.0	\$ 13.8	27.50	55.00
Media³									
Maintenance and Construction Management									
Software Upgrade for Interagency Information Exchange ⁴	CA005	\$ 40.0	1 \$	40.0	1 \$	40.0	\$ 0.8	\$ 0.8	\$ 0.8
Roadside Subsystems⁵									
Roadside Control									
Variable Message Sign ¹⁰	RS015	\$ 120.0	10 \$	1,200.0	20 \$	2,400.0	\$ 6.0	\$ 60.0	\$ 120.0
Variable Message Sign Tower ¹⁰	RS016	\$ 125.0	10 \$	1,250.0	20 \$	2,500.0	\$ -	\$ -	\$ -
Wireline to Roadside Message sign ^{7,10}	RS013	\$ 75.0	20 \$	1,500.0	40 \$	3,000.0	\$ 3.8	\$ 75.0	\$ 150.0
Staff									
Labor for Traffic Information Dissemination	TM024		1		2		\$ 110.00	\$ 110.0	220
Communications									
DSO Communications line ⁶	TM001	\$ 1.0	2 \$	2.0	4 \$	4.0	\$ 1.2	\$ 2.4	\$ 4.8
				Subtotal	\$ 4,843.5	\$ 9,345.5		\$ 283.8	\$ 558.7
Design Development Allowance									
				Subtotal	\$ 1,210.9	\$ 2,336.4		\$ 71.0	\$ 139.7
				Total	\$ 6,054.4	\$ 11,681.9		\$ 354.8	\$ 698.4

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Cost for ISP for NJDOT C TIS
- 3 Assume Print and Broadcast Media request borne by other projects
- 4 Assume this Software package or one similar would be used for NJDOT to share construction and maintenance information
- 5 Roadside Control equipment for Reversible Lane Management
- 6 Assume one DSO for each interconnected center: NJDOT CM; NJDOT Maint.; TMA TIS
- 7 cost for comm. to field devices
- 8 Add Lane Control function at NJDOT N TOC
- 9 Integration of Traffic Surveillance at NJDOT CM; NJDOT Maint; TMA TIS
- 10 for new VMS controlled from new NJDOT C TOC subsystem

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 9
 PANYNJ Airport Traffic Info Dissemination
 Traffic Information Dissemination
 ATMS06-04

		Capital Cost				Annual Cost			
		unit cost	quantities	low end extension	quantities	high end extension	unit cost	low end extension	high end extension
Center Subsystems									
Information Service Provider									
Hardware ²	IS001	\$ 49.5	0	\$ -	0	\$ -	\$ 1.0	\$ -	\$ -
Systems Integration ²	IS017	\$ 110.0	0	\$ -	0	\$ -	-	-	-
Hardware Upgrade for interactive information ⁶	IS006	\$ 23.0	1	\$ 23.0	1	\$ 23.0	\$ 0.5	\$ 0.5	\$ 0.5
Software upgrade for interactive information ⁶	IS007	\$ 500.0	1	\$ 500.0	1	\$ 500.0	\$ 25.0	\$ 25.0	\$ 25.0
Hardware for Traffic Information Dissemination ⁴	TM021	\$ 10.0	0	\$ -	0	\$ -	\$ 0.5	\$ -	\$ -
Software for Traffic Information Dissemination ⁵	TM022	\$ 22.0	2	\$ 44.0	2	\$ 44.0	\$ 1.1	\$ 2.2	\$ 2.2
Integration for Traffic Information Dissemination ⁵	TM023	\$ 110.0	2	\$ 220.0	2	\$ 220.0	\$ 5.5	\$ 11.0	\$ 11.0
Roadway Information System Status									
Variable Message Sign	RS015	\$ 120.0	2	\$ 240.0	4	\$ 480.0	\$ 6.0	\$ 12.0	\$ 24.0
Variable Message Sign Tower	RS016	\$ 125.0	2	\$ 250.0	4	\$ 500.0	\$ -	\$ -	\$ -
Variable Message Sign - Portable		\$ 25.5	3	\$ 76.5	5	\$ 127.5	\$ 2.0	\$ 6.0	\$ 10.0
Highway Advisory Radio	RS017	\$ 32.0	1	\$ 32.0	2	\$ 64.0	\$ 1.0	\$ 1.0	\$ 2.0
Highway Advisory Radio Sign		\$ 5.0	1	\$ 5.0	2	\$ 10.0	\$ 0.25	\$ 0.3	\$ 0.5
							\$ 0.8	\$ -	\$ -
Staff⁷									
added labor for interactive information ⁶	IS008						\$ 150.0	\$ -	\$ -
		Subtotal	\$ 1,390.5		\$ 1,968.5		\$ 57.9	\$ 75.2	
Design Development Allowance	25%	Subtotal	\$ 347.6		\$ 492.1		\$ 14.5	\$ 18.8	
		Total	\$ 1,738.1		\$ 2,460.6		\$ 72.4	\$ 94.0	

Notes:

- Costs are shown in thousands of dollars
- Assume cost of ISPs borne in projects #2 (TRANSCOM) and #5 (Airports)
- Assume cost for Hardware/Software/Integration between ITS Field Devices and NJDOT TOC Central are borne by other projects
- Assume cost for Hardware/Software/Integration for PANYNJ Airport is borne by project #5
- Assume this is the cost for Software and Integration of VMS and HAR
- Costs for additional ISP features for PANYNJ TIS IVR and Web
- Assume existing Airport Operations Center Staff can assume additional workload

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 10
 NJDOT TOC North Regional Coordination
 Regional Traffic Control
 ATMS07-01

Center Subsystems

Information Service Provider
 Hardware² IS001
 Systems Integration² IS017
 Hardware for Traffic Information
 Dissemination⁴ TM021
 Software, Integration for Regional
 Control⁶ TM011

Staff⁵

Labor for Regional Control TM012

Communications

DS0 Communications line⁶ TM001

Design Development Allowance

25%

Capital Cost					Annual Cost		
unit cost	quantities	low end extension	high end quantities	high end extension	unit cost	low end extension	high end extension
\$ 49.5	0	\$ -	0	\$ -	\$ 1.0	\$ -	\$ -
\$ 110.0	0	\$ -	0	\$ -	-	-	-
\$ 10.0	1	\$ 10.0	1	\$ 10.0	\$ 0.5	\$ 0.5	\$ 0.5
\$ 440.0	10	\$ 4,400.0	16	\$ 7,040.0	\$ -	\$ -	\$ -
	1		1		\$ 220.00	\$ 220.0	\$ 220.0
\$ 1.0	6	\$ 6.0	10	\$ 10.0	\$ 1.2	\$ 7.2	\$ 12.0
Subtotal		\$ 4,416.0	\$ 7,060.0		\$ 227.7		\$ 232.5
Subtotal		\$ 1,104.0	\$ 1,765.0		\$ 56.9		\$ 58.1
Total		\$ 5,520.0	\$ 8,825.0		\$ 284.6		\$ 290.6

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Assume cost of ISPs borne in project #7
- 4 Assume Hardware for NJDOT TOC North only
- 5 For NJDOT N TOC
- 6 Integrate Control with 5 centers (say 4-6 for low-high): NJDOT C, NJDOT S, NJTA PKWY, NJTA TPKE, Share information and add communications with 8 (say 6-10 for low-high): DRJTBC, I-95CC, NPS, NJDEP, NYSDOT IEN, NYSTA, PIP HQ, PennDOT

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 11
 NJDOT TOC Central Regional Coordination
 Regional Traffic Control
 ATMS07-02

Center Subsystems

Information Service Provider
 Hardware² IS001
 Systems Integration² IS017
 Hardware for Traffic Information
 Dissemination⁴ TM021
 Software, Integration for Regional
 Control⁶ TM011

Staff⁵

Labor for Regional Control TM012

Communications

DS0 Communications line⁶ TM001

Design Development Allowance

25%

Capital Cost					Annual Cost		
unit cost	quantities	low end extension	high end quantities	high end extension	unit cost	low end extension	high end extension
\$ 49.5	0	\$ -	0	\$ -	\$ 1.0	\$ -	\$ -
\$ 110.0	0	\$ -	0	\$ -	-	-	-
\$ 10.0	1	\$ 10.0	1	\$ 10.0	\$ 0.5	\$ 0.5	\$ 0.5
\$ 440.0	14	\$ 6,160.0	22	\$ 9,680.0	\$ -	\$ -	\$ -
	1		1		\$ 220.00	\$ 220.0	\$ 220.0
\$ 1.0	14	\$ 14.0	22	\$ 22.0	\$ 1.2	\$ 16.8	\$ 26.4
Subtotal		\$ 6,184.0	\$ 9,712.0		\$ 237.3		\$ 246.9
Subtotal		\$ 1,546.0	\$ 2,428.0		\$ 59.3		\$ 61.7
Total		\$ 7,730.0	\$ 12,140.0		\$ 296.6		\$ 308.6

Notes:

1 Costs are shown in thousands of dollars
 2 Assume cost of ISPs borne in project #8

4 Assume Hardware for NJDOT TOC C only

5 For NJDOT C TOC

6 Integrate Control with 5 centers was already addressed in project 10 ; \$0 here

Share information and add communications with additional centers not addressed in prev projects (say 14-22 for low-high): AC JOC, BCBCF, DeIDOT, DRPA, DVRPC, SJTA TOC, SJTPO Cty (say 4-8), SJTPO Mun (say 4-8)

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 12
 NJTA Turnpike TOC Roadway Closure Information Dissemination (ATMS)
 ATMS21 Roadway Closure Information
 ATMS21-2

Center Subsystems

Hardware for Lane Control TM008
 Software, Integration for Lane Control TM009

Communications

DS0 Communication Line5 TC001
 Wireline to Roadside Beacon⁴ CC005

Roadway Subsystems

Lane Control Gates RS012
 Software for Lane Control RS011

Design Development Allowance

25%

Capital Cost				Annual Cost			
unit cost	quantities	extension		unit cost	extension		
\$ 6.6	1	\$ 6.6		\$ 0.3	\$ 0.3		
\$ 275.0	1	\$ 275.0		\$ 13.8	\$ 13.8		
\$ 1.0	1	\$ 1.0		\$ 1.2	\$ 1.2		
\$ 20.0	1	\$ 20.0		\$ 0.8	\$ 0.8		
\$ 150.0	1	\$ 150.0		\$ 3.0	\$ 3.0		
\$ 50.00	1	\$ 50.0		\$ 5.00	\$ 5.0		
Subtotal			\$ 502.6	\$ 24.1			
Subtotal			\$ 125.7	\$ 6.0			
			\$ -	\$ -			
Total			\$ 628.3	\$ 30.1			

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Assume no incremental labor costs
- 3 Roadway Subsystem Costs based on one gate

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 13
 NJDOT Maintenance and TOC North Road Weather Integration
 Road Weather Data Collection
 MC03-1

Center Subsystems

Road Weather Information
 System (RWIS)³
 Integration for Rail Crossing
 Monitor⁹ TM038

Roadside Detection

Environmental Sensing Station
 (Weather Station)⁴

Staff²

Communications

Wireless Communications, High
 Usage⁴ TC006
 DS0 Communications line⁵ TM001

Design Development Allowance

25%

Capital Cost					Annual Cost		
unit cost	quantities	low end extension	high end quantities	high end extension	unit cost	low end extension	high end extension
\$ 25.0	3	\$ 75.0	3	\$ 75.0	\$ 2.5	\$ 7.5	\$ 7.5
\$ 110.0	2	\$ 220.0	3	\$ 330.0	\$ -	\$ -	\$ -
\$ 50.0	10	\$ 500.0	20	\$ 1,000.0	\$ 4.1	\$ 41.0	\$ 82.0
\$ 1.0	10	\$ 10.0	20	\$ 20.0	\$ 1.8	\$ 18.0	\$ 36.0
\$ 1.0	2	\$ 2.0	3	\$ 3.0	\$ 1.2	\$ 2.4	\$ 3.6
Subtotal		\$ 807.0	\$ 1,428.0		\$ 68.9		\$ 129.1
Subtotal		\$ 201.8	\$ 357.0		\$ 17.2		\$ 32.3
Total		\$ 1,008.8	\$ 1,785.0		\$ 86.1		\$ 161.4

Notes:

- 1 Costs are shown in thousands of dollars
- 2 assume no additional staff required
- 3 One RWIS in the NJDOT Maintenance Center
- 4 comm. between RWIS & ESS
- 5 comm. between RWIS & Weather Service Provider
- 6 Assume connection with Weather service is through ISPs

9 Integration of weather data with other systems

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 14
 DRJTBC Flood Monitoring System
 Road Weather Data Collection
 MC03-4

Center Subsystems

Road Weather Information
 System (RWIS)^{3,4}
 Integration for Rail Crossing
 Monitor⁹ TM038

Roadside Detection

Automated Flood Warning
 System⁵

Staff⁶

Communications

Wireless Communications, High
 Usage⁷ TC006
 DS0 Communications line⁸ TM001

Design Development Allowance

25%

Capital Cost						Annual Cost		
unit cost	quantities	low end extension	quantities	high end extension	unit cost	low end extension	high end extension	
\$ 25.0	1	\$ 25.0	1	\$ 25.0	\$ 2.5	\$ 2.5	\$ 2.5	
\$ 110.0	3	\$ 330.0	5	\$ 550.0	\$ -	\$ -	\$ -	
\$ 42.0	3	\$ 126.0	6	\$ 252.0	\$ -	\$ -	\$ -	
\$ 1.0	3	\$ 3.0	6	\$ 6.0	\$ 1.8	\$ 5.4	\$ 10.8	
\$ 1.0	3	\$ 3.0	5	\$ 5.0	\$ 1.2	\$ 3.6	\$ 6.0	
Subtotal		\$ 487.0	\$ 838.0		\$ 11.5		\$ 19.3	
Subtotal		\$ 121.8	\$ 209.5		\$ 2.9		\$ 4.8	
Total		\$ 608.8	\$ 1,047.5		\$ 14.4		\$ 24.1	

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Assume cost of ISPs borne in other projects
- 3 RWIS used because there is no Flood Detector Center System information provided
- 4 RWIS provided in DRJTBC
- 5 Number of Flood Sensors assumed is a placeholder only.
- 6 Assume existing Operations Center Staff can assume additional workload
- 7 Assume communications for Flood Sensors
- 8 Assume comm. to Weather service

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 15
 NJDOT Central Road Weather Data Collection, Integration, and Distribution
 Road Weather Data Collection, Weather Info Processing and Distribution
 MC03-5, MC04-3, MC04-4

Center Subsystems

Road Weather Information System (RWIS)³
 Integration for Rail Crossing Monitor⁹ TM038

Roadside Detection

Environmental Sensing Station (Weather Station)⁴

Staff²

Communications

Wireless Communications, High Usage⁴ TC006
 DS0 Communications line⁶ TM001
 DS0 Communications line⁷ TM001

