

Vermont Statewide Intelligent Transportation Systems Plan Update

Executive Summary

September 30, 2005

Prepared for:

Vermont Agency of Transportation

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Revision History

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Executive Summary

Introduction

The Vermont Statewide Intelligent Transportation Systems Plan Update Project was undertaken to update the Intelligent Transportation Systems (ITS) Strategic Plan for the State of Vermont that was originally developed in 1999 (and formally adopted by VTrans in 2002). This current project is intended to address the expanded realm of ITS in Vermont and to respond to specific recommendations and requirements needed to bring the State into compliance with current (2003) ITS program standards set by the Federal Highway Administration (FHWA) for development of architecture, strategic plans, and standards plans.

The major objective of this project is to provide VTrans with a comprehensive, statewide ITS plan and architecture that will enable VTrans and other agencies in Vermont to continue to deploy and integrate ITS technologies as a regular component of their transportation planning and design process; to assist in the maintenance and operations of the statewide transportation network; to provide VTrans and other Vermont agencies with tools to ensure that the planning, deployment and integration of ITS systems throughout the state is done with a common framework through ITS architecture and standards development; and to ensure that ITS systems, architecture and standards comply with federal requirements, as stated in the Code of Federal Regulations, and meet the approval of the Federal Highway Administration.

This project has created three documents which will be summarized in this Executive Summary:

- Vermont Statewide ITS Architecture document
- Vermont Strategic Plan for ITS Deployment document
- Standards Plan document

In addition, two other key outputs of the project will also be addressed by this Executive Summary:

- Vermont Statewide ITS Architecture web page
- Vermont Statewide ITS Architecture Turbo Architecture Database

The development of the Vermont Statewide Intelligent Transportation Systems (ITS) Architecture Plan and Strategic Deployment Plan project has created a statewide regional ITS architecture for the state of Vermont. This statewide ITS architecture is to be considered a roadmap for transportation systems integration in the State of Vermont over the next 15 to 20 years. This architecture has been developed through a cooperative and consensus based effort led by the State's transportation agency, with the participation of members of their statewide ITS stakeholders group, covering all modes and all roads in the State. This architecture represents a shared vision of how

each agency's systems work together currently or will work together in the future, sharing information and resources to provide a safer, more efficient, and more effective transportation system for travelers in the State.

Purpose

The Vermont Statewide ITS Architecture represents a consensus blueprint for ITS Investments in the state. Why develop this ITS architecture? First and foremost, the architecture defines possible integration opportunities between agencies within the state and identifies how cooperation between the agencies in the deployment of ITS systems can be used to satisfy transportation needs. By defining what currently exists in the area of ITS deployments, the Statewide ITS architecture can be used to identify gaps in needed ITS services and can identify how these gaps might be addressed.

The architecture can be used to efficiently structure implementations of ITS technologies. By creating a long range plan for the implementation of these systems and technologies, agencies can:

- Prepare for future expansion
- Leverage funding
- Identify standard interfaces

Finally, development of the Vermont Statewide ITS Architecture allows Vermont to comply with the FHWA Rule/FTA Policy on Architecture and Standards. The FHWA Final Rule (and corresponding FTA policy) to implement Section 5206(e) of the TEA-21 requires that Intelligent Transportation Systems (ITS) projects funded through the Highway Trust Fund conform to the National ITS Architecture and applicable standards. The Rule/Policy requires that the National ITS Architecture be used to develop a local implementation of the National ITS Architecture, which is referred to as a "Regional ITS Architecture." The federal deadline for conformance to this Final Rule/Policy was April 8, 2005. The development of this statewide architecture will make the entire state of Vermont fully compliant with this Rule/Policy, which will facilitate the approval of federal funds to support ITS projects in the state.

Major Findings and Highlights

The development of this statewide ITS architecture is being done to support transportation planning at the state and regional levels. As such, the architecture is ultimately an expression of ITS services that can be implemented to meet transportation needs. What makes up a statewide ITS architecture? The following are the key aspects to the statewide ITS architecture:

- **Scope.** A definition of the geographic scope, timeframe, and range of services covered by the ITS architecture.
- **Stakeholders.** The agencies or organizations involved in surface transportation in the state.
- **Inventory.** A set of “elements” that represent the systems (or parts of systems) owned, managed, or maintained by the stakeholders.
- **Needs and Services.** These represent how the ITS elements will share information to provide services that satisfy transportation needs. Each architecture defines a set of customized services, referred to as “Customized Market Packages” (after the name given in the National ITS Architecture to represent how ITS provides specific surface transportation services).
- **Operational Concept.** A description of the roles and responsibilities of the stakeholders in providing the ITS Services.
- **Functional Requirements.** Each major element in the architecture has functional requirements that it must meet to provide the functionality implied by the market packages in which it participates.
- **Interfaces and Information Exchanges.** The interfaces and information flows between the elements are the details of the architecture and are described in a set of customized market packages.
- **Standards.** The definition of interfaces and information flows provides a pointer to ITS standards that may be applicable in the regional or statewide deployments.
- **Project Sequencing.** Projects are the high level definition of how one or more customized market packages defined by the architectures will be implemented. While the architecture represents a long range vision for transportation in the state or individual region, projects will be implemented in some sequence or time order (short term to long term) depending on a variety of factors including agency priorities, funding, technical issues, and institutional issues.
- **Agreements.** The definition of interfaces between the elements of different agencies identifies the possible need for formal or informal agreements between these agencies.
- **Statewide ITS System Planning and Deployment Process.** The definition of how the ITS architectures will be used to support both transportation planning and project development.

The project outputs described above were developed with extensive, consensus stakeholder review.

Scope

The geographic scope of the Vermont Statewide ITS Architecture is, naturally, the entire state covering all the highways and arterials in the state as shown in Figure 1. In addition to the State of Vermont, the geographic scope includes projects and systems that cross state or provincial boundaries. A timeframe of 20 years into the future was chosen for the architecture development. Regarding scope of services, typical statewide ITS architectures cover those services that are statewide in nature (e.g. Commercial Vehicle Operations or Electronic Toll Payment) as well as services of statewide agencies (e.g. transit). However, since there is only one other known ITS architecture in the state (CCMPO Regional ITS Architecture for Burlington, VT), the Statewide ITS Architecture for Vermont covers general services in the areas of Traffic Management, Traveler Information, Emergency Management, Transit Management, Archive Data Management, and Maintenance Management.

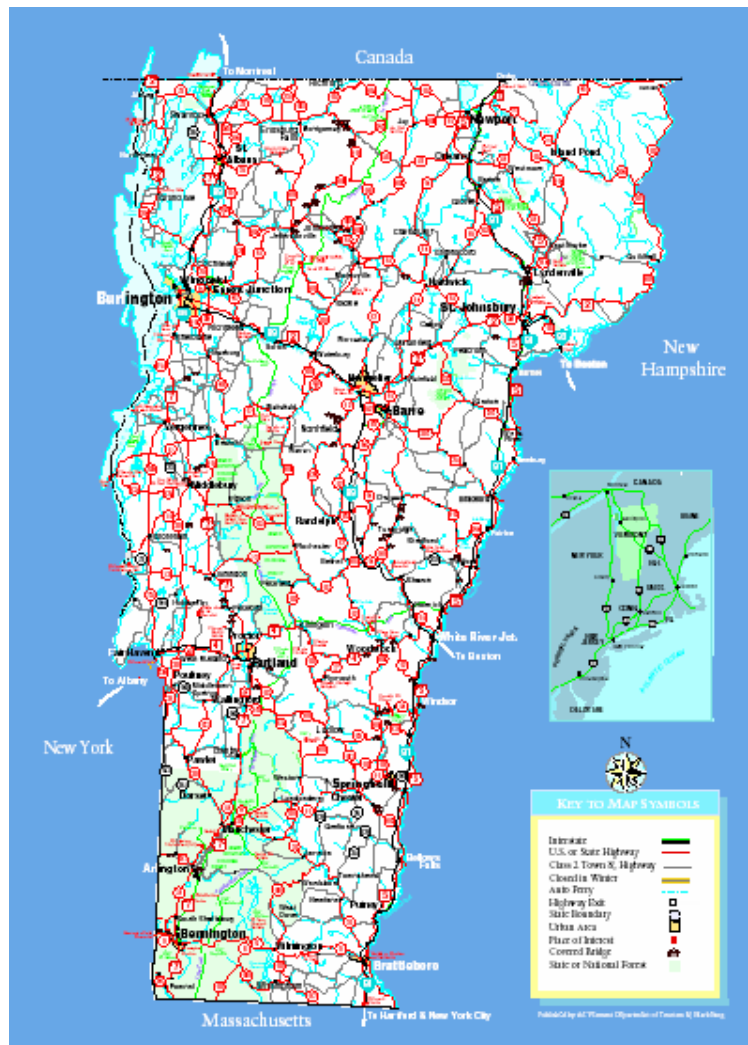


Figure 1. State of Vermont

Stakeholders

Stakeholder coordination and involvement is one of the keys to the development of an ITS architecture. Who are the stakeholders? A stakeholder is any organization or agency that has a vested interest in the transportation systems within a region. Throughout the course of this project, the stakeholders of the region (the State) have been brought together to develop, review, and comment on key aspects of the Vermont Statewide ITS Architecture. The stakeholder meetings that were held on this project included:

- Architecture Workshops (19 April, 2004 and 11 June, 2004)
- Standards Development Plan meeting (29 November, 2004)
- Strategic Deployment Plan for ITS Workshop (30 November, 2004)

These meetings helped aid in the development of the Statewide ITS Architecture for Vermont, the development of the Strategic Deployment Plan for ITS, and the Standards Plan. In addition, these meetings helped the architecture team and other stakeholders develop an understanding of systematic problems within the region, and allowed for open discussions between stakeholders to begin the process of developing institutional agreements between agencies. There were approximately 37 stakeholders from various agencies or organizations that participated in these workshops and meetings. The stakeholders came from a wide array of state, county, and local agencies representing public safety, transportation operations, transit operations, transportation planning.

Table 1 summarizes the organizational participation at the workshops. The first column indicates the agency/organization the stakeholder represented. The second column indicates the number of different individuals from that organization that attended workshops, while the third column indicates that total number of meetings at which the organization was represented.

Table 1. Stakeholder Participation at Stakeholder Meetings and Workshops

Organization	Representation	Stakeholder Participation in Meetings
Addison County RPC	1	1
Advance Transit	1	1
CCTA	1	1
Central Vermont RPC	1	1
Chittenden County Metropolitan Planning Organization (CCMPO)	1	3
Federal Motor Carrier Safety	1	1
Marble Valley Transit	2	3

Organization	Representation	Stakeholder Participation in Meetings
NHDOT	1	3
Rutland RPC	1	1
Southern Windsor County Regional Planning Commission	1	1
U.S. DOT, FHWA Vermont Division	1	2
U.S. DOT, FHWA New Hampshire Division	1	1
University of Vermont	1	1
Vermont Dept of Building and General Services	2	2
VT Dept of Public Safety	2	2
VT Public Service Dept	1	2
VTrans DMV	2	4
VTrans	17	4

A more detailed discussion of the stakeholders for the project is given in Section 3 of the Vermont Statewide ITS Architecture document and in Section 4 of the Vermont Strategic Plan for ITS Deployment document.

Inventory

The Statewide ITS Architecture for Vermont is defined by a set of ITS elements, also known as the ITS Inventory. An ITS element is defined as the name used by the stakeholder to describe an ITS system. Some examples of ITS elements (and their stakeholders) are:

- VTrans State TOC (VTrans Operations)
- Marble Valley Transit Dispatch (Marble Valley Transit)
- VSP Headquarters (Vermont Department of Public Safety)

In some cases the ITS elements represent parts of a system (rather than the complete system). Some examples of this are:

- Municipal Field Equipment (Municipal Engineering Departments) which represents field equipment such as dynamic message signs, CCTV, etc.
- VTrans Traffic Signals (VTrans Program Development)

In addition ITS elements may represent other non-ITS systems that interface with ITS systems. Some examples of this type of element are:

- Print and Broadcast Media
- Regional Hospitals

There are 158 different ITS elements defined in the Vermont Statewide ITS Architecture. For each ITS element the Inventory contains a definition, assignment to stakeholder, and a mapping to entity of the National ITS Architecture. This last aspect of the inventory is used to connect the statewide ITS architecture to the National ITS Architecture so that the services, interfaces, and information flows defined in the national effort can be used for the statewide architecture. The National ITS Architecture defines 22 subsystems (the major “players” in providing ITS services) and 73 Terminators (the “players” who are on the edge of the architecture. The subsystems exchange information with these peripheral players). The 22 subsystems of the National ITS architecture can be shown on a single diagram called the “sausage diagram” given in Figure 2.

