

Appendix E

New York State ITS Standards Specification Development Guide

ITS Standards Document Overview

Prepared for

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Revision History

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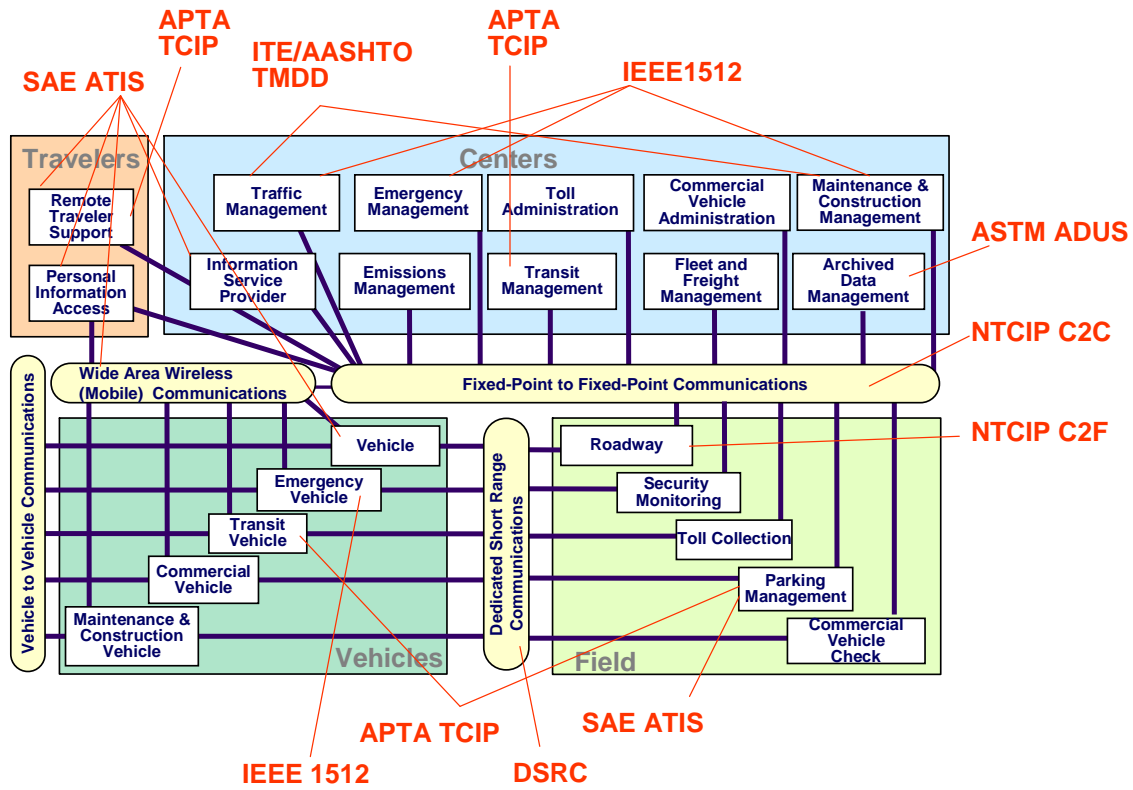
1 Introduction

The ITS Standards Development Program are supported and guided by several existing Standards Development Organizations (SDOs). The SDOs that are currently involved in the development of ITS standards include:

- National Transportation Communications for ITS Protocol (NTCIP). A joint venture of American Association of State Highway and Transportation Officials (AASHTO), Institute of Transportation Engineers (ITE), and the National Electrical Manufacturers Association (NEMA).
- American Public Transportation Association (APTA)
- ASTM International (formerly, the American Society for Testing & Materials - ASTM)
- Institute of Electrical and Electronics Engineers (IEEE)
- Institute of Transportation Engineers (ITE)
- Society of Automotive Engineers (SAE)

Each SDO has focused its efforts on specific areas of communications within the ITS industry. APTA, for example, focuses on communications between transit management centers, between transit management centers and transit vehicles, and between transit management centers to remote traveler devices such as kiosks. ASTM, as another example, focuses only on archiving data activities. Figure B-1 shows the relation of the ITS standards activities to the National ITS Architecture.