Capital Cost						Annual Cost		
unit cost	quantities	low end extension	high end quantities	high end extension	unit cost	low end extension	high end extension	
\$ 25.0	3	\$ 75.0	5	\$ 125.0	\$ 2.5	\$ 7.5	\$ 12.5	
\$ 110.0	12	\$ 1,320.0	24	\$ 2,640.0	\$ -	\$ -	\$ -	
\$ 50.0	5	\$ 250.0	10	\$ 500.0	\$ 4.1	\$ 20.5	\$ 41.0	
\$ 1.0	5	\$ 5.0	10	\$ 10.0	\$ 1.8	\$ 9.0	\$ 18.0	
\$ 1.0	3	\$ 3.0	5	\$ 5.0	\$ 1.2	\$ 3.6	\$ 6.0	
\$ 1.0	12	\$ 12.0	24	\$ 24.0	\$ 1.2	\$ 14.4	\$ 28.8	
Subtotal		\$ 1,665.0		\$ 3,304.0		\$ 55.0	\$ 106.3	
Subtotal		\$ 416.3		\$ 826.0		\$ 13.8	\$ 26.6	
Total		\$ 2,081.3		\$ 4,130.0		\$ 68.8	\$ 132.9	

Design Development Allowance

25%

Notes:

- 1 Costs are shown in thousands of dollars
- 2 assume no additional staff required
- 3 One RWIS each in the NJDOT Maintenance Center, NJDOT TECC, TOC C, RECC
- 4 comm. between RWIS & ESS
- 5 comm. between RWIS & Weather Service Provider
- 6 Assume connection with Weather service is through ISPs
- 7 Assume for integration of weather information with other systems
- 9 Integration of weather data with other systems

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 16
 NJDOT TOC North Winter Maintenance Management
 Winter Maintenance
 MC06-1

Center Subsystems

Fleet Center Hardware³ FM001
 Software/Integration³ FM002
 Software for Tracking and Scheduling³ FM005
 integration for fleet maintenance⁸ fm008
 Transit Center Hardware⁴ TR001
 Transit Center Software/Integration⁴ TR002
 Emergency Response Hardware⁵ EM001
 Emergency Response Software⁵ EM002
 Hardware for Traffic Information Dissemination⁶ TM021
 Software for Traffic Information Dissemination⁶ TM022
 Integration for Traffic Information Dissemination⁶ TM023

Staff⁷

Fleet Center labor FM003

	Capital Cost				Annual Cost			
	unit cost	quantities	low end extension	high end extension	unit cost	low end extension	high end extension	
	\$ 30.0	1	\$ 30.0	1 \$ 30.0	\$ 0.06	\$ 0.1	\$ 0.1	
	\$ 500.0	1	\$ 500.0	1 \$ 500.0	\$ -	\$ -	\$ -	
	\$ 100.0	1	\$ 100.0	1 \$ 100.0	\$ 10.0	\$ 10.0	\$ 10.0	
	\$ 400.0	12	\$ 4,800.0	24 \$ 9,600.0	\$ 4.0	\$ 48.0	\$ 96.0	
	\$ 30.0	0	\$ -	0 \$ -	\$ -	\$ -	\$ -	
	\$ 1,720.0	0	\$ -	0 \$ -	\$ 12.0	\$ -	\$ -	
	\$ 30.0	0	\$ -	0 \$ -	\$ 0.6	\$ -	\$ -	
	\$ 150.0	0	\$ -	0 \$ -	\$ 3.5	\$ -	\$ -	
	\$ 10.0	0	\$ -	0 \$ -	\$ 0.5	\$ -	\$ -	
	\$ 22.0	0	\$ -	0 \$ -	\$ 1.1	\$ -	\$ -	
	\$ 110.0	0	\$ -	0 \$ -	\$ 5.5	\$ -	\$ -	
		1		1	\$ 412.00	\$ 412.0	\$ 412.0	
	Subtotal		\$ 5,430.0	\$ 10,230.0	\$ 470.1	\$ 518.1		
Design Development Allowance								
	Subtotal		\$ 1,357.5	\$ 2,557.5	\$ 117.5	\$ 129.5		
	Total		\$ 6,787.5	\$ 12,787.5	\$ 587.6	\$ 647.6		

Notes:

- 1 Costs are shown in thousands of dollars
- 3 Fleet Management Systems used to monitor DOT Construction and Maintenance Vehicles
- 4 Cost for Transit Center Systems borne in Other Projects
- 5 Cost for Emergency Response Center Systems borne in Other Projects
- 6 Cost for Road Network Reporting System borne in Project 10
- 7 Assume additional Staff at NJDOT N TOC
- 8 assume for cost to integrate with other center subsystems: TM, TR, EM
- 9 communications among centers already addressed via other projects.

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 17
 NJDOT TOC Central Winter Maintenance Management
 Winter Maintenance
 MC06-2

Center Subsystems

Information Service Provider
 Hardware² IS001
 Systems Integration² IS017
 Fleet Center Hardware³ FM001
 Fleet Center
 Software/Integration³ FM002
 Software for Tracking and
 Scheduling³ FM005
 integration for fleet maintenance⁸ fm008
 Transit Center Hardware⁴ TR001
 Transit Center
 Software/Integration⁴ TR002
 Emergency Response Hardware⁵ EM001
 Emergency Response Software⁵ EM002
 Hardware for Traffic Information
 Dissemination⁶ TM021
 Software for Traffic Information
 Dissemination⁶ TM022
 Integration for Traffic Information
 Dissemination⁶ TM023

Staff⁷

Fleet Center labor FM003

Capital Cost						Annual Cost		
unit cost	quantities	low end extension	high end extension	quantities	high end extension	unit cost	low end extension	high end extension
\$ 49.5	0	\$ -	0	\$ -	\$ -	\$ 1.0	\$ -	\$ -
\$ 110.0	0	\$ -	0	\$ -	\$ -	-	-	-
\$ 30.0	1	\$ 30.0	1	\$ 30.0	\$ 30.0	0.06	\$ 0.1	\$ 0.1
\$ 500.0	1	\$ 500.0	1	\$ 500.0	\$ 500.0	-	-	-
\$ 100.0	1	\$ 100.0	1	\$ 100.0	\$ 100.0	10.0	\$ 10.0	\$ 10.0
\$ 400.0	12	\$ 4,800.0	24	\$ 9,600.0	\$ 9,600.0	4.0	\$ 48.0	\$ 96.0
\$ 30.0	0	\$ -	0	\$ -	\$ -	-	-	-
\$ 1,720.0	0	\$ -	0	\$ -	\$ -	12.0	\$ -	\$ -
\$ 30.0	0	\$ -	0	\$ -	\$ -	0.6	\$ -	\$ -
\$ 150.0	0	\$ -	0	\$ -	\$ -	3.5	\$ -	\$ -
\$ 10.0	0	\$ -	0	\$ -	\$ -	0.5	\$ -	\$ -
\$ 22.0	0	\$ -	0	\$ -	\$ -	1.1	\$ -	\$ -
\$ 110.0	0	\$ -	0	\$ -	\$ -	5.5	\$ -	\$ -
	1		1			\$ 412.00	\$ 412.0	\$ 412.0
Subtotal		\$ 5,430.0		\$ 10,230.0		\$ 470.1	\$ 518.1	
Subtotal		\$ 1,357.5		\$ 2,557.5		\$ 117.5	\$ 129.5	
Total		\$ 6,787.5		\$ 12,787.5		\$ 587.6	\$ 647.6	

Notes:

- 1 Costs are shown in thousands of dollars
- 3 Fleet Management Systems used to monitor DOT Construction and Maintenance Vehicles
- 4 Cost for Transit Center Systems borne in Other Projects
- 5 Cost for Emergency Response Center Systems borne in Other Projects
- 6 Cost for Road Network Reporting System borne in Project 10
- 7 Assume additional Staff at NJDOT C TOC

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 18
 NJTA Parkway Division Winter Maintenance
 Winter Maintenance
 MC06-3

		Capital Cost				Annual Cost			
		low end		high end		low end		high end	
		unit cost	quantities	extension	quantities	extension	unit cost	extension	extension
Center Subsystems									
Information Service Provider									
Hardware ²	IS001	\$ 49.5	0	\$ -	0	\$ -	\$ 1.0	\$ -	\$ -
Systems Integration ²	IS017	\$ 110.0	0	\$ -	0	\$ -	-	-	-
Fleet Center Hardware ^{3,9}	FM001	\$ 30.0	1	\$ 30.0	1	\$ 30.0	0.06	\$ 0.1	\$ 0.1
Fleet Center									
Software/Integration ^{3,9}	FM002	\$ 500.0	1	\$ 500.0	1	\$ 500.0	\$ -	\$ -	\$ -
Software for Tracking and Scheduling ^{3,9}	FM005	\$ 100.0	1	\$ 100.0	1	\$ 100.0	\$ 10.0	\$ 10.0	\$ 10.0
Vehicle Location Interface ^{3,9}	FM006	\$ 15.0	1	\$ 15.0	1	\$ 15.0	\$ -	\$ -	\$ -
Integration for fleet maintenance ⁸	fm008	\$ 400.0	1	\$ 400.0	2	\$ 800.0	\$ 4.0	\$ 4.0	\$ 8.0
Transit Center									
Software/Integration ⁴	TR002	\$ 1,720.0	0	\$ -	0	\$ -	\$ 12.0	\$ -	\$ -
Emergency Response Hardware ⁵	EM001	\$ 30.0	0	\$ -	0	\$ -	\$ 0.6	\$ -	\$ -
Emergency Response Software ⁵	EM002	\$ 150.0	0	\$ -	0	\$ -	\$ 3.5	\$ -	\$ -
Hardware for Traffic Information Dissemination ⁶	TM021	\$ 10.0	0	\$ -	0	\$ -	\$ 0.5	\$ -	\$ -
Software for Traffic Information Dissemination ⁶	TM022	\$ 22.0	0	\$ -	0	\$ -	\$ 1.1	\$ -	\$ -
Integration for Traffic Information Dissemination ⁶	TM023	\$ 110.0	0	\$ -	0	\$ -	\$ 5.5	\$ -	\$ -
Vehicle Subsystems									
GPS/DGPS	VS004	\$ 0.5	20		40	\$ 20.0	\$ 0.010	\$ 0.2	\$ 0.4
communication equipment	VS001	\$ 0.4	20		40	\$ 16.0	\$ 0.008	\$ 0.2	\$ 0.3
Staff⁷									
Fleet Center labor	FM003		1		1		\$ 412.00	\$ 412.0	412
Communications									
Wireless Communications, low Usage ⁴	tc004	\$ -	20	\$ -	40	\$ -	\$ 0.2	\$ 4.0	\$ 8.0
Design Development Allowance									
	25%								
Subtotal		\$ 1,045.0			\$ 1,481.0		\$ 430.4		\$ 438.8
Subtotal		\$ 261.3			\$ 370.3		\$ 107.6		\$ 109.7
Total		\$ 1,306.3			\$ 1,851.3		\$ 538.0		\$ 548.5

Notes:

1 Costs are shown in thousands of dollars

3 Fleet Management Systems used to monitor Construction and Maintenance Vehicles

4 Cost for Transit Center Systems borne in Other Projects

5 Cost for Emergency Response Center Systems borne in Other Projects

6 Cost for borne in other projects

7 Assume additional Staff at NJTA Parkway

8 assume for cost to integrate with other center subsystems: TM, TR, EM (previously addressed by projects 16&17)

9 communications among centers already addressed via other projects.

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 19
 PANYNJ TB/T Winter Maintenance Management
 Winter Maintenance
 MC06-4

Center Subsystems

Fleet Center Hardware³ FM001
 Fleet Center
 Software/Integration³ FM002
 Software for Tracking and
 Scheduling³ FM005
 Vehicle Location Interface³ FM006
 integration for fleet maintenance⁸ fm008

Communications

DS0 Communications line⁵ TM001

Staff⁷

Fleet Center labor FM003

		Capital Cost				Annual Cost			
		low end		high end		low end		high end	
unit cost	quantities	extension	quantities	extension	unit cost	extension	extension	extension	
\$ 30.0	1	\$ 30.0	1	\$ 30.0	0.06	\$ 0.1	\$ 0.1		
\$ 500.0	1	\$ 500.0	1	\$ 500.0	\$ -	\$ -	\$ -		
\$ 100.0	1	\$ 100.0	1	\$ 100.0	\$ 10.0	\$ 10.0	\$ 10.0		
\$ 15.0	1	\$ 15.0	1	\$ 15.0	\$ -	\$ -	\$ -		
\$ 400.0	4	\$ 1,600.0	6	\$ 2,400.0	\$ 4.0	\$ 16.0	\$ 24.0		
\$ 1.0	4	\$ 4.0	6	\$ 6.0	\$ 1.2	\$ 4.8	\$ 7.2		
	1		1		\$ 412.00	\$ 412.0	\$ 412.0		
Subtotal		\$ 2,249.0		\$ 3,051.0		\$ 442.9	\$ 453.3		
Subtotal		\$ 562.3		\$ 762.8		\$ 110.7	\$ 113.3		
Total		\$ 2,811.3		\$ 3,813.8		\$ 553.6	\$ 566.6		

Notes:

- 1 Costs are shown in thousands of dollars
- 2
- 3 Fleet Management Systems used to monitor PANYNJ TB/T Maintenance Vehicles
- 4 Assume existing Operations Center Staff can assume additional workload
- 5 cost for center to center communications from TB/Ts to Maintenance
- 6
- 7 assume additional staff at PANYNJ
- 8 cost for integration of systems with fleet center subsystem
- 9 communications among centers already addressed via other projects.