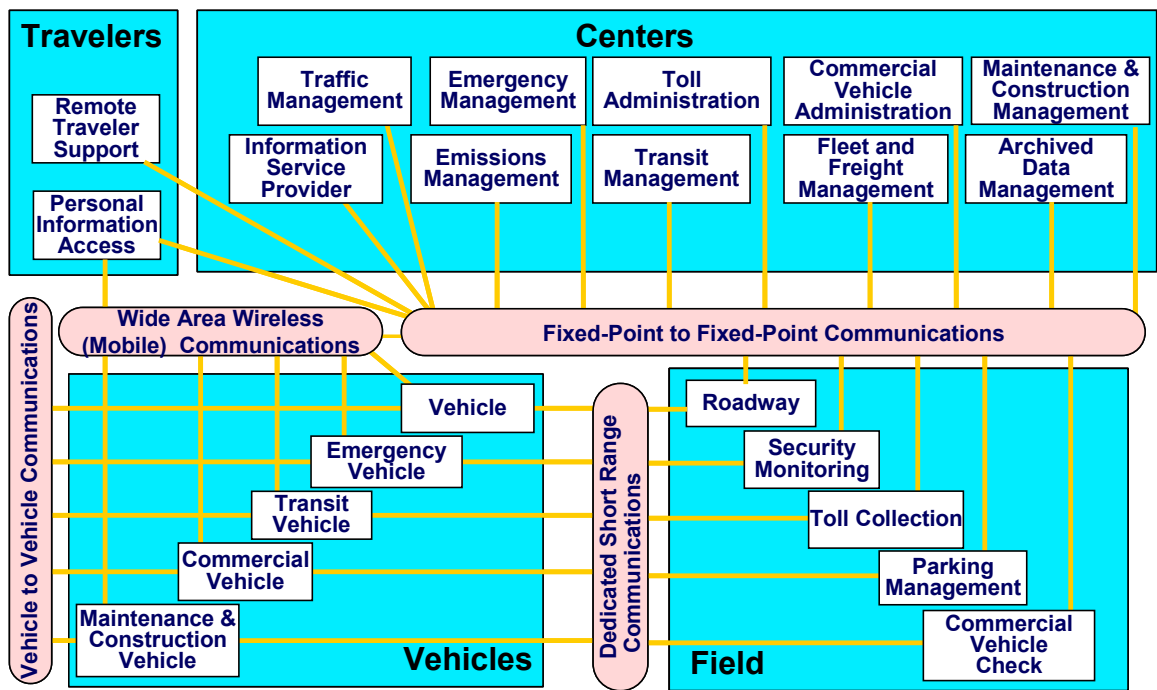


Figure 2. National ITS Architecture Sausage Diagram

A brief analysis of the mapping of the Statewide Architecture’s elements to the National ITS Architecture yields the following summary statistics. These statistics are derived from the Statewide Architecture database and provide an indication of the number and types of ITS elements included in the Vermont Statewide ITS Architecture.

Table 2. ITS Inventory Summary Statistics

Subsystem	Number of Existing Elements Mapped to Subsystem	Number of Planned Elements Mapped to Subsystem
Archived Data Management Subsystem	6	1
Commercial Vehicle Administration	8	9
Commercial Vehicle Check	2	3
Commercial Vehicle Subsystem	1	0
Emergency Management Subsystem	21	3
Emergency Vehicle Subsystem	6	0
Emissions Management	0	0
Fleet and Freight Management	1	0
Information Service Provider	15	3
Maintenance and Construction Management	11	1
Maintenance and Construction Vehicle	2	0
Parking Management	0	0
Personal Information Access	0	1
Remote Traveler Support	5	3
Roadway Subsystem	8	1
Security Monitoring Subsystem	0	1
Toll Administration	0	0
Toll Collection	0	0
Traffic Management	8	2
Transit Management	12	1
Transit Vehicle Subsystem	7	1
Vehicle	2	0

Additional details relating to the inventory are contained in Section 4 of the Vermont Statewide ITS Architecture document and on the Vermont Statewide ITS Architecture web page.

Needs and Services

User needs were identified throughout the ITS architecture development process. The needs, as expressed by the stakeholders, are fulfilled by ITS services. The services were identified from the approximately 80 specific ITS services identified in the National

ITS Architecture. These services are called Market Packages in the National ITS Architecture. Market packages collect together two or more system elements (from the same or multiple stakeholders) that can work together to deliver a given transportation service and the architecture flows that connect them. External systems on the boundary of ITS are also included. In other words, Market Packages identify the ITS system elements required to implement a particular transportation service. Market packages included in the Vermont Statewide ITS Architecture were tailored to fit, separately or in combination, real-world transportation problems and needs.

Customized market packages represent the stakeholder consensus requirements for information that may be exchanged between specific ITS elements to effect specific sets of ITS services. The customized market packages for the Vermont Statewide ITS Architecture have been organized by transportation functional area as follows:

- Archived Data Management Systems (AD)
- Advanced Public Transportation Systems (APTS)
- Advanced Traveler Information Systems (ATIS)
- Advanced Traffic Management Systems (ATMS