Figure 1-1. Relation of ITS Standards to the National ITS Architecture



2 NTCIP – National Transportation Communications for ITS Protocol

The NTCIP suite of standards is developed and supported jointly by AASHTO, ITE, and NEMA. The NTCIP suite defines the protocols and profiles to support the operation and control of traffic management devices. The NTCIP suite provides communications standards for two different types of ITS communications:

- **Center-to-Field Communications.** Exchange of information between a management center and roadside control and monitoring devices, and,
- **Center-to-Center Communications.** Exchange of information and data between multiple central management centers.

Each will be discussed separately.

Center-To-Field Standards

When specifying the NTCIP center-to-field standards, both the base standard and protocol (communications protocol) and the primary standard (data elements) must be specified.

NTCIP 1100 Series

The NTCIP 1100 series of standards consists of the base standards. This series consists of the basic rules on how to use and deploy the NTCIP ITS standards. The 1100 series of standards for center-to-field communications consists of the following standards:

Document Number	Standard Title	Status	Description
NTCIP 1101	NTCIP Simple Transportation Management Framework (STMF) – TS3.2, Amendment 1	To be replaced by NTCIP 1102, NTCIP 1103, and NTCIP 8004	The STMF describes the simple transportation management framework used for managing and communicating information between management stations and transportation devices. It covers integrated management of transportation networks, networking devices, and transportation specific equipment attached to NTCIP-based networks.
NTCIP 1102	NTCIP - Octet Encoding Rules (OER) – v01.14	Recommended Standard – to be published January 2006.	Defines the presentation layer data encoding rules that are used in conjunction with application layer protocols defined in other standards. Serves as a replacement for part of NTCIP 1101 (STMF), but also defines additional features.
NTCIP 1103	NTCIP Transportation Management Protocol (TMP) – v01.26a	Recommended Standard – to be published 2006.	Includes STMP (NTCIP 1101) with definitions of traps and fixed messages.

NTCIP 1101 is considered mature and has been widely deployed. NTCIP 1102 and 1103 were developed to replace NTCIP 1101 by clarifying definitions and concepts based on lessons

learned from earlier deployments of NTCIP center-to-field standards. Since NTCIP 1102 and NTCIP 1103 are replacements for the mature NTCIP 1101 standard, and were approved by AASHTO, ITE, and NEMA, both NTCIP Standards should be included and referenced in all specifications requiring implementation of the NTCIP standard.

NTCIP 2100 Series

The NTCIP 2100 series of standards are Subnetwork standards define the rules and procedures for exchanging data between two 'adjacent' devices over some communications media. These standards are roughly equivalent to the Data Link and Physical Layers of the seven (7) layer Open Systems Interconnect (OSI) model. The 2100 series of standards for consists of the following standards:

Document Number	Standard Title	Status	Description
NTCIP 2101	NTCIP - Point-to-Multipoint Protocol/RS232 Subnetwork Profile – Version 1	Recommended Standard	Defines how to communicate over a multi-drop serial communications link.
NTCIP 2102	NTCIP - Point-to-Multipoint Protocol/FSK Subnetwork Profile – Version 1	Recommended Standard – to be published December 2005.	Defines how to communicate over twisted wire using FSK modems.
NTCIP 2103	NTCIP - Point-to-Point Protocol/RS232 Subnetwork Profile – Version 1	Recommended Standard – to be published December 2005.	Defines how to communicate over a dial-up link or other serial point-to-point link.
NTCIP 2104	NTCIP - Ethernet Subnetwork Profile – Version 1	Recommended Standard – to be published December 2005.	Defines how to communicate over ethernet links.

NTCIP 2101 and 2103 are considered mature and has been widely deployed. NTCIP 2102 and 2104 are not as widely deployed. NTCIP 2102 may be considered mature.

When specifying an implementation of an ITS system requiring the use of the NTCIP center-to-field standard, at least one of the NTCIP 2100 series of standard should be specified. Which 2100 standard will depend on the communications infrastructure to be used to communicate with the field device. For example, if dial-up modems are to be used for communicating between the management center to the field device, NTCIP 2102 should be specified. If in the future, ethernet will be used to communicate between the management center to the field device, NTCIP 2104 should also be specified.