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 20
 TRANSCOM Roadway and Winter Maintenance Management
 Winter Maintenance, Roadway Maintenance and Construction
 MC06-5, mc07-4

Center Subsystems

Emergency Response Hardware⁵ EM001
 Emergency Response Software⁵ EM002
 Fleet Center Hardware⁶ FM001
 Fleet Center
 Software/Integration⁶ FM002
 Software for Tracking and
 Scheduling⁶ FM005
 Vehicle Location Interface⁶ FM006
 integration for fleet maintenance³ fm008

Staff⁷

Fleet Center labor FM003

Design Development Allowance

25%

	Capital Cost				Annual Cost			
	unit cost	quantities	low end extension	quantities	high end extension	unit cost	low end extension	high end extension
Emergency Response Hardware ⁵ EM001	\$ 30.0	1	\$ 30.0	1	\$ 30.0	\$ 0.6	\$ 0.6	\$ 0.6
Emergency Response Software ⁵ EM002	\$ 150.0	1	\$ 150.0	1	\$ 150.0	\$ 3.5	\$ 3.5	\$ 3.5
Fleet Center Hardware ⁶ FM001	\$ 30.0	1	\$ 30.0	1	\$ 30.0	\$ 0.06	\$ 0.1	\$ 0.1
Fleet Center Software/Integration ⁶ FM002	\$ 500.0	1	\$ 500.0	1	\$ 500.0	\$ -	\$ -	\$ -
Software for Tracking and Scheduling ⁶ FM005	\$ 100.0	1	\$ 100.0	1	\$ 100.0	\$ 10.0	\$ 10.0	\$ 10.0
Vehicle Location Interface ⁶ FM006	\$ 15.0	1	\$ 15.0	1	\$ 15.0	\$ -	\$ -	\$ -
integration for fleet maintenance ³ fm008	\$ 400.0	0	\$ -	0	\$ -	\$ 4.0	\$ -	\$ -
		1		1		\$ 412.00	\$ 412.0	\$ 412
Subtotal	\$	825.0	\$	825.0		\$	426.2	\$
Subtotal	\$	206.3	\$	206.3		\$	106.5	\$
Total	\$	1,031.3	\$	1,031.3		\$	532.7	\$

Notes:

- 1 Costs are shown in thousands of dollars
- 2
- 3 assume no integration of centers is required, assume was accounted for in earlier ATMS & ATIS MC projects
- 4 Assume cost for Transit Center Hardware and Software borne by other projects
- 5 Assume cost for Emergency Response Center Hardware and Software borne by other projects except for NJST Dispatch - Troop D
- 6 Assume Maintenance and Construction Management links are handled by the Fleet Management Equipment
- 7 Assume additional TRANSCOM staff to handle coordination of maintenance
- 8 Assume communications between centers all addressed in earlier ATMS & ATIS projects

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 22
 TRANSCOM Workzone Management
 ATIS Broadcast Traveler Information, ATIS2 Interactive Traveler Information
 MC08-1, MC08-2

Center Subsystems	Capital Cost				Annual Cost			
	unit cost	quantities	low end extension	high end quantities	high end extension	unit cost	low end extension	high end extension
Information Service Provider								
Hardware ²	IS001	\$ 49.5	0 \$ -	0 \$ -	0 \$ -	\$ 1.0	\$ -	\$ -
Systems Integration ²	IS017	\$ 110.0	0 \$ -	0 \$ -	0 \$ -	-	-	-
Hardware for Traffic Information								
Dissemination ³	TM021	\$ 10.0	0 \$ -	0 \$ -	0 \$ -	\$ 0.5	\$ -	\$ -
Software for Traffic Information								
Dissemination ³	TM022	\$ 22.0	0 \$ -	0 \$ -	0 \$ -	\$ 1.1	\$ -	\$ -
Integration for Traffic Information								
Dissemination ³	TM023	\$ 110.0	0 \$ -	0 \$ -	0 \$ -	\$ 5.5	\$ -	\$ -
Transit Center Hardware ⁴	TR001	\$ 30.0	0 \$ -	0 \$ -	0 \$ -	\$ -	\$ -	\$ -
Transit Center								
Software/Integration ⁴	TR002	\$ 1,720.0	0 \$ -	0 \$ -	0 \$ -	\$ 12.0	\$ -	\$ -
Emergency Response Hardware ⁵	EM001	\$ 30.0	3 \$ 90.0	3 \$ 90.0	3 \$ 90.0	\$ 0.6	\$ 1.8	\$ 1.8
Emergency Response Software ⁵	EM002	\$ 150.0	3 \$ 450.0	3 \$ 450.0	3 \$ 450.0	\$ 3.5	\$ 10.5	\$ 10.5
Fleet Center Hardware ⁶	FM001	\$ 30.0	0 \$ -	0 \$ -	0 \$ -	0.06	\$ -	\$ -
Fleet Center Software/Integration ⁶	FM002	\$ 500.0	0 \$ -	0 \$ -	0 \$ -	\$ -	\$ -	\$ -
Software for Tracking and								
Scheduling ⁶	FM005	\$ 100.0	0 \$ -	0 \$ -	0 \$ -	\$ 10.0	\$ -	\$ -
Vehicle Location Interface ⁶	FM006	\$ 15.0	0 \$ -	0 \$ -	0 \$ -	\$ -	\$ -	\$ -
Staff⁷								
Subtotal		\$ 540.0		\$ 540.0		\$ 12.3	\$ 12.3	
Design Development Allowance	25%	\$ 135.0		\$ 135.0		\$ 3.1	\$ 3.1	
Total		\$ 675.0		\$ 675.0		\$ 15.4	\$ 15.4	

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Assume cost of ISPs borne in project #4
- 3 Assume cost for Information Dissemination Hardware/Software/Integration borne by other projects
- 4 Assume cost for Transit Center Hardware and Software borne by other projects
- 5 Assume cost for Emergency Response Center Hardware and Software borne by other projects except for NJST Dispatch - Troops A,B, and C
- 6 Assume Maintenance and Construction Management links are handled by the Fleet Management Equipment
- 7 Assume existing Operations Center Staff can assume additional workload

Project Number		Capital Cost						Annual Cost			
		Construction / Deployment	Engineering			Subtotal	Escalation 2-1/2 years at 4% per year	Total	Subtotal	Escalation 2-1/2 years at 4% per year	Total
			Design	Construction Support	Construction Inspection						
Project Name		10%	2%	10%		10%		10%			
1		NJT Bus North Fixed-Route Operations North and Conditions Reporting (APTS)									
	high end	\$ 3,413.8	\$ 341	\$ 68	\$ 341	\$ 4,165	\$ 416	\$ 4,581	\$ 491	\$ 49	\$ 540
	low end	\$ 3,132.5	\$ 313	\$ 63	\$ 313	\$ 3,822	\$ 382	\$ 4,204	\$ 406	\$ 41	\$ 447
2		NJT LRT (Newark City and Hudson Bergen Fixed-Route Operations and Conditions Reporting (APTS))									
	high end	\$ 3,195.9	\$ 320	\$ 64	\$ 320	\$ 3,899	\$ 390	\$ 4,289	\$ 445	\$ 44	\$ 489
	low end	\$ 3,195.9	\$ 320	\$ 64	\$ 320	\$ 3,899	\$ 390	\$ 4,289	\$ 399	\$ 40	\$ 439
3		Northern TMA Fixed-Route Operations and Conditions Reporting (APTS)									
	high end	\$ 2,553.8	\$ 255	\$ 51	\$ 255	\$ 3,116	\$ 312	\$ 3,427	\$ 441	\$ 44	\$ 485
	low end	\$ -	-	-	-	-	-	-	\$ -	-	-
4		North New Jersey Municipal/County Fixed-Route Operations (APTS)									
	high end	\$ 29,064.4	\$ 2,906	\$ 581	\$ 2,906	\$ 35,459	\$ 3,546	\$ 39,004	\$ 639	\$ 64	\$ 703
	low end	\$ 13,339.4	\$ 1,334	\$ 267	\$ 1,334	\$ 16,274	\$ 1,627	\$ 17,901	\$ 449	\$ 45	\$ 494
5		PANYNJ PATH Fixed-Route Operations (APTS)									
	high end	\$ 4,400.0	\$ 440	\$ 88	\$ 440	\$ 5,368	\$ 537	\$ 5,905	\$ 392	\$ 39	\$ 431
	low end	\$ 3,523.8	\$ 352	\$ 70	\$ 352	\$ 4,299	\$ 430	\$ 4,729	\$ 381	\$ 38	\$ 419
6		Rutgers Campus Shuttle Fixed-Route and Demand Response Operations (APTS)									
	high end	\$ 2,241.3	\$ 224	\$ 45	\$ 224	\$ 2,734	\$ 273	\$ 3,008	\$ 341	\$ 34	\$ 376
	low end	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
7		Private Bus/Shuttle Fixed Route and Demand Response Operations (APTS)									
	high end	\$ 90,151.9	\$ 9,015	\$ 1,803	\$ 9,015	\$ 109,985	\$ 10,999	\$ 120,984	\$ 915	\$ 91	\$ 1,006
	low end	\$ 45,488.1	\$ 4,549	\$ 910	\$ 4,549	\$ 55,496	\$ 5,550	\$ 61,045	\$ 474	\$ 47	\$ 521

Project Number		Capital Cost					Annual Cost					
		Construction / Deployment	Engineering			Subtotal	Escalation 2-1/2 years at 4% per year	Total	Subtotal	Escalation 2-1/2 years at 4% per year	Total	
			Design	Construction Support	Construction Inspection							
Project Name	10%	2%	10%		10%		10%					
8	high end	Private Ferry Fixed-Route Operations										
	low end	\$ 13,430.0	\$ 1,343	\$ 269	\$ 1,343	\$ 16,385	\$ 1,638	\$ 18,023	\$ 109	\$ 11	\$ 120	
9	high end	NJT Bus Operations North Transit Security (APTS)										
	low end	\$ 4,664.7	\$ 466	\$ 93	\$ 466	\$ 5,691	\$ 569	\$ 6,260	\$ 644	\$ 64	\$ 708	
10	high end	NJT Rail Operations Transit Security (APTS)										
	low end	\$ 451.3	\$ 45	\$ 9	\$ 45	\$ 551	\$ 55	\$ 606	\$ 12	\$ 1	\$ 13	
11	high end	NJT LRT (Newark City and Hudson Bergen) Transit Security (APTS)										
	low end	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	
12	high end	Northern TMAs Transit Security (APTS)										
	low end	\$ 4,432.5	\$ 443	\$ 89	\$ 443	\$ 5,408	\$ 541	\$ 5,948	\$ 892	\$ 89	\$ 982	
13	high end	North New Jersey Municipal/County Transit Security (APTS)										
	low end	\$ 2,917.5	\$ 292	\$ 58	\$ 292	\$ 3,559	\$ 356	\$ 3,915	\$ 520	\$ 52	\$ 572	
14	high end	PANYNJ PATH Transit Security (APTS)										
	low end	\$ 950.0	\$ 95	\$ 19	\$ 95	\$ 1,159	\$ 116	\$ 1,275	\$ 139	\$ 14	\$ 153	
13	high end	North New Jersey Municipal/County Transit Security (APTS)										
	low end	\$ 750.0	\$ 75	\$ 15	\$ 75	\$ 915	\$ 92	\$ 1,007	\$ 88	\$ 9	\$ 96	
13	high end	North New Jersey Municipal/County Transit Security (APTS)										
	low end	\$ 4,225.0	\$ 423	\$ 85	\$ 423	\$ 5,155	\$ 515	\$ 5,670	\$ 402	\$ 40	\$ 442	
14	high end	PANYNJ PATH Transit Security (APTS)										
	low end	\$ 1,650.0	\$ 165	\$ 33	\$ 165	\$ 2,013	\$ 201	\$ 2,214	\$ 108	\$ 11	\$ 119	
14	high end	PANYNJ PATH Transit Security (APTS)										
	low end	\$ 3,177.5	\$ 318	\$ 64	\$ 318	\$ 3,877	\$ 388	\$ 4,264	\$ 456	\$ 46	\$ 502	
14	high end	PANYNJ PATH Transit Security (APTS)										
	low end	\$ 1,998.8	\$ 200	\$ 40	\$ 200	\$ 2,438	\$ 244	\$ 2,682	\$ 289	\$ 29	\$ 318	

Project Number		Construction / Deployment	Capital Cost					Annual Cost			
			Design	Engineering		Subtotal	Escalation 2-1/2 years at 4% per year	Total	Subtotal	Escalation 2-1/2 years at 4% per year	Total
				Construction Support	Construction Inspection						
Project Name		10%	2%	10%		10%			10%		
15		TRANSCOM Regional Architecture Expansion									
	high end	\$ 19,306.3	\$ 1,931	\$ 386	\$ 1,931	\$ 23,554	\$ 2,355	\$ 25,909	\$ 335	\$ 34	\$ 369
	low end	\$ 11,598.8	\$ 1,160	\$ 232	\$ 1,160	\$ 14,150	\$ 1,415	\$ 15,566	\$ 326	\$ 33	\$ 359
16		TRANSCOM Regional Transit Information (TRIPS 123)									
	high end	\$ 7,053.1	\$ 705	\$ 141	\$ 705	\$ 8,605	\$ 860	\$ 9,465	\$ 318	\$ 32	\$ 350
	low end	\$ 3,626.9	\$ 363	\$ 73	\$ 363	\$ 4,425	\$ 442	\$ 4,867	\$ 317	\$ 32	\$ 348
Total											
	high end	\$ 192,711	\$ 19,271	\$ 3,854	\$ 19,271	\$ 235,108	\$ 23,511	\$ 258,618	\$ 6,972	697.17	\$ 7,669
	low end	\$ 98,351	\$ 9,835	\$ 1,967	\$ 9,835	\$ 119,988	\$ 11,999	\$ 131,987	\$ 4,130	412.95	\$ 4,542

Table 12-2. NJTPA – APTS - Short Term Project Benefit Summary

Project Number	Project Name	Program Area	SubArea	Expected Benefit Types (Goal Area)	Referenced Study
1	NJT Bus North Fixed-Route Operations North and Conditions Reporting (APTS)	Transit Management Systems	Fleet Management: AVL/CAD	- Productivity - Customer Satisfaction - Mobility	81, 12
			Information Dissemination : Internet/Wireless/Phone	- Customer Satisfaction	84
2	NJT LRT (Newark City and Hudson Bergen Fixed-Route Operations and Conditions Reporting (APTS)	Transit Management Systems	Fleet Management: AVL/CAD	- Productivity - Customer Satisfaction - Mobility	81, 12
			Information Dissemination : Internet/Wireless/Phone	- Customer Satisfaction	84
3	Northern TMA Fixed-Route Operations and Conditions Reporting (APTS)	Transit Management Systems	Fleet Management: AVL/CAD	- Productivity - Customer Satisfaction - Mobility	81, 12
			Information Dissemination : Internet/Wireless/Phone	- Customer Satisfaction	84
4	North New Jersey Municipal/County Fixed-Route Operations (APTS)	Transit Management Systems	Fleet Management: AVL/CAD	- Productivity - Customer Satisfaction - Mobility	81, 12
5	PANYNJ PATH Fixed-Route Operations (APTS)	Transit Management Systems	Fleet Management: AVL/CAD	- Productivity - Customer Satisfaction - Mobility	81, 12
			Information Dissemination : Internet/Wireless/Phone	- Customer Satisfaction	84
6	Rutgers Campus Shuttle Fixed-Route and Demand Response Operations (APTS)	Transit Management Systems	Fleet Management: AVL/CAD	- Productivity - Customer Satisfaction - Mobility	81, 12
			Transit Demand Management: Dynamic Routing/Scheduling	-Mobility - Productivity -Customer Satisfaction	78, 79
7	Private Bus/Shuttle Fixed Route and Demand Response Operations (APTS)	Transit Management Systems	Fleet Management: AVL/CAD	- Productivity - Customer Satisfaction - Mobility	81, 12
			Transit Demand Management: Dynamic Routing/Scheduling	-Mobility - Productivity -Customer Satisfaction	78, 79
8	Private Ferry Fixed-Route Operations	Transit Management Systems	Fleet Management: AVL/CAD	- Productivity - Customer Satisfaction - Mobility	81, 12
9	NJT Bus Operations North Transit Security (APTS)	Transit Management Systems	Safety and Security: On-Vehicle Surveillance	- Customer Satisfaction	76
		Driver Assistance Systems	Safety and Security: Facility Surveillance On-board Monitoring: Safety and Security Safety Event Recorders	- Customer Satisfaction - no data to report - no data to report	76
10	NJT Rail Operations Transit Security (APTS)	Transit Management Systems	Safety and Security: On-Vehicle Surveillance	- Customer Satisfaction	76
		Driver Assistance Systems	Safety and Security: Facility Surveillance On-board Monitoring: Safety and Security Safety Event Recorders	- Customer Satisfaction - no data to report - no data to report	76
11	NJT LRT (Newark City and Hudson Bergen) Transit Security (APTS)	Transit Management Systems	Safety and Security: On-Vehicle Surveillance	- Customer Satisfaction	76
		Driver Assistance Systems	Safety and Security: Facility Surveillance On-board Monitoring: Safety and Security Safety Event Recorders	- Customer Satisfaction - no data to report - no data to report	76