NTCIP 2200 Series

The NTCIP 2200 series of standards are Transport standards that define the rules and procedures for exchanging the Application data between point 'A' and point 'X' on a network, including any necessary routing, message disassembly/re-assembly and network management functions. Transportation level standards are roughly equivalent to the Transport and Network

Layers of the seven (7) layer Open Systems Interconnect (OSI) model. The 2200 series of standards consists of the following standards:

Document Number	Standard Title	Status	Description
NTCIP 2201	NTCIP Transport Profile – Version 1	Recommended Standard	Defines a bandwidth efficient mechanism to transit data when the subject devices are directly connected and do not require network services.
NTCIP 2202	NTCIP - Internet (TCP/IP & UDP/IP) Transport Profiles – Version 1	Recommended Standard	Defines how to communicate using the Internet suite of protocols.

NTCIP 2201 is considered mature and has been widely deployed. NTCIP 2202 is also considered mature but not as widely deployed.

When specifying an implementation of an ITS system requiring the use of the NTCIP center-to-field standard, one of the NTCIP 2200 series of standards should be specified. Which 2200 standard will depend on the communications infrastructure to be used to communicate with the field device. For example, if the communications infrastructure is using Internet protocols (e.g., IP addressing), then NTCIP 2202 should be specified.

NTCIP 2300 Series

The NTCIP 2300 series of standards are application layer standards that define the rules and procedures for exchanging information data. The rules may include definitions of proper grammar and syntax of a single statement, as well as the sequence of allowed statements. These standards are roughly equivalent to the Session, Presentation, and Application Layers of the seven (7) layer Open Systems Interconnect (OSI) model. The 2300 series of standards for center-to-field communications consists of the following standards:

Document Number	Standard Title	Status	Description
NTCIP 2301	NTCIP – Simple Transportation Management Framework Application Profile – Version 1	Approved	Defines how to exchange data between a management system and a field device.
NTCIP 2302	NTCIP - Trivial File Transfer Protocol - Application Profile – Version 1	Approved	Defines how to use the Trivial File Transfer Protocol within transportation networks
NTCIP 2303	NTCIP - File Transfer Protocol - Application Profile – Version 1	Approved	Defines how to use the File Transfer Protocol within transportation networks

NTCIP 2301 is considered mature and has been widely deployed. When specifying an implementation of an ITS system requiring the use of the NTCIP center-to-field standard, one of the NTCIP 2300 series of standards should be specified. Currently, only NTCIP 2301 is applicable for center-to-field communications, and should be specified. NTCIP 2302 and NTCIP 2303 are relevant and should be specified only if file transfers are required.

NTCIP 1200 Series

The NTCIP 1200 series of standards are mainly primary standards that define the data elements (objects) for transmitting specific pieces of information between a management center and a field device. The data element definitions may include syntax, allowable ranges, and may also include valid sequences for transmitting data elements. NTCIP 1201, Global Objects, is considered a supporting standard, not a primary standard, because it can be used for multiple types of field devices.

Document Number	Standard Title	Status	Description
NTCIP 1201	NTCIP - Global Object Definitions – Version 2	Recommended Standard – to be published January 2006	Defines the pieces of data that are likely to be used in multiple device types, such as time, schedules, report generation
NTCIP 1202	NTCIP - Object Definitions for Actuated Traffic Signal Controller Units – Version 2	Recommended Standard – to be published January 2006	Defines the data that are frequently found in actuated traffic signal controllers.
NTCIP 1203	NTCIP - Object Definitions for Dynamic Message Signs – Version 1, Amendment 1	Version 2 submitted for balloting	Defines the data that are found in dynamic message signs, including blank-out signs, changeable message signs, and variable message signs.
NTCIP 1204	NTCIP - Object Definitions for Environmental Sensor Stations – Version 2	Recommended Standard	Defines the data that are found in road weather information stations and air quality sensors.
NTCIP 1205	NTCIP - Object Definitions for Closed Circuit Television Camera Control – Version 1	Recommended Standard. Amendment 1 submitted for balloting	Defines the data that are used to control video cameras
NTCIP 1206	NTCIP – Object Definitions for Data Collection – Version 1	Recommended Standard – to be published January 2006	Deals with the data stored in roadside count stations.
NTCIP 1207	NTCIP - Object Definitions for Ramp Meter Control – Version 1	Recommended Standard	Defines the data that are found in ramp meters
NTCIP 1208	NTCIP - Object Definitions for Video Switches – User Comment Draft – v01.04	Recommended Standard – to be published January 2006	Defines the data to control a video switch to enable multiple monitors to view multiple video feeds.
NTCIP 1209	NTCIP - Object Definitions for Transportation Sensor Systems – Version 1	Recommended Standard – to be published January 2006	Deals with the data collected by various types of detectors used by real-time management systems.
NTCIP 1210	NTCIP – Objects for Signal System Masters – User comment draft – v01.14	Resolving user comments	Defines the data used to control a field master
NTCIP 1211	NTCIP – Objects for Signal Control and Prioritization – User comment draft – v01.37b	In balloting.	Defines the data for controlling traffic signal systems in priority applications

Document Number	Standard Title	Status	Description
NTCIP 1212	NTCIP – Objects for Network Camera Operations – Working Group Draft	In development	Defines the data that are used with digital image cameras
NTCIP 1213	NTCIP – Objects for Electrical and Lighting Management Systems – v01.03b	Recommended Standard	Defines the data for roadside electrical and lighting management systems

Center-To-Center Standards

When specifying the NTCIP center-to-center standards, both the base standard and protocol (communications protocol) and the primary standard (messages) must be specified.

NTCIP 1100 Series

The NTCIP 1100 series of standards consists of the base standards. This series consists of the basic rules on how to use and deploy the NTCIP ITS standards. The 1100 series of standards for center-to-center communications consists of the following standards:

Document Number	Standard Title	Status	Description
NTCIP 1104	NTCIP Center-to-Center Naming Convention Specification – v01.08c	Recommended Standard	Defines the naming convention for use in center-to-center communications in the transportation domain, and lists the requirements for establishing names for center resources.

The NTCIP 1104 standard was developed to aid in the unique assignment of identifiers to center resources. This standard is intended as a supporting standard.

NTCIP 2300 Series

The NTCIP 2300 series of standards are application layer standards that define the rules and procedures for exchanging information data. The rules may include definitions of proper grammar and syntax of a single statement, as well as the sequence of allowed statements. These standards are roughly equivalent to the Session, Presentation, and Application Layers of the seven (7) layer Open Systems Interconnect (OSI) model. The 2300 series of standards for center-to-center communications consists of the following standards:

Document Number	Standard Title	Status	Description
NTCIP 2304	NTCIP - Application Profile - Data Exchange (DATEX)	Recommended Standard	Defines how to use the DATEX-ASN protocol within US-based transportation networks.

NTCIP 2306	Application Profile for XML in ITS Center to Center Communications (AP-C2CXML)	User Comment Draft	Specifies communications interfaces (message form, message use, and transport) encoded in the Extensible Markup Language (XML) between a center and an external center.
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It is important to note that the Application Profiles cover only message transport and message encoding options. The content of the messages themselves have been developed by the message set standards working groups.

When specifying an implementation of an ITS system requiring the use of the NTCIP center-to-center standard, one of the NTCIP 2300 series of standards should be specified. If the implementation of the center-to-center communications will use DATEX, NTCIP 2304 should be specified. However, it is expected that future implementations of center-to-center communications will use XML, and those implementations should specify NTCIP 2306.

NTCIP 1300 Series

The NTCIP 1300 series of standards are mainly primary standards that define the messages for transmitting specific pieces of information between management centers. The message set definitions provides the information definition (semantics) and format (syntax) to handle individual information exchanges on specific topics.

Currently, only one message set standard has been developed by auspices of the NTCIP family of standards, NTCIP 1301, Weather Reports. However, other message sets have been developed by other standards development organizations, including IEEE (IEEE 1512 for Incident Management).

Document Number	Standard Title	Status	Description
NTCIP 1301	NTCIP Weather Report Message Set for ESS – Working Group Draft	In development	Defines the message set to exchange weather and pavement data between centers

As indicated in the table, NTCIP 1301 is still under development, and there are no known implementations of the standard. It is not considered a key standard for New York State.