Project Number	Project Name	Program Area	SubArea	Expected Benefit Types (Goal Area)	Referenced Study
12	Northern TMAs Transit Security (APTS)	Transit Management Systems	Safety and Security:On-Vehicle Surveillance	- Customer Satisfaction	76
		Driver Assistance Systems	Safety and Security: Facility Surveillance On-board Monitoring: Safety and Security Safety Event Recorders	- Customer Satisfaction - no data to report - no data to report	76
13	North New Jersey Municipal/County Transit Security (APTS)	Transit Management Systems	Safety and Security:On-Vehicle Surveillance	- Customer Satisfaction	76
		Driver Assistance Systems	Safety and Security: Facility Surveillance On-board Monitoring: Safety and Security Safety Event Recorders	- Customer Satisfaction - no data to report - no data to report	76
14	PANYNJ PATH Transit Security (APTS)	Transit Management Systems	Safety and Security:On-Vehicle Surveillance	- Customer Satisfaction	76
		Driver Assistance Systems	Safety and Security: Facility Surveillance On-board Monitoring: Safety and Security Safety Event Recorders	- Customer Satisfaction - no data to report - no data to report	76
15	TRANSCOM Regional Architecture Expansion	Traveler Information	Information Dissemination : Internet/Wireless/Phone Transit Demand Management : Service Coordination	- Customer Satisfaction	84
				- Productivity	51
16	TRANSCOM Regional Transit Information (TRIPS 123)	Transit Management Systems	Information Dissemination : Internet/Wireless/Phone	- Customer Satisfaction	84

Appendix 12.C

Implementation – Project Tables

Commercial Vehicle Operations

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 1
 DRJTBC Electronic Clearance
 CVO03 Electronic Clearance
 CVO03-3

		Capital Cost				Annual Cost				
		unit cost	low end		high end		unit cost	low end		high end
			quantities	extension	quantities	extension		extension		
Center Subsystems										
Commercial Vehicle Admin Hardware	CA001	\$ 30.0	1 \$ 30.0	1 \$ 30.0	\$ 0.6	\$ 0.6	\$ 0.6			
Commercial Vehicle Admin Software, Integration	CA002	\$ 220.0	1 \$ 220.0	1 \$ 220.0	\$ 4.4	\$ 4.4	\$ 4.4			
Check Station Structure ⁵	CC001	\$ 75.0	7 \$ 525.0	20 \$ 1,500.0						
Signal Board	CC002	\$ 15.0	14 \$ 210.0	40 \$ 600.0	\$ 1.5	\$ 21.0	\$ 60.0			
Signal Indicator	CC003	\$ 10.0	14 \$ 140.0	40 \$ 400.0	\$ 0.5	\$ 7.0	\$ 20.0			
Roadside Beacon	CC004	\$ 8.0	14 \$ 112.0	40 \$ 320.0	\$ 0.8	\$ 11.2	\$ 32.0			
Wireline to Roadside Beacon	CC005	\$ 20.0	14 \$ 280.0	40 \$ 800.0						
Check Station Software, Integration	CC006	\$ 215.0	7 \$ 1,505.0	20 \$ 4,300.0						
Check Station Hardware	CC007	\$ 0.5	7 \$ 3.5	20 \$ 10.0	\$ 0.0	\$ 0.1	\$ 0.2			
Safety and Fitness Electronic Records (SAFER) Data Mailbox		\$ 9.2	7 \$ 64.4	20 \$ 184.0		\$ -	\$ -			
Detection System	CC008	\$ 75.0	7 \$ 525.0	20 \$ 1,500.0	\$ 3.8	\$ 26.3	\$ 75.0			
Electronic ID Tag ²	CV001	\$ 1.1	0 \$ -	0 \$ -	\$ 0.0	\$ -	\$ -			
Communication Equipment ²	CV002	\$ 2.3	0 \$ -	0 \$ -	0.0125	\$ -	\$ -			
Software Upgrade for Inter-Agency Info Exchange ⁶	CA005	\$ 40.0	10 \$ 400.0	25 \$ 1,000.0	0.8000	\$ 8.0	\$ 20.0			
Fleet Center Hardware ⁴	FM001	\$ 30.0	1 \$ 30.0	1 \$ 30.0	0.6	\$ 0.6	\$ 0.6			
Fleet Center Software, Integration ⁴	FM002	\$ 500.0	1 \$ 500.0	1 \$ 500.0	0	\$ -	\$ -			
Staff										
Fleet Center Labor ⁴	FM003		1 \$ -	1 \$ -	412	\$ 412.0	\$ 412.0			
Commercial Vehicle Admin Labor ³	CA003		1 \$ -	1 \$ -	\$ 330.0	\$ 330.0	\$ 330.0			
Communications⁶										
DS0 Communications line	TC001	\$ 1.0	10 \$ 10.0	25 \$ 25.0	\$ 1.2	\$ 12.0	\$ 30.0			
			Subtotal	\$ 4,554.9	\$ 11,419.0	\$ 833.1	\$ 984.8			
Design Development Allowance	25%		Subtotal	\$ 1,138.7	\$ 2,854.8	\$ 208.3	\$ 246.2			
			Total	\$ 5,693.6	\$ 14,273.8	\$ 1,041.4	\$ 1,231.0			

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Cost for these items are the responsibility of the vehicle owner
- 3 for DRJTBC CVA
- 4 Assume required for connections from DRJTBC Facilities Operations Center and the Private Commercial Vehicle and Fleet Dispatch
- 5 Low end = 7 (# of DRJTBC Toll Bridges, High End = 20 (Total # of DRJTBC Bridges)
- 6 Assume one DS0 and one CA005 for each DRJTBC facility (7-20) and for each interconnected center: NJSP, F&M Private CV Dispatch (say 2-4)

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 2
 PANYNJ Port Commerce Electronic Clearance and Processing System
 CVO03 Electronic Clearance
 CVO03-4, CVO04-1

		Capital Cost				Annual Cost			
		unit cost	quantities	low end extension	quantities	high end extension	unit cost	low end extension	high end extension
Center Subsystems									
Commercial Vehicle Admin Hardware	CA001	\$ 30.0	1	\$ 30.0	1	\$ 30.0	\$ 0.6	\$ 0.6	\$ 0.6
Commercial Vehicle Admin Software, Integration	CA002	\$ 220.0	1	\$ 220.0	1	\$ 220.0	\$ 4.4	\$ 4.4	\$ 4.4
Software Upgrade for Electronic Credential Purchasing	CA004	\$ 140.0	1	\$ 140.0	1	\$ 140.0	\$ 2.8	\$ 2.8	\$ 2.8
Check Station Structure ⁵	CC001	\$ 75.0	6	\$ 450.0	12	\$ 900.0			
Signal Board	CC002	\$ 15.0	6	\$ 90.0	12	\$ 180.0	\$ 1.5	\$ 9.0	\$ 18.0
Signal Indicator	CC003	\$ 10.0	6	\$ 60.0	12	\$ 120.0	\$ 0.5	\$ 3.0	\$ 6.0
Roadside Beacon	CC004	\$ 8.0	6	\$ 48.0	12	\$ 96.0	\$ 0.8	\$ 4.8	\$ 9.6
Wireline to Roadside Beacon	CC005	\$ 20.0	6	\$ 120.0	12	\$ 240.0			
Check Station Software, Integration	CC006	\$ 215.0	6	\$ 1,290.0	12	\$ 2,580.0			
Check Station Hardware	CC007	\$ 0.5	6	\$ 3.0	12	\$ 6.0	\$ 0.0	\$ 0.1	\$ 0.1
Safety and Fitness Electronic Records (SAFER) Data Mailbox		\$ 9.2	6	\$ 55.2	12	\$ 110.4	\$ -	\$ -	\$ -
Detection System	CC008	\$ 75.0	6	\$ 450.0	12	\$ 900.0	\$ 3.8	\$ 22.5	\$ 45.0
Electronic ID Tag ²	CV001	\$ 1.1	0	\$ -	0	\$ -	\$ 0.0	\$ -	\$ -
Communication Equipment ²	CV002	\$ 2.3	0	\$ -	0	\$ -	0.0125	\$ -	\$ -
Software Upgrade for Inter-Agency Info Exchange ⁵	CA005	\$ 40.0	5	\$ 200.0	7	\$ 280.0	0.8	\$ 4.0	\$ 5.6
Fleet Center Hardware ⁴	FM001	\$ 30.0	1	\$ 30.0	1	\$ 30.0	0.6	\$ 0.6	\$ 0.6
Fleet Center Software, Integration ⁴	FM002	\$ 500.0	1	\$ 500.0	1	\$ 500.0	0	\$ -	\$ -
Staff									
Fleet Center Labor ⁴	FM003		1	\$ -	1	\$ -	412	\$ 412.0	\$ 412.0
Commercial Vehicle Admin Labor ³	CA003		1	\$ -	1	\$ -	\$ 330.0	\$ 330.0	\$ 330.0
Communications									
DS0 Communications line ⁶	TC001	\$ 1.0	5	\$ 5.0	7	\$ 7.0	\$ 1.2	\$ 6.0	\$ 8.4
		Subtotal		\$ 3,691.2		\$ 6,339.4		\$ 799.8	\$ 843.1
Design Development Allowance 25%									
		Subtotal		\$ 922.8		\$ 1,584.9		\$ 199.9	\$ 210.8
		Total		\$ 4,614.0		\$ 7,924.3		\$ 999.7	\$ 1,053.9

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Cost for these items are the responsibility of the vehicle owner
- 3 for PANYNJ Port Commerce
- 4 Assume required for connections from PANYNJ Port Commerce to the Private Commercial Vehicle and Fleet Dispatch
- 5 Low end = 6 (# of PA Ports and assumes only one entrance, High End = 12 (Total # of Ports but assumes there are 2 entrances per port)
- 6 Assume one DS0 and one CA005 for each PANYNJ Port C; PANYNJ Credentialing Back Office; PAPD; and for each interconnected F&M Private CV Dispatch (say 2-4)

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 4
 Other Facilities Weigh in Motion
 CV006 Weigh-in-Motion
 CV006-3

		Capital Cost				Annual Cost				
		unit cost	quantities	low end extension	quantities	high end extension	unit cost	low end extension	high end extension	
Center Subsystems										
Commercial Vehicle Admin										
	Hardware ¹⁰	CA001	\$ 30.0	1	\$ 30.0	2	\$ 60.0	\$ 0.6	\$ 0.6	\$ 1.2
Commercial Vehicle Admin										
	Software, Integration ¹⁰	CA002	\$ 220.0	1	\$ 220.0	2	\$ 440.0	\$ 4.4	\$ 4.4	\$ 8.8
Software Upgrade for Inter-Agency Info Exchange ⁸										
	CA005	\$ 40.0	1	\$ 40.0	2	\$ 80.0	0.8	\$ 0.8	\$ 1.6	
Software Upgrade for Safety Administration										
	CA007	\$ 80.0	1	\$ 80.0	2	\$ 160.0	\$ 1.6	\$ 1.6	\$ 3.2	
Commercial Vehicle Check Station										
	Check Station Structure ²	CC001	\$ 75.0	0	\$ -	0	\$ -			
	Signal Board ²	CC002	\$ 15.0	0	\$ -	0	\$ -	\$ 1.5	\$ -	\$ -
	Signal Indicator ²	CC003	\$ 10.0	0	\$ -	0	\$ -	\$ 0.5	\$ -	\$ -
	Roadside Beacon	CC004	\$ 8.0	0	\$ -	0	\$ -	\$ 0.8	\$ -	\$ -
	Wireline to Roadside Beacon ²	CC005	\$ 20.0	0	\$ -	0	\$ -			
Check Station Software, Integration ²										
	CC006	\$ 215.0	0	\$ -	0	\$ -				
	Check Station Hardware ²	CC007	\$ 0.5	0	\$ -	0	\$ -	\$ 0.0	\$ -	\$ -
Safety and Fitness Electronic Records (SAFER) Data Mailbox ²										
	\$ 9.2	0	\$ -	0	\$ -		\$ -			
	Detection System ²	CC008	\$ 75.0	0	\$ -	0	\$ -	\$ 3.8	\$ -	\$ -
Weigh-in-Motion Facility										
	CC012	\$ 21.0	10	\$ 210.0	15	\$ 315.0	\$ 2.1	\$ 21.0	\$ 31.5	
	Wireline to Weigh-in-Motion	CC013	\$ 2.0	10	\$ 20.0	15	\$ 30.0	\$ 0.2	\$ 2.0	\$ 3.0
Commercial Vehicle Subsystem										
	Electronic ID Tag ²	CV001	\$ 1.1	0	\$ -	0	\$ -	\$ 0.0	\$ -	\$ -
	Communication Equipment ³	CV002	\$ 2.3	0	\$ -	0	\$ -	0.0125	\$ -	\$ -
Staff										
Commercial Vehicle Admin Labor ¹⁰										
	CA003			1	\$ -	2	\$ -	\$ 330.0	\$ 330.0	\$ 660.0
Communications										
	Telephone Drop ⁷		\$ 3.0	10		15		\$ 0.3	\$ 3.0	\$ 4.5
	DS0 Communications line ⁸	TC001	\$ 1.0	1	\$ 1.0	2	\$ 2.0	\$ 1.2	\$ 1.2	\$ 2.4
			Subtotal	\$ 601.0		\$ 1,087.0		\$ 364.6	\$ 716.2	
Design Development Allowance 25%										
			Subtotal	\$ 150.3		\$ 271.8		\$ 91.2	\$ 179.1	
			Total	\$ 751.3		\$ 1,358.8		\$ 455.8	\$ 895.3	

- Notes:**
- 1 Costs are shown in thousands of dollars
 - 2 Cost of these items borne by project no 3
 - 3 Cost for these items are the responsibility of the vehicle owner
 - 4 Assume cost for communications from Check Station to Other Facility Operations Centers
 - 5 Assume cost for connections from Operation Centers to Other ITS Field Equipment borne by other projects
 - 6 Assume DS0 & CA005 for PRISM & CVIEW only, other center connections borne by project 3
 - 7 Assume data and voice communication for WIM facility is handled by Telephone lines
 - 8 Assume cost of Connection to Enforcement Agency is borne by project 3
 - 9 Low end = 10 (# of Weigh-in-Motion sites, High End = 15 (Weigh-in-Motion sites) for consistency with project 3

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 5
 PANYNJ Port Commerce HAZMAT Mgt
 CV010 HAZMAT
 CV010-2