NTCIP 9000 Series

The NTCIP 9000 series of standards are information reports. The documents in this series are not standards, but are papers that provide guidance to users on how to use, deploy, and implement the NTCIP family of standards.

Document Number	Standard Title	Status	Description
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NTCIP 9001	NTCIP Guide	Approved	Guide on the NTCIP Family of Standards.
NTCIP 9010	XML in ITS Center-to-Center Communications	Recommended Information Report	General information report describing XML-based standards development efforts.
NTCIP 9012	Users Guide to Testing	User Commend Draft	General guide for those interested in developing testing programs (whether private or public institutions) for NTCIP-based field device communications.

3 APTA – American Public Transportation Association

APTA is an international organization that represents and promotes all aspects of the transit industry, including bus, rapid transit and commuter rail systems, as well as the organizations responsible for planning, designing, constructing, financing and operating transit systems. The organization has recently assumed the lead role in the development of standards for the transit community.

A suite of Transit Communications Interface Profiles (TCIP) standards were originally developed and published by ITE (through the NTCIP effort). These standards, which covered most of the interfaces to the Transit Management Subsystem of the National ITS Architecture, defined data and messages for the interfaces.

Document Number	Standard Title	Status	Description
NTCIP 1400	TCIP Framework Standard	Approved Standard	Defines how the various NTCIP 1400 series of standards work together.
NTCIP 1401	TCIP Common Public Transportation (CPT) Objects	Approved Standard	This standard defines those data elements and data frames that are generic to multiple TCIP Business areas.
NTCIP 1402	TCIP Incident Management (IM) Bus. Area Std.	Approved Standard	This standard defines data elements and messages used for exchanging information on incident management operations.
NTCIP 1403	TCIP Passenger Information (PI) Bus. Area Std.	Approved Standard	This standard defines data elements and messages used for passenger information data exchanges.
NTCIP 1404	TCIP Scheduling/Runcutting (SCH) Bus. Area Std.	Approved Standard	This standard defines data elements and messages used to exchange information about transit schedules and runcutting information.
NTCIP 1405	TCIP Spatial Representation (SP) Bus. Area Std.	Approved Standard	This standard defines data elements and messages used to exchange location and spatial concepts.
NTCIP 1406	TCIP On-Board (OB) Objects	Approved Standard	This standard defines data elements and messages used to exchange data about devices and operations on-board the transit vehicle.
NTCIP 1407	TCIP Control Center (CC) Objects	Approved Standard	Defines data elements and messages for exchanges between control centers.
NTCIP 1408	TCIP Fare Collection (FC) Objects	Approved Standard	This standard defines data elements and messages used to exchange information about fare collection operations.
APTA TCIP-S-001	TCIP Dialogs – Transit Communications Interface Profile	In Development	Allows TCIP components to communicate with one another in a standardized manner.

4 ASTM International

ASTM International, originally known as the American Society for Testing and Materials (ASTM), provides a forum for producers, users, consumers, and others who have interests in standard test methods, specifications, practices, guides, classifications, and terminology.

Document Number	Standard Title	Status	Description
ASTM WK7592	Standard Practice for Metadata to Support Archived Data Management Systems	In development	Specifies how to annotate data for subsequent uses.
ASTM WK7604	Standard Specification for Archiving ITS-Related Traffic Monitoring Data	In development	Specifies a data dictionary for archiving traffic data.
ASTMA E2259-03	Standard Guide for Archiving and Retrieving ITS-Generated Data	Published Standard	This guide covers desired approaches to be considered and followed in planning, developing, and operating specific ADMS for the archiving and retrieval of ITS-generated data