		Capital Cost				Annual Cost				
		unit cost	quantities	low end extension	quantities	high end extension	unit cost	low end extension	high end extension	
Center Subsystems										
	Commercial Vehicle Admin Hardware ²	CA001	\$ 30.0	1	\$ 30.0	1	\$ 30.0	\$ 0.6	\$ 0.6	\$ 0.6
	Commercial Vehicle Admin Software, Integration ²	CA002	\$ 220.0	1	\$ 220.0	1	\$ 220.0	\$ 4.4	\$ 4.4	\$ 4.4
	Software Upgrade for Inter-Agency Info Exchange ²	CA005	\$ 40.0	10	\$ 400.0	12	\$ 480.0	0.8	\$ 8.0	\$ 9.6
Fleet and Freight Management										
	Fleet Center Hardware ³	FM001	\$ 30.0	0	\$ -	0	\$ -	0.6	\$ -	\$ -
	Fleet Center Software, Integration ³	FM002	\$ 500.0	0	\$ -	0	\$ -	0	\$ -	\$ -
	Software Upgrade for HAZMAT Management ³	FM009	\$ 40.0	10	\$ 400.0	12	\$ 480.0	\$ 0.8	\$ 8.0	\$ 9.6
	Hardware Upgrade for HAZMAT Management ³	FM010	\$ 10.0	10	\$ 100.0	12	\$ 120.0	\$ 0.2	\$ 2.0	\$ 2.4
Commercial Vehicle Subsystem										
	Electronic ID Tag ³	CV001	\$ 1.1	0	\$ -	0	\$ -	\$ 0.0	\$ -	\$ -
	Communication Equipment ³	CV002	\$ 2.3	0	\$ -	0	\$ -	0.0125	\$ -	\$ -
	GPS/DGPS ³	CV004	\$ 0.5	0	\$ -	0	\$ -	0.006	\$ -	\$ -
	Cargo Monitoring Sensors and Gauges ³	CV006	\$ 0.4	0	\$ -	0	\$ -	0.035	\$ -	\$ -
Emergency Management⁴										
Staff										
	Commercial Vehicle Admin Labor ²	CA003		0	\$ -	0	\$ -	\$ 330.0	\$ -	\$ -
	Fleet Center Labor ²	FM003		0	\$ -	0	\$ -	412	\$ -	\$ -
Communications⁶										
	DS0 Communications line ⁵	TC001	\$ 1.0	1	\$ 1.0	1	\$ 1.0	\$ 1.2	\$ 1.2	\$ 1.2
			Subtotal	\$ 1,151.0		\$ 1,331.0		\$ 24.2	\$ 27.8	
Design Development Allowance		25%	Subtotal	\$ 287.8		\$ 332.8		\$ 6.1	\$ 7.0	
			Total	\$ 1,438.8		\$ 1,663.8		\$ 30.3	\$ 34.8	

Notes:

- 1 Costs are shown in thousands of dollars
- 2 CVA systems already installed by earlier projects (except 1 for NJDEP), cost is for integration of HAZMAT with the identified centers
- 3 Assume these FM items located at Private Commercial Fleet Operators, cost borne by public sector
- 4 Assume Cost of Emergency Management borne by other Projects
- 5 Assume Operations Staff added in earlier projects can Assume Additional Workload
- 6 Assume Communications Cost are borne by other projects, (except 1 for NJDEP interconnect)

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 6
 Comm HAZMAT Driver Vehicle Security Management
 CV012 CV Driver Security Authentication
 CV012-1

		Capital Cost				Annual Cost			
		unit cost	quantities	low end extension	quantities	high end extension	unit cost	low end extension	high end extension
Center Subsystems									
	Software Upgrade for Inter-Agency Info Exchange ^{2,4}	CA005	\$ 40.0	4 \$ 160.0	8 \$ 320.0	0.8 \$ 3.2	\$ 6.4		
Fleet and Freight Management									
	Fleet Center Hardware ³	FM001	\$ 30.0	2 \$ 60.0	4 \$ 120.0	0.6 \$ 1.2	\$ 2.4		
	Fleet Center Software, Integration ^{3,6}	FM002	\$ 500.0	2 \$ 1,000.0	4 \$ 2,000.0	0 \$ -	\$ -		
Commercial Vehicle Subsystem									
	Electronic ID Tag ³	CV001	\$ 1.1	0 \$ -	0 \$ -	\$ 0.0	\$ -	\$ -	
	Communication Equipment ³	CV002	\$ 2.3	0 \$ -	0 \$ -	0.0125 \$ -	\$ -	\$ -	
	GPS/DGPS ³	CV004	\$ 0.5	0 \$ -	0 \$ -	0.006 \$ -	\$ -	\$ -	
	Cargo Monitoring Sensors and Gauges ³	CV006	\$ 0.4	0 \$ -	0 \$ -	0.035 \$ -	\$ -	\$ -	
	Security Package ^{3,7}	TV006	\$ 7.0	0 \$ -	0 \$ -	0.265	0.000	0.000	
Staff⁵									
	Fleet Center Labor ³	FM003		0 \$ -	0 \$ -	412 \$ -	\$ -	\$ -	
Communications⁶									
	DS0 Communications line ⁶	TC001	\$ 1.0	2 \$ 2.0	4 \$ 4.0	\$ 1.2	\$ 2.4	\$ 4.8	
			Subtotal	\$ 1,220.0	\$ 2,440.0	\$ 4.4	\$ 8.8		
Design Development Allowance		25%							
			Subtotal	\$ 305.0	\$ 610.0	\$ 1.1	\$ 2.2		
			Total	\$ 1,525.0	\$ 3,050.0	\$ 5.5	\$ 11.0		

Notes:

- 1 Costs are shown in thousands of dollars
- 2 cost for integration of Pub Safety Ag with Priv Comm Veh Ops Re automated vehicle disable
- 3 Cost of these items borne by Private Commerical Fleet Operators
- 4 Assume Cost of Emergency Management Center are borne by other Projects
- 5 Assume Existing Operations Staff can Assume Additional Workload
- 6 Assume Cost are borne by other projects, except for 2 to 4 additional public safety agencies
- 7 use TV006 to estimate cost for vehicle disable technology

Project Number		Construction / Deployment	Capital Cost					Annual Cost			
			Design	Engineering		Subtotal	Escalation 2-1/2 years at 4% per year	Total	Subtotal	Escalation 2-1/2 years at 4% per year	Total
				Construction Support	Construction Inspection						
Project Name	10%	2%	10%		10%		10%				
1		DRJTBC Electronic Clearance									
	high end	\$ 14,273.8	\$ 1,427	\$ 285	\$ 1,427	\$ 17,414	\$ 1,741	\$ 19,155	\$ 1,231	\$ 123	\$ 1,354
	low end	\$ 5,693.6	\$ 569	\$ 114	\$ 569	\$ 6,946	\$ 695	\$ 7,641	\$ 1,041	\$ 104	\$ 1,146
2		PANYNJ Port Commerce Electronic Clearance and Processing System									
	high end	\$ 7,924.3	\$ 792	\$ 158	\$ 792	\$ 9,668	\$ 967	\$ 10,634	\$ 1,054	\$ 105	\$ 1,159
	low end	\$ 4,614.0	\$ 461	\$ 92	\$ 461	\$ 5,629	\$ 563	\$ 6,192	\$ 1,000	\$ 100	\$ 1,100
3		Other Toll Facilities Electronic Clearance Systems									
	high end	\$ 11,753.1	\$ 1,175	\$ 235	\$ 1,175	\$ 14,339	\$ 1,434	\$ 15,773	\$ 2,953	\$ 295	\$ 3,248
	low end	\$ 7,813.8	\$ 781	\$ 156	\$ 781	\$ 9,533	\$ 953	\$ 10,486	\$ 1,967	\$ 197	\$ 2,164
4		Other Facilities Weigh in Motion									
	high end	\$ 1,358.8	\$ 136	\$ 27	\$ 136	\$ 1,658	\$ 166	\$ 1,823	\$ 895	\$ 90	\$ 985
	low end	\$ 751.3	\$ 75	\$ 15	\$ 75	\$ 917	\$ 92	\$ 1,008	\$ 456	\$ 46	\$ 501
5		PANYNJ Port Commerce HAZMAT Mgt									
	high end	\$ 1,663.8	\$ 166	\$ 33	\$ 166	\$ 2,030	\$ 203	\$ 2,233	\$ 35	\$ 3	\$ 38
	low end	\$ 1,438.8	\$ 144	\$ 29	\$ 144	\$ 1,755	\$ 176	\$ 1,931	\$ 30	\$ 3	\$ 33
6		Comm HAZMAT Driver Vehicle Security Management									
	high end	\$ 3,050.0	\$ 305	\$ 61	\$ 305	\$ 3,721	\$ 372	\$ 4,093	\$ 11	\$ 1	\$ 12
	low end	\$ 1,525.0	\$ 153	\$ 31	\$ 153	\$ 1,861	\$ 186	\$ 2,047	\$ 6	\$ 1	\$ 6
Total											
	high end	\$ 40,023.6	\$ 4,002	\$ 800	\$ 4,002	\$ 48,829	\$ 4,883	\$ 53,712	\$ 6,179	\$ 618	\$ 6,797
	low end	\$ 21,836.4	\$ 2,184	\$ 437	\$ 2,184	\$ 26,640	\$ 2,664	\$ 29,304	\$ 4,500	\$ 450	\$ 4,950

Project Number	Project Name	Program Area	SubArea	Expected Benefit Types (Goal Area)	Referenced Study
1	DRJTBC Electronic Clearance	Commercial Vehicle Operations	Safety Assurance: Safety Information Exchange	- Safety - Mobility - Customer Satisfaction	29
			Electronic Screening: Safety Screening	- Productivity - Customer Satisfaction	29
			Electronic Screening: Credential Checking	- Productivity	122, 126
2	PANYNJ Port Commerce Electronic Clearance and Processing System	Commercial Vehicle Operations	Safety Assurance: Safety Information Exchange	- Safety - Mobility - Customer Satisfaction	29
			Electronic Screening: Safety Screening	- Productivity - Customer Satisfaction	29
			Electronic Screening: Credential Checking	- Productivity	122, 126
3	Other Toll Facilities Electronic Clearance Systems	Commercial Vehicle Operations	Safety Assurance: Safety Information Exchange	- Safety - Mobility - Customer Satisfaction	29
			Electronic Screening: Safety Screening	- Productivity - Customer Satisfaction	29
			Electronic Screening: Credential Checking	- Productivity	122, 126
4	Other Facilities Weigh in Motion	Commercial Vehicle Operations	Electronic Screening: Weight Screening	Mobility	125
5	PANYNJ Port Commerce HAZMAT Mgt	Commercial Vehicle Operations	no data to report		
6	Comm HAZMAT Driver Vehicle Security Management	Emergency Management Systems	Hazardous Materials Management	no data to report	
		Commercial Vehicle Operations Emergency Management Systems	no data to report Hazardous Materials Management	no data to report	

Appendix 12.D

Implementation – Project Tables

Public Safety

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 1
 NJDOT North Incident Management Program
 ATMS08 Incident Management
 ATMS08-01, ATMS08-08

		Capital Cost				Annual Cost			
		low end		high end		low end		high end	
		unit cost	quantities	extension	quantities	extension	unit cost	extension	extension
Center Subsystems									
Hardware for Incident Response ³	TM018	\$ 3.3	2	\$ 6.6	4	\$ 13.2	0.165	\$ 0.3	\$ 0.7
Integration for Incident Response ³	TM026	\$ 220.0	14	\$ 3,080.0	22	\$ 4,840.0	\$ -	\$ -	\$ -
Software for Incident Response ³	TM019	\$ 16.5	2	\$ 33.0	4	\$ 66.0	0.825	\$ 1.7	\$ 3.3
Basic facilities, Comm for large area ²	TM040	\$ 4,000.0	0	\$ -	0	\$ -	600	\$ -	\$ -
Event Promoters									
Regional Event Promoters ⁵									
TRANSCOM Communications Center Servers ⁵									
Staff									
Labor for Incident Response	TM020		3		5		\$ 110.0	\$ 330.0	\$ 550.0
Communications									
DS0 Communications line ⁷	TM001	\$ 1.0	14	\$ 14.0	22	\$ 22.0	\$ 1.2	\$ 16.8	\$ 26.4
		Subtotal		\$ 3,119.6	\$ 4,919.2		\$ 332.0		\$ 554.0
Design Development Allowance									
		Subtotal		\$ 779.9	\$ 1,229.8		\$ 83.0		\$ 138.5
		Total		\$ 3,899.5	\$ 6,149.0		\$ 415.0		\$ 692.5

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Assume Basic Facilities TM040 for new STOC covered by other project
- 3 Assume 4 (say 3-5) new Incident Response Systems for NJDOT: N, C, TECC; Assume Integration with (14-22) additional centers
- 4 Assume integration (per note 3) with existing Emergency Management Systems
- 5 Assume Costs associated with Regional Events Promoters are the responsibility of each Promoter
- 6 Assume associated with TRANSCOM Communications Center Servers are borne by other projects
- 7 Assume one DS0 for each center interconnected by this project (say 14 to 22)

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 3
 PANYNJ Tunnels/Bridges Incident Mgmt Program
 ATMS08 Incident Management
 ATMS08-04

		Capital Cost				Annual Cost			
		unit cost	quantities	low end extension	quantities	high end extension	unit cost	low end extension	high end extension
Center Subsystems									
EM Response Hardware ⁴	EM001	\$ 30.0	1	\$ 30.0	1	\$ 30.0	0.06	\$ 0.1	\$ 0.1
EM Response Software ⁴	EM002	\$ 500.0	1	\$ 500.0	1	\$ 500.0	\$ -	\$ -	\$ -
EM Comm Software ⁴	EM004	\$ 200.0	4	\$ 800.0	6	\$ 1,200.0	4	\$ 16.0	\$ 24.0
EV Subsystem									
Communications Interface	EV001	\$ 2.0	20	\$ 40.0	40	\$ 80.0	0.02	\$ 0.4	\$ 0.8
Event Promoters									
Regional Event Promoters ⁵									
TRANSCOM Communications									
Center Servers ⁶									
Staff									
EM Response Labor	EM003		2		2		\$ 165.0	\$ 330.0	\$ 330.0
Communications									
DS0 Communications line ⁷	TM001	\$ 1.0	6	\$ 6.0	10	\$ 10.0	\$ 1.2	\$ 7.2	\$ 12.0
Wireless Communications, low Usage ⁸	tc004	\$ -	20	\$ -	40	\$ -	\$ 0.2	\$ 4.0	\$ 8.0
Subtotal				\$ 1,370.0		\$ 1,810.0		\$ 346.5	\$ 354.9

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 5
 TRANSCOM Incident Management
 ATMS08 Incident Management
 ATMS08-06,ATMS08-07

Center Subsystems

Hardware for Incident Response² TM018
 Integration for Incident Response⁴ TM026

Communications

DSO Communications Line³ TC001

Design Development Allowance

25%

Capital Cost						Annual Cost		
unit cost	quantities	low end extension	high end quantities	high end extension	unit cost	low end extension	high end extension	
\$ 3.3	10	\$ 33.0	13	\$ 42.9	0.165	\$ 1.7	\$ 2.1	
\$ 220.0	2	\$ 440.0	2	\$ 440.0	\$ -	\$ -	\$ -	
\$ 1.0	10	\$ 10.0	13	\$ 13.0	\$ 1.2	\$ 12.0	\$ 15.6	
Subtotal		\$ 483.0	\$ 495.9		\$ 13.7	\$ 17.7		
Subtotal		\$ 120.8	\$ 124.0		\$ 3.4	\$ 4.4		
Total		\$ 603.8	\$ 619.9		\$ 17.1	\$ 22.2		

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Assume 10 to 13 new RAD workstations needed at a subset of the TOCs listed
- 3 Communications from new RAD workstations to TRANSCOM Communications Servers
- 4 Integration at TRANSCOM and PANYNJ facilities (see project 3)
- 5 Assume link to event promoters addressed by event promoters
- 6 EM systems at PANYNJ facilities addressed by project no 3.

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 6
 NJTPA Municipality County PWD MCM Coordination
 ATMS08 Incident Management
 ATMS08-09, ATMS08-10

		Capital Cost				Annual Cost			
		unit cost	quantities	low end extension	quantities	high end extension	unit cost	low end extension	high end extension
Center Subsystems									
Fleet Center Hardware ²	FM001	\$ 30.0	13	\$ 390.0	26	\$ 780.0	0.06	\$ 0.8	\$ 1.6
Fleet Center Software/Integration ²	FM002	\$ 500.0	13	\$ 6,500.0	26	\$ 13,000.0	\$ -	\$ -	\$ -
Software for Tracking and Scheduling ²	FM005	\$ 100.0	13	\$ 1,300.0	26	\$ 2,600.0	\$ 10.0	\$ 130.0	\$ 260.0
Event Promoters									
Regional Event Promoters ³									
Communications									
DS0 Communications line ⁴	TM001	\$ 1.0	13	\$ 13.0	26	\$ 26.0	\$ 1.2	\$ 15.6	\$ 31.2
		Subtotal		\$ 8,203.0	\$ 16,406.0		\$ 146.4		\$ 292.8
Design Development Allowance									
	25%	Subtotal		\$ 2,050.8	\$ 4,101.5		\$ 36.6		\$ 73.2
		Total		\$ 10,253.8	\$ 20,507.5		\$ 183.0		\$ 366.0

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Assume costs associated with Maintenance and Construction Management Centers are borne by other projects except for Public Works Operations.
- 3 Assume link to event promoters addressed by event promoters
- 4 Assume one DS0 to link each Mun & Co PWD
- 5 Number of Systems - Low end = 13, High end = 26 for the 13 Co and 13 Mun

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 7
 NJTPA Incident and Emergency Response Coordination
 EM01 Emergency Response Coordination
 EM01-1

Center Subsystems

Emergency Response Hardware² EM001
 Emergency Response software² EM002
 Emergency Management
 Communications Software^{2,4}

Staff

Emergency Response Labor⁶ EM003

Design Development Allowance

25%

Capital Cost						Annual Cost			
unit cost	quantities	low end		high end		unit cost	low end		high end
		extension		quantities	extension		extension		
\$ 30.0		1	\$ 30.0	1	\$ 30.0	\$ 0.6	\$ 0.6	\$ 0.6	0.6
\$ 150.0		1	\$ 150.0	1	\$ 150.0	\$ 3.5	\$ 3.5	\$ 3.5	3.5
\$ 10.0		24	\$ 240.0	36	\$ 360.0	\$ 5.0	\$ 120.0	\$ 180.0	180.0
		1		1		\$ 165.0	\$ 165.0	\$ 165.0	165.0
Subtotal			\$ 420.0		\$ 540.0		\$ 289.1	\$ 349.1	
Subtotal			\$ 105.0		\$ 135.0		\$ 72.3	\$ 87.3	
Total			\$ 525.0		\$ 675.0		\$ 361.4	\$ 436.4	

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Assume new EM system for Emergency Response System for NJTPA Region Incident and Mutual Aid Network
- 3 Assume costs associated with Emergency Management Centers for Mun and CO are borne by project 8
- 4 cost for integration of 9 centers + 13 co EOC, 13 mun EOC, 1 NJTPA Region PS dispatch centers
- 5 assume comm costs to county facilities addressed by projects 2 and 6
- 6 for NJTPA Region Incident and Mutual Aid Network

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 8
 North New Jersey Municipal/County EOCs Coordination
 EM01 Emergency Response Coordination
 EM01-2

Center Subsystems

Emergency Response Hardward² EM001
 Emergency Response software² EM002
 Emergency Management
 Communications Software²

Staff

Emergency Response Labor EM003

Design Development Allowance

25%

Capital Cost						Annual Cost			
unit cost	quantities	low end		high end		unit cost	low end		high end
		extension		quantities	extension		extension		
\$ 30.0		13	\$ 390.0	26	\$ 780.0	\$ 0.6	\$ 7.8	\$ 15.6	
\$ 150.0		13	\$ 1,950.0	26	\$ 3,900.0	\$ 3.5	\$ 45.5	\$ 91.0	
		0		0		\$ 165.0	\$ -	\$ -	
Subtotal			\$ 2,340.0		\$ 4,680.0		\$ 53.3	\$ 106.6	
Subtotal			\$ 585.0		\$ 1,170.0		\$ 13.3	\$ 26.7	
Total			\$ 2,925.0		\$ 5,850.0		\$ 66.6	\$ 133.3	

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Assume Emergency Response Systems for the 13 NJTPA Municipalities and the 13 NJTPA Counties (these are used in project 7)
- 3 assume comm costs to county facilities addressed by projects 2 and 6

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 9
 North New Jersey Public Safety Emergency Routing
 EM02 Emergency Routing
 EM02-5

Center Subsystems

Emergency Response Hardward² EM001
 Emergency Response software² EM002
 Software Upgrade for Emergency
 Route Planning³ IS012
 Software for Vehicle Tracking and
 Scheduling FM005

Emergency Vehicle Subsystem

Communication Interface⁴ EV001
 Route Guidance Processor VS006
 GPS/DGPS VS004
 GIS Software VS005

Staff

Labor for Incident Response TM020

Design Development Allowance

25%

Capital Cost						Annual Cost				
unit cost	quantities	low end		high end		unit cost	low end		high end	
		extension		quantities	extension		extension		extension	
\$ 30.0		1	\$ 30.0	1	\$ 30.0	\$ 0.6	\$ 0.6	\$ 0.6	\$ 0.6	
\$ 150.0		1	\$ 150.0	1	\$ 150.0	\$ 3.5	\$ 3.5	\$ 3.5	\$ 3.5	
\$ 100.0		1	\$ 100.0	1	\$ 100.0	\$ 5.0	\$ 5.0	\$ 5.0	\$ 5.0	
\$ 100.0		1	\$ 100.0	1	\$ 100.0	\$ 10.0	\$ 10.0	\$ 10.0	\$ 10.0	
\$ 2.0		0	\$ -	0	\$ -	0.02	\$ -	\$ -	\$ -	
0.15		26	\$ 3.9	52	\$ 7.8	0.003	\$ 0.1	\$ 0.2	\$ 0.2	
0.50		26	\$ 13.0	52	\$ 26.0	0.010	\$ 0.3	\$ 0.5	\$ 0.5	
0.30		26	\$ 7.8	52	\$ 15.6					
		0		0		\$ 110.0	\$ -	\$ -	\$ -	
Subtotal			\$ 404.7		\$ 429.4		\$ 19.4		\$ 19.8	
Subtotal			\$ 101.2		\$ 107.4		\$ 4.9		\$ 4.9	
Total			\$ 505.9		\$ 536.8		\$ 24.3		\$ 24.7	

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Assume costs associated for Emergency Management system at NJTPA Region PS Dispatch; others by other projects
- 3 Assume ISP Software upgrade for Emergency Route Planning
- 4 Assume costs associated with Emergency Management Communications are borne by Public Safety project #2

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 10
 DRJTBC Emergency Routing
 EM02 Emergency Routing
 EM02-6

		Capital Cost				Annual Cost			
		unit cost	quantities	low end extension	quantities	high end extension	unit cost	low end extension	high end extension
Center Subsystems									
Emergency Response Hardward ²	EM001	\$ 30.0	1	\$ 30.0	1	\$ 30.0	\$ 0.6	\$ 0.6	\$ 0.6
Emergency Response Softward ²	EM002	\$ 150.0	1	\$ 150.0	1	\$ 150.0	\$ 3.5	\$ 3.5	\$ 3.5
Software Upgrade for Emergency Route Planning ³	IS012	\$ 100.0	1	\$ 100.0	1	\$ 100.0	\$ 5.0	\$ 5.0	\$ 5.0
Software for Vehicle Tracking and Scheduling	FM005	\$ 100.0	1	\$ 100.0	1	\$ 100.0	\$ 10.0	\$ 10.0	\$ 10.0
Emergency Vehicle Subsystem									
Communication Interface ⁴	EV001	\$ 2.0	20	\$ 40.0	40	\$ 80.0	0.02	\$ 0.4	\$ 0.8
Route Guidance Processor	VS006	0.15	20	\$ 3.0	40	\$ 6.0	0.003	\$ 0.1	\$ 0.1
GPS/DGPS	VS004	0.50	20	\$ 10.0	40	\$ 20.0	0.010	\$ 0.2	\$ 0.4
GIS Software	VS005	0.30	20	\$ 6.0	40	\$ 12.0			
Staff									
Labor for Incident Response	TM020		0		0		\$ 110.0	\$ -	\$ -
Communications									
DS0 Communications line ⁴	TM001	\$ 1.0	0	\$ -	0	\$ -	\$ 1.2	\$ -	\$ -
Wireless Communications, low Usage ⁵	tc004	\$ -	20	\$ -	40	\$ -	\$ 0.2	\$ 4.0	\$ 8.0
		Subtotal		\$ 439.0		\$ 498.0		\$ 23.8	\$ 28.4
Design Development Allowance									
	25%	Subtotal		\$ 109.8		\$ 124.5		\$ 5.9	\$ 7.1
		Total		\$ 548.8		\$ 622.5		\$ 29.7	\$ 35.5

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Assume costs associated with Emergency Management system at DRJTBC; others by other projects
- 3 Assume ISP Software upgrade for Emergency Route Planning
- 4 Assume costs associated with center to center comm for DRJTBC are borne by Public Safety project #4
- 5 for EM to EV comm

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 11
 PANYNJ Tunnels/Bridges Infrastructure Protection Program
 EM05 Transportation Infrastructure Protection
 EM05-6

	Capital Cost				Annual Cost			
	unit cost	quantities	low end extension	high end extension	unit cost	low end extension	high end extension	
Center Subsystems								
Emergency Response Hardward ² EM001	\$ 30.0	1	\$ 30.0	1	\$ 30.0	\$ 0.6	\$ 0.6	
Emergency Response Softward ² EM002	\$ 150.0	1	\$ 150.0	1	\$ 150.0	\$ 3.5	\$ 3.5	
Hardware for Security System ³	\$ 90.0	1	\$ 90.0	1	\$ 90.0	\$ 1.8	\$ 1.8	
Integration of Security System with Existing Systems ³	\$ 500.0	1	\$ 500.0	1	\$ 500.0	\$ -	\$ -	
Security Monitoring Subsystem⁴								
CCTV Video Camera RS007	7.5	15	\$ 112.5	30	\$ 225.0	2.4	\$ 36.0	
CCTV Video Camera Tower RS008	2	15	\$ 30.0	30	\$ 60.0	0	\$ -	
Lowering System ⁵	8	10	\$ 80.0	20	\$ 160.0	0	\$ -	
Pedestrian Detection (Infrared) ⁶	0.5	15	\$ 7.5	30	\$ 15.0	0	\$ -	
Infrared Sensor (Active) ⁷	14	15	\$ 210.0	30	\$ 420.0	0	\$ -	
Wireline to Roadside Message sign ⁸ RS013	\$ 75.0	70	\$ 5,250.0	140	\$ 10,500.0	\$ 3.8	\$ 262.5	
Staff								
Emergency Response Labor EM003		2		4		\$ 165.0	\$ 330.0	
Labor for Security System TR011		1		1		\$ 247.0	\$ 247.0	
Communications⁹								
DS1 Communications line TC002	\$ 1.0	6	\$ 6.0	9	\$ 9.0	\$ 8.4	\$ 50.4	
			Subtotal \$ 6,466.0		\$ 12,159.0		\$ 931.8	
							\$ 1,585.5	
Design Development Allowance								
			Subtotal \$ 1,616.5		\$ 3,039.8		\$ 233.0	
							\$ 396.4	
			Total \$ 8,082.5		\$ 15,198.8		\$ 1,164.8	
							\$ 1,981.9	

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Assume costs associated with Emergency Management Centers are borne by other projects
- 3 Transit Management Center Security Package used because it was the only Security System Cost Data available from the ITS Unit Cost Database.
- 4 Traffic Monitoring Devices used as an estimate for Security Monitoring Items cost due to lack of cost information available for Security Monitoring Devices
- 5 Not all Cameras with require Lowering Device
- 6 Intruder Detection
- 7 Vehicle Detection
- 8 Assume for T-1 comm cost for Security Monitoring Equipment (includes video)
- 9 Assume for comm between centers

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 12
 North New Jersey Regional Alerts Program
 EM06 Wide Area Alert
 EM06-1

Center Subsystems

Emergency Response Hardware² EM001
 Emergency Response Software² EM002
 Emergency Response Comm
 Software³ EM004

Staff

Emergency Response Labor⁴ EM003

Communications⁵

Design Development Allowance

25%

Capital Cost						Annual Cost				
unit cost	quantities	low end		high end		unit cost	low end		high end	
		extension		quantities	extension		extension		extension	
\$ 30.0		1	\$ 30.0	1	\$ 30.0	\$ 0.6	\$ 0.6	\$ 0.6	\$ 0.6	\$ 0.6
\$ 150.0		1	\$ 150.0	1	\$ 150.0	\$ 3.5	\$ 3.5	\$ 3.5	\$ 3.5	\$ 3.5
\$ 10.0		42	\$ 420.0	60	\$ 600.0	\$ 5.0	\$ 210.0	\$ 300.0	\$ 300.0	\$ 300.0
		1		1		\$ 165.0	\$ 165.0	\$ 165.0	\$ 165.0	\$ 165.0
Subtotal			\$ 600.0		\$ 780.0		\$ 379.1		\$ 469.1	
Subtotal			\$ 150.0		\$ 195.0		\$ 94.8		\$ 117.3	
Total			\$ 750.0		\$ 975.0		\$ 473.9		\$ 586.4	

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Emergency Response System at NJSP -- used to provide Alert Notifications
- 3 cost to integrate with other centers
- 4 staffing at NJSP
- 5 assume communications addressed in earlier Public Safety projects