5 IEEE – Institute of Electrical and Electronics Engineers

Document Number	Standard Title	Status	Description
IEEE P1512.BASE	Standard for Common Incident Management Message Sets for use by Emergency Management Centers	Published Standard	Standards describing the form and content of the incident management messages sets for emergency management systems (EMS) to traffic management systems (TMS) and from emergency management systems to the emergency telephone system (ETS) or (E911).
IEEE P1512.1	Standard for Traffic Incident Management Message Sets for Use by EMCs	Published Standard	Enables consistent standardized communications among Incident Management centers, fleet and freight management centers, information service providers, emergency management centers, planning subsystems, traffic management centers and transit management centers.
IEEE P1512.2	Standard for Public Safety Incident Management Message Sets for Use by EMCs	Balloted	A comprehensive set of messages required for incident management that is unique to public safety communications. These message sets will be generated and transmitted among the emergency management subsystem to all the other subsystems and public safety providers.
IEEE P1512.3	Standard for Hazardous Material Incident Management Message Sets for Use by Emergency Management Centers	Published Standard	Enables consistent standardized communications among incident management centers, HAZMAT teams, police, local government, special emergency and emergency management centers.
IEEE P1512.4	Standard for Common Traffic Incident Management Message Sets for Use in Entities External to Centers	Working Group Draft	Addresses Traffic Incident Management Message Sets which will be exchanged by and between mobile data terminals in response vehicles including mobile command posts and to their respective response and/or dispatch centers such that the exchange of information will be standard and produce the needed response(s). Limited to common message sets for use by emergency management including transportation, fire/rescue, enforcement, HazMat, etc.
IEEE 1570	Standard for the Interface Between the Rail Subsystem and the Highway Subsystem at a Highway Rail Intersection	Published Standard	This standard defines the logical and physical interfaces, and the performance attributes for the interface between the rail subsystem and the highway subsystem at a highway rail intersection.
IEEE P1609.1	Standard for Wireless Access in Vehicular Environments (WAVE) – Application Resource Manager	Under Development	This standard describes a resource manager that arbitrates requests for transponder usage.
IEEE P1609.2	Standard for Wireless Access in Vehicular Environments (WAVE) – Application Services	Under Development	Describes application services, notably radio security, used in conjunction with the resource manager.
IEEE P1609.3	Standard for Wireless Access in Vehicular Environments (WAVE) - Networking Services	Under Development	Describes standard that supports higher layer communication stacks, including TCP/IP.
IEEE P1609.4	Standard for Wireless Access in Vehicular Environments (WAVE) - Multi-Channel Operations	Under Development	Describes extension services for the Media Access Control (MAC), channel delegation, and interface to 802.11 p standard formats for WAVE/DSRC applications at 5.9 GHz.

6 ITE – Institute of Transportation Engineers

Document Number	Standard Title	Status	Description
ITE TM 2.1	ITE/AASHTO – Traffic Management Center-to-Center Communications (Advanced Traffic Management Data Dictionary (TMDD) and Message Sets (MS)) version 2.1	Published Standard	A message set standards for communication between traffic management centers and other centers. This document contains messages and data elements for roadway links and for incidents and traffic-disruptive roadway events. Includes data elements for traffic control, ramp metering, traffic modeling, video camera control traffic, parking management and weather forecasting, as well as data elements related to detectors, actuated signal controllers, vehicle probes, and dynamic message signs.
ITE 9603-1	Application Programming Interface (API) Standard for the Advanced Transportation Controller (ATC)	Under Development	An advanced transportation controller (ATC) software application program interfaces (APIs) that support ITS data flows and standards enabling the deployment of ITS functions. The APIs provide a template for API programming for specific functionality associated with equipment and market packages defined by the National ITS Architecture.

7 SAE – Society of Automotive Engineers

Document Number	Standard Title	Status	Description
SAE-J2354	Message Sets for Advanced Traveler Information Systems (ATIS) Revision 2.0	Published standard	A basic message set using the data elements from the ATIS data dictionary needed by potential information service providers to deploy ATIS services and to provide the basis for future interoperability of ATIS devices.
SAE-J2734	Standard for Data Dictionary and Message Sets for Dedicated Short Range Communications (DSRC)	Under development	This standard will assure that DSRC applications will be interoperable. Applications such as collision avoidance, emergency vehicle warnings, and signage require this standard before they can be effective.
SAE-J2529	Rules for Standardizing Street Names and Route IDs	Recommended Standard	Specifies the rules for standardizing street names for use in ATIS and other ITS applications.
SAE-J2266	Location Referencing Message Specification	Recommended Standard	Specifies rules for encoding various forms of geographic information.
SAE-J2540-2	ITIS (International Traveler Information Systems" Phrase List	Recommended Standard	Specifies rules for encoding and list of standardized identifiers and accompanying phrases used in the descriptions of transportation and ITS information.