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 13
 North New Jersey Early Warning System
 EM07 Early Warning System
 EM07-1

Center Subsystems

Emergency Response Hardward² EM001
 Emergency Response Softward² EM002
 Transit Center Hardward TR001

 Transit Center Software/Integration TR002
 Hardware for Incident Response TM018
 Integration for Incident Response TM026
 Software for Incident Response TM019
 Software Upgrade for Inter-Agency Info Exchange³ CA005

Staff

Emergency Response Labor EM003

Communications

Design Development Allowance

25%

Capital Cost						Annual Cost		
unit cost	low end		high end		unit cost	low end		high end
	quantities	extension	quantities	extension		extension	extension	
\$ 30.0	0	\$ -	0	\$ -	\$ 0.6	\$ -	\$ -	\$ -
\$ 150.0	0	\$ -	0	\$ -	\$ 3.5	\$ -	\$ -	\$ -
\$ 30.0	0	\$ -	0	\$ -	\$ -	\$ -	\$ -	\$ -
\$ 1,720.0	0	\$ -	0	\$ -	\$ 12.0	\$ -	\$ -	\$ -
\$ 3.3	0	\$ -	0	\$ -	0.165	\$ -	\$ -	\$ -
\$ 22.0	0	\$ -	0	\$ -	0	\$ -	\$ -	\$ -
\$ 16.5	0	\$ -	0	\$ -	0.825	\$ -	\$ -	\$ -
\$ 40.0	40	\$ 1,600.0	60	\$ 2,400.0	0.800	\$ 32.0	\$ 48.0	\$ 48.0
	0		0		\$ 165.0	\$ -	\$ -	\$ -
Subtotal		\$ 1,600.0	\$ 2,400.0		\$ 32.0	\$ 48.0		
Subtotal		\$ 400.0	\$ 600.0		\$ 8.0	\$ 12.0		
Total		\$ 2,000.0	\$ 3,000.0		\$ 40.0	\$ 60.0		

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Assume Emergency Response System Cost borne by Public Safety Project #8
- 3 Assume Inter-Agency Info Exchange is for Threat Information Coordination
- 4 Assume staffing and communications addressed in earlier Public Safety Projects

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 14
 NJTPA County EOCs Disaster & Response Management
 EM08 Disaster Response and Recovery
 EM08-1, EM08-2

Center Subsystems

Emergency Response Hardward² EM001
 Emergency Response Softward² EM002
 Transit Center Hardward TR001

 Transit Center Software/Integration TR002
 Hardware for Incident Response TM018
 Integration for Incident Response TM026
 Software for Incident Response TM019
 Software Upgrade for Inter-Agency Info Exchange³ CA005

Staff

Emergency Response Labor EM003

Communications

Design Development Allowance

25%

Capital Cost						Annual Cost		
unit cost	quantities	low end extension	high end quantities	high end extension	unit cost	low end extension	high end extension	
\$ 30.0		0 \$ -	0 \$ -		\$ 0.6	\$ -	\$ -	
\$ 150.0	1	\$ 150.0	1	\$ 150.0	\$ 3.5	\$ 3.5	\$ 3.5	
\$ 30.0		0 \$ -	0 \$ -		\$ -	\$ -	\$ -	
\$ 1,720.0		0 \$ -	0 \$ -		\$ 12.0	\$ -	\$ -	
\$ 3.3		0 \$ -	0 \$ -		0.165	\$ -	\$ -	
\$ 22.0		0 \$ -	0 \$ -		0	\$ -	\$ -	
\$ 16.5		0 \$ -	0 \$ -		0.825	\$ -	\$ -	
\$ 40.0	40	\$ 1,600.0	60	\$ 2,400.0	0.800	\$ 32.0	\$ 48.0	
		0	0		\$ 165.0	\$ -	\$ -	
Subtotal		\$ 1,750.0		\$ 2,550.0		\$ 35.5	\$ 51.5	
Subtotal		\$ 437.5		\$ 637.5		\$ 8.9	\$ 12.9	
Total		\$ 2,187.5		\$ 3,187.5		\$ 44.4	\$ 64.4	

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Assume Emergency Response System Cost borne by Public Safety Project #8(EM002 is assume cost for additional response plan functionality)
- 3 Assume Inter-Agency Info Exchange is for Emergency Plan Coordination, Emergency Transit Service Request, Transportation System Status, and Road Network Status Assessment
- 4 Assume staffing and communications addressed in earlier Public Safety Projects

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 15
 NJTPA County EOCs Evacuation & Reentry System
 EM09 Evacuation and Reentry Management
 EM09-1, EM09-2

Center Subsystems

Emergency Response Hardward² EM001
 Emergency Response Softward² EM002
 Transit Center Hardward TR001

 Transit Center Software/Integration TR002
 Hardware for Incident Response TM018
 Integration for Incident Response TM026
 Software for Incident Response TM019
 Software Upgrade for Inter-Agency Info Exchange³ CA005

Staff

Emergency Response Labor EM003

Communications

Design Development Allowance

25%

	Capital Cost					Annual Cost				
	unit cost	low end		high end		unit cost	low end		high end	
		quantities	extension	quantities	extension		extension	extension		
	\$ 30.0	0	\$ -	0	\$ -	\$ 0.6	\$ -	\$ -	\$ -	\$ -
	\$ 150.0	0	\$ -	0	\$ -	\$ 3.5	\$ -	\$ -	\$ -	\$ -
	\$ 30.0	0	\$ -	0	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
	\$ 1,720.0	0	\$ -	0	\$ -	\$ 12.0	\$ -	\$ -	\$ -	\$ -
	\$ 3.3	0	\$ -	0	\$ -	0.165	\$ -	\$ -	\$ -	\$ -
	\$ 22.0	0	\$ -	0	\$ -	0	\$ -	\$ -	\$ -	\$ -
	\$ 16.5	0	\$ -	0	\$ -	0.825	\$ -	\$ -	\$ -	\$ -
	\$ 40.0	40	\$ 1,600.0	60	\$ 2,400.0	0.800	\$ 32.0	\$ 48.0	\$ 48.0	\$ 48.0
		0		0		\$ 165.0	\$ -	\$ -	\$ -	\$ -
	Subtotal		\$ 1,600.0		\$ 2,400.0		\$ 32.0		\$ 48.0	
	Subtotal		\$ 400.0		\$ 600.0		\$ 8.0		\$ 12.0	
	Total		\$ 2,000.0		\$ 3,000.0		\$ 40.0		\$ 60.0	

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Assume Emergency Response System Cost borne by Public Safety Project #8
- 3 Assume Inter-Agency Info Exchange is for Evacuation Coordination, Emergency Transit Service Response
- 4 Assume staffing and communications addressed in earlier Public Safety Projects

Project Number		Capital Cost						Annual Cost				
		Construction / Deployment	Engineering			Subtotal	Escalation 2-1/2 years at 4% per year	Total	Subtotal	Escalation 2-1/2 years at 4% per year	Total	
			Design	Construction Support	Construction Inspection							
Project Name	10%	2%	10%		10%			10%				
1		NJDOT North Traveler Information System Development										
	high end	\$ 6,149.0	\$ 615	\$ 123	\$ 615	\$ 7,502	\$ 750	\$ 8,252	\$ 692	\$ 69	\$ 762	
	low end	\$ 3,899.5	\$ 390	\$ 78	\$ 390	\$ 4,757	\$ 476	\$ 5,233	\$ 415	\$ 41	\$ 456	
2		North New Jersey Municipal/County TOCs Incident Management Program										
	high end	\$ 12,586.0	\$ 1,259	\$ 252	\$ 1,259	\$ 15,355	\$ 1,535	\$ 16,890	\$ 389	\$ 39	\$ 427	
	low end	\$ 6,624.3	\$ 662	\$ 132	\$ 662	\$ 8,082	\$ 808	\$ 8,890	\$ 332	\$ 33	\$ 365	
3		PANYNJ Tunnels/Bridges Incident Mgmt Program										
	high end	\$ 1,810.0	\$ 181	\$ 36	\$ 181	\$ 2,208	\$ 221	\$ 2,429	\$ 355	\$ 35	\$ 390	
	low end	\$ 1,370.0	\$ 137	\$ 27	\$ 137	\$ 1,671	\$ 167	\$ 1,839	\$ 346	\$ 35	\$ 381	
4		DRJTBC Incident Mgmt Program										
	high end	\$ 1,699.5	\$ 170	\$ 34	\$ 170	\$ 2,073	\$ 207	\$ 2,281	\$ 277	\$ 28	\$ 305	
	low end	\$ 849.8	\$ 85	\$ 17	\$ 85	\$ 1,037	\$ 104	\$ 1,140	\$ 139	\$ 14	\$ 153	
5		TRANSCOM Incident Management										
	high end	\$ 619.9	\$ 62	\$ 12	\$ 62	\$ 756	\$ 76	\$ 832	\$ 22	\$ 2	\$ 24	
	low end	\$ 603.8	\$ 60	\$ 12	\$ 60	\$ 737	\$ 74	\$ 810	\$ 17	\$ 2	\$ 19	
6		NJTPA Municipality County PWD MCM Coordination										
	high end	\$ 20,507.5	\$ 2,051	\$ 410	\$ 2,051	\$ 25,019	\$ 2,502	\$ 27,521	\$ 366	\$ 37	\$ 403	
	low end	\$ 10,253.8	\$ 1,025	\$ 205	\$ 1,025	\$ 12,510	\$ 1,251	\$ 13,761	\$ 183	\$ 18	\$ 201	

Project Number		Capital Cost						Annual Cost			
		Construction / Deployment	Engineering			Subtotal	Escalation 2-1/2 years at 4% per year	Total	Subtotal	Escalation 2-1/2 years at 4% per year	Total
			Design	Construction Support	Construction Inspection						
		Project Name	10%	2%	10%		10%			10%	
7		NJTPA Incident and Emergency Response Coordination									
	high end	\$ 675.0	\$ 68	\$ 14	\$ 68	\$ 824	\$ 82	\$ 906	\$ 436	\$ 44	\$ 480
	low end	\$ 525.0	\$ 53	\$ 11	\$ 53	\$ 641	\$ 64	\$ 705	\$ 361	\$ 36	\$ 398
8		North New Jersey Municipal/County EOCs Coordination									
	high end	\$ 5,850.0	\$ 585	\$ 117	\$ 585	\$ 7,137	\$ 714	\$ 7,851	\$ 133	\$ 13	\$ 147
	low end	\$ 2,925.0	\$ 293	\$ 59	\$ 293	\$ 3,569	\$ 357	\$ 3,925	\$ 67	\$ 7	\$ 73
9		North New Jersey Public Safety Emergency Routing									
	high end	\$ 536.8	\$ 54	\$ 11	\$ 54	\$ 655	\$ 65	\$ 720	\$ 25	\$ 2	\$ 27
	low end	\$ 505.9	\$ 51	\$ 10	\$ 51	\$ 617	\$ 62	\$ 679	\$ 24	\$ 2	\$ 27
10		DRJTBC Emergency Routing									
	high end	\$ 622.5	\$ 62	\$ 12	\$ 62	\$ 759	\$ 76	\$ 835	\$ 36	\$ 4	\$ 39
	low end	\$ 548.8	\$ 55	\$ 11	\$ 55	\$ 669	\$ 67	\$ 736	\$ 30	\$ 3	\$ 33
11		PANYNJ Tunnels/Bridges Infrastructure Protection Program									
	high end	\$ 15,198.8	\$ 1,520	\$ 304	\$ 1,520	\$ 18,542	\$ 1,854	\$ 20,397	\$ 1,982	\$ 198	\$ 2,180
	low end	\$ 8,082.5	\$ 808	\$ 162	\$ 808	\$ 9,861	\$ 986	\$ 10,847	\$ 1,165	\$ 116	\$ 1,281
12		North New Jersey Regional Alerts Program									
	high end	\$ 975.0	\$ 98	\$ 20	\$ 98	\$ 1,190	\$ 119	\$ 1,308	\$ 586	\$ 59	\$ 645
	low end	\$ 750.0	\$ 75	\$ 15	\$ 75	\$ 915	\$ 92	\$ 1,007	\$ 474	\$ 47	\$ 521

Project Number		Capital Cost						Annual Cost			
		Construction / Deployment	Engineering			Subtotal	Escalation 2-1/2 years at 4% per year	Total	Subtotal	Escalation 2-1/2 years at 4% per year	Total
			Design	Construction Support	Construction Inspection						
Project Name	10%	2%	10%		10%			10%			
13	high end	North New Jersey Early Warning System									
	low end	\$ 3,000.0	\$ 300	\$ 60	\$ 300	\$ 3,660	\$ 366	\$ 4,026	\$ 60	\$ 6	\$ 66
14	high end	NJTPA County EOCs Disaster & Response Management									
	low end	\$ 3,187.5	\$ 319	\$ 64	\$ 319	\$ 3,889	\$ 389	\$ 4,278	\$ 64	\$ 6	\$ 71
15	high end	NJTPA County EOCs Evacuation & Reentry System									
	low end	\$ 2,187.5	\$ 219	\$ 44	\$ 219	\$ 2,669	\$ 267	\$ 2,936	\$ 44	\$ 4	\$ 49
Total	high end	\$ 76,417	\$ 7,642	\$ 1,528	\$ 7,642	\$ 93,229	\$ 9,323	\$ 102,552	\$ 5,484	548.40	\$ 6,032
	low end	\$ 43,126	\$ 4,313	\$ 863	\$ 4,313	\$ 52,613	\$ 5,261	\$ 57,875	\$ 3,677	367.70	\$ 4,045

Project Number	Project Name	Program Area	SubArea	Expected Benefit Types (Goal Area)	Referenced Study
1	NJDOT North Incident Management Program	Incident Management Systems	Mobilization and Response	-Safety -Mobility -Customer Satisfaction -Productivity -Energy/ Environment	19,13,17,14,15,16,87
2	North New Jersey Municipal/County TOCs Incident Management Program	Incident Management Systems Emergency Management Systems	Mobilization and Response Response and Recovery: Response Management	-Safety -Mobility -Customer Satisfaction -Productivity -Energy/ Environment no data to report	19,13,17,14,15,16,87
3	PANYNJ Tunnels/Bridges Incident Mgmt Program	Emergency Management Systems	Response and Recovery: Response Management	no data to report	
4	DRJTBC Incident Mgmt Program	Incident Management Systems	Mobilization and Response	-Safety -Mobility -Customer Satisfaction -Productivity -Energy/ Environment	19,13,17,14,15,16,87
5	TRANSCOM Incident Management	Incident Management Systems	Mobilization and Response	-Safety -Mobility -Customer Satisfaction -Productivity -Energy/ Environment	19,13,17,14,15,16,87
6	NJTPA Municipality County PWD MCM Coordination	Roadway Operations and Maintenance	Asset Management: Fleet Management	no data to report	
7	NJTPA Incident and Emergency Response Coordination	Emergency Management Systems	Response and Recovery: Response Management	no data to report	
8	North New Jersey Municipal/County EOCs Coordination	Emergency Management Systems	Response and Recovery: Response Management	no data to report	
9	North New Jersey Public Safety Emergency Routing	Emergency Management Systems	Response and Recovery: Response Management	no data to report	
10	DRJTBC Emergency Routing	Emergency Management Systems	Response and Recovery: Response Management	no data to report	
11	PANYNJ Tunnels/Bridges Infrastructure Protection Program	Transit Management Systems	Safety & Security: Facility Surveillance	Customer Satisfaction	76
12	North New Jersey Regional Alerts Program	Emergency Management Systems	Response and Recovery: Response Management	no data to report	
13	North New Jersey Early Warning System	Emergency Management Systems	Response and Recovery: Response Management	no data to report	
14	NJTPA County EOCs Disaster & Response Management	Emergency Management Systems	Response and Recovery: Response Management	no data to report	
15	NJTPA County EOCs Evacuation & Reentry System	Emergency Management Systems	Response and Recovery: Response Management	no data to report	

Appendix 12.E

Implementation – Project Tables

Information Archive Management

Region
 Project Number
 Project Name
 Market Package
 Market Package Diagram No.

North
 1
 NJTPA RWIS Archive Management
 ITS Data Warehouse NJTPA Database
 AD3-2

Center Subsystems²

ISP Hardware IS001
 ISP Software, Integration IS002
 System Integration³ IS017

Communications

DSO Communications line³ TC001

Staff⁷

Design Development Allowance

25%

Capital Cost						Annual Cost			
unit cost	quantities	low end		high end		unit cost	low end		high end
		extension		quantities	extension		extension	extension	
\$ 49.5		1	\$ 49.5	1	\$ 49.5	\$ 1.0	\$ 1.0	\$ 1.0	
\$ 550.0		1	\$ 550.0	1	\$ 550.0	\$ 27.5	\$ 27.5	\$ 27.5	
\$ 110.0		5	\$ 550.0	5	\$ 550.0	\$ 5.5	\$ 27.5	\$ 27.5	
Subtotal						\$ 62.0	\$ 62.0	\$ 62.0	
\$ 1.0		5	\$ 5.0	5	\$ 5.0	\$ 1.2	\$ 6.0	\$ 6.0	
Subtotal						\$ 15.5	\$ 15.5	\$ 15.5	
Total						\$ 77.5	\$ 77.5	\$ 77.5	

Notes:

- 1 Costs are shown in thousands of dollars
- 2 Since No Database Information provided, Assumed cost of NJTPA Regional Database similar to the cost of an ISP
- 3 Assume one TC001 and one IS017 for each center to be interconnected with the archived data system
- 4
- 5
- 6
- 7 Assume existing Staff can assume additional workload
- 8 Cost of Links with Print and Broadcast Media borne in Project #4

Project Number		Construction / Deployment	Capital Cost					Annual Cost			
			Design	Engineering		Subtotal	Escalation 2-1/2 years at 4% per year	Total	Subtotal	Escalation 2-1/2 years at 4% per year	Total
				Construction Support	Construction Inspection						
Project Name			10%	2%	10%		10%			10%	
1		NJTPA RWIS Archive Management									
	high end	\$ 1,443.1	\$ 144	\$ 29	\$ 144	\$ 1,761	\$ 176	\$ 1,937	\$ 77	\$ 8	\$ 85
	low end	\$ 1,443.1	\$ 144	\$ 29	\$ 144	\$ 1,761	\$ 176	\$ 1,937	\$ 77	\$ 8	\$ 85

Table 13-10. NJTPA - IAM - Short Term Benefits Summary

Project Number	Project Name	Program Area	SubArea	Expected Benefit Types (Goal Area)	Referenced Study
1	NJTPA RWIS Archive Management	Information Management	Data Archiving	no data to report	

Appendix 12.F

Implementation – Project Tables

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Appendix 12.F: Benefit References

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Appendix 13.A

Applicable ITS Standards

Applicable ITS Standards

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Standards for New Jersey ITS Architecture



NOTE: The ITS standards presented in this report may represent a superset of options, and in some cases, provide redundant capabilities. In addition, these ITS standards are at different maturity levels. Care should be taken to select the standards that best meet the needs of the region or project.

Lead SDO	Standard Name	Version	Document ID
AASHTO/ITE/NEMA	NTCIP Center-to-Center Standards Group		(See Footnote)
AASHTO/ITE/NEMA	NTCIP Center-to-Field Standards Group		(See Footnote)
AASHTO/ITE/NEMA	Global Object Definitions		NTCIP 1201
AASHTO/ITE/NEMA	Object Definitions for Actuated Traffic Signal Controller Units		NTCIP 1202
AASHTO/ITE/NEMA	Object Definitions for Dynamic Message Signs		NTCIP 1203
AASHTO/ITE/NEMA	Object Definitions for Environmental Sensor Stations & Roadside Weather Information System		NTCIP 1204
AASHTO/ITE/NEMA	Data Dictionary for Closed Circuit Television (CCTV)		NTCIP 1205
AASHTO/ITE/NEMA	Data Collection & Monitoring Devices		NTCIP 1206
AASHTO/ITE/NEMA	Ramp Meter Controller Objects		NTCIP 1207
AASHTO/ITE/NEMA	Object Definitions for Video Switches		NTCIP 1208
AASHTO/ITE/NEMA	Transportation System Sensor Objects		NTCIP 1209
AASHTO/ITE/NEMA	Objects for Signal Systems Master		NTCIP 1210
AASHTO/ITE/NEMA	Objects for Signal Control Priority		NTCIP 1211
AASHTO/ITE/NEMA	TCIP - Common Public Transportation (CPT) Business Area Standard		NTCIP 1401
AASHTO/ITE/NEMA	TCIP - Incident Management (IM) Business Area Standard		NTCIP 1402
AASHTO/ITE/NEMA	TCIP - Passenger Information (PI) Business Area Standard		NTCIP 1403
AASHTO/ITE/NEMA	TCIP - Scheduling/Runcutting (SCH) Business Area Standard		NTCIP 1404
AASHTO/ITE/NEMA	TCIP - Spatial Representation (SP) Business Area Standard		NTCIP 1405

Standards for New Jersey ITS Architecture

Lead SDO	Standard Name	Version	Document ID
AASHTO/ITE/NEMA	TCIP - Onboard (OB) Business Area Standard		NTCIP 1406
AASHTO/ITE/NEMA	TCIP - Control Center (CC) Business Area Standard		NTCIP 1407
AASHTO/ITE/NEMA	TCIP - Fare Collection (FC) Business Area Standard		NTCIP 1408
ANSI	Commercial Vehicle Safety Reports		ANSI TS284
ANSI	Commercial Vehicle Safety and Credentials Information Exchange		ANSI TS285
ANSI	Commercial Vehicle Credentials		ANSI TS286
ANSI	Electronic Filing of Tax Return Data		ANSI TS813
ASTM	Dedicated Short Range Communication at 915 MHz Standards Group		(See Footnote)
ASTM	Standard Specification for Archiving ITS Generated Traffic Monitoring Data		ASTM E2259-xx
IEEE	Incident Management Standards Group		(See Footnote)
IEEE	Standard for Interface Between the Rail Subsystem and the Highway Subsystem at a Highway Rail Intersection		IEEE 1570-2002
IEEE	Standard for Message Sets for Vehicle/Roadside Communications		IEEE Std 1455-1999
ITE	Standard for Functional Level Traffic Management Data Dictionary (TMDD)		ITE TM 1.03
ITE	Message Sets for External TMC Communication (MS/ETMCC)		ITE TM 2.01
SAE	Advanced Traveler Information Systems (ATIS) Bandwidth Limited Standards Group		(See Footnote)
SAE	Advanced Traveler Information Systems (ATIS) General Use Standards Group		(See Footnote)
SAE	On-board Vehicle Mayday Standards Group		(See Footnote)
SAE/IEEE	Dedicated Short Range Communication at 5.9 GHz Standards Group		(See Footnote)

Standards for New Jersey ITS Architecture

Lead SDO	Standard Name	Version	Document ID
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Footnotes:**Advanced Traveler Information Systems (ATIS) Bandwidth Limited Standards Group**

SDO	Standard Name	Document ID
SAE	Location Referencing Message Specification (LRMS)	SAE J2266
SAE	Message Set for Advanced Traveler Information System (ATIS)	SAE J2354
SAE	Standard for ATIS Message Sets Delivered Over Bandwidth Restricted Media	SAE J2369
SAE	Rules for Standardizing Street Names and Route IDs	SAE J2529
SAE	Messages for Handling Strings and Look-Up Tables in ATIS Standards	SAE J2540
SAE	RDS (Radio Data System) Phrase List	SAE J2540-1
SAE	ITIS (International Traveler Information Systems) Phrase Lists	SAE J2540-2
SAE	National Names Phrase List	SAE J2540-3
SAE	Converting ATIS Message Standards from ASN.1 to XML	SAE J2630

Advanced Traveler Information Systems (ATIS) General Use Standards Group

SDO	Standard Name	Document ID
SAE	Location Referencing Message Specification (LRMS)	SAE J2266
SAE	Message Set for Advanced Traveler Information System (ATIS)	SAE J2354
SAE	Rules for Standardizing Street Names and Route IDs	SAE J2529
SAE	Messages for Handling Strings and Look-Up Tables in ATIS Standards	SAE J2540
SAE	RDS (Radio Data System) Phrase List	SAE J2540-1
SAE	ITIS (International Traveler Information Systems) Phrase Lists	SAE J2540-2
SAE	National Names Phrase List	SAE J2540-3
SAE	Converting ATIS Message Standards from ASN.1 to XML	SAE J2630

Dedicated Short Range Communication at 5.9 GHz Standards Group

SDO	Standard Name	Document ID
IEEE	Resource Manager for DSRC 5.9 GHz	IEEE 1609.1
IEEE	Application Services (Layers 6,7) for DSRC 5.9 GHz	IEEE 1609.2
IEEE	Communications Services (Layers 4,5) for DSRC 5.9 GHz (Future Standard)	IEEE 1609.3
IEEE	Medium Access Control (MAC) Extension & the MAC Extension Management Entity for DSRC 5.9 GHz	IEEE 1609.4
IEEE	Standard Specification for Telecommunications and Information Exchange Between Roadside and Vehicle Systems - 5 GHz Band Dedicated Short Range Communications (DSRC) Medium Access Control (MAC) and Physical Layer (PHY) Specifications	IEEE 802.11
IEEE	Logical Link (Layer 2) for DSRC 5.9 GHz	IEEE 802.2
ISO	Networking Services (Layer 3) for DSRC 5.9 GHz	ISO 21210

Dedicated Short Range Communication at 915 MHz Standards Group

SDO	Standard Name	Document ID
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Standards for New Jersey ITS Architecture

Lead SDO	Standard Name	Version	Document ID
Dedicated Short Range Communication at 915 MHz Standards Group			
SDO	Standard Name		Document ID
ASTM	Standard Specification for Dedicated Short Range Communication (DSRC) Physical Layer using Microwave in the 902-928 MHz Band		ASTM E2158-01
ASTM	Standard Provisional Specification for Dedicated Short Range Communication (DSRC) Data Link Layer		ASTM PS 105-99
Incident Management Standards Group			
SDO	Standard Name		Document ID
IEEE	Standard for Traffic Incident Management Message Sets for Use by EMCs		IEEE 1512.1-2003
IEEE	Standard for Hazardous Material IMMS for use by EMCs		IEEE 1512.3-2002
IEEE	Standard for Common Incident Management Message Sets (IMMS) for use by EMCs		IEEE 1512-2000
IEEE	Standard for Public Safety IMMS for use by EMCs		IEEE P1512.2
NTCIP Center-to-Center Standards Group			
SDO	Standard Name		Document ID
AASHTO/ITE/NEMA	Base Standard: Octet Encoding Rules (OER)		NTCIP 1102
AASHTO/ITE/NEMA	CORBA Naming Convention		NTCIP 1104
AASHTO/ITE/NEMA	CORBA Security Service		NTCIP 1105
AASHTO/ITE/NEMA	CORBA Near-Real Time Data Service		NTCIP 1106
AASHTO/ITE/NEMA	Subnet Profile for Ethernet		NTCIP 2104
AASHTO/ITE/NEMA	Internet (TCP/IP and UDP/IP) Transport Profile		NTCIP 2202
AASHTO/ITE/NEMA	Application Profile for File Transfer Protocol (FTP)		NTCIP 2303
AASHTO/ITE/NEMA	Application Profile for Data Exchange ASN.1 (DATEX)		NTCIP 2304
AASHTO/ITE/NEMA	Application Profile for Common Object Request Broker Architecture (CORBA)		NTCIP 2305
AASHTO/ITE/NEMA	Information Profile for DATEX		NTCIP 2501
AASHTO/ITE/NEMA	Information Profile for CORBA		NTCIP 2502
NTCIP Center-to-Field Standards Group			
SDO	Standard Name		Document ID
AASHTO/ITE/NEMA	Simple Transportation Management Framework (STMF)		NTCIP 1101
AASHTO/ITE/NEMA	Base Standard: Octet Encoding Rules (OER)		NTCIP 1102
AASHTO/ITE/NEMA	Simple Transportation Management Protocol (STMP)		NTCIP 1103
AASHTO/ITE/NEMA	Point to Multi-Point Protocol Using RS-232 Subnetwork Profile		NTCIP 2101
AASHTO/ITE/NEMA	Subnet Profile for PMPP Over FSK modems		NTCIP 2102
AASHTO/ITE/NEMA	Subnet Profile for Point-to-Point Protocol using RS 232		NTCIP 2103
AASHTO/ITE/NEMA	Subnet Profile for Ethernet		NTCIP 2104
AASHTO/ITE/NEMA	Transportation Transport Profile		NTCIP 2201
AASHTO/ITE/NEMA	Internet (TCP/IP and UDP/IP) Transport Profile		NTCIP 2202
AASHTO/ITE/NEMA	Application Profile for Simple Transportation Management Framework (STMF)		NTCIP 2301
AASHTO/ITE/NEMA	Application Profile for Trivial File Transfer Protocol		NTCIP 2302
AASHTO/ITE/NEMA	Application Profile for File Transfer Protocol (FTP)		NTCIP 2303

Standards for New Jersey ITS Architecture

Lead SDO	Standard Name	Version	Document ID
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On-board Vehicle Mayday Standards Group

SDO	Standard Name	Document ID
SAE	Location Referencing Message Specification (LRMS)	SAE J2266
SAE	On-Board Land Vehicle Mayday Reporting Interface	SAE J2313
SAE	Message Set for Advanced Traveler Information System (ATIS)	SAE J2354
SAE	Rules for Standardizing Street Names and Route IDs	SAE J2529
SAE	Messages for Handling Strings and Look-Up Tables in ATIS Standards	SAE J2540
SAE	RDS (Radio Data System) Phrase List	SAE J2540-1
SAE	ITIS (International Traveler Information Systems) Phrase Lists	SAE J2540-2
SAE	National Names Phrase List	SAE J2540-3
SAE	Converting ATIS Message Standards from ASN.1 to XML	SAE J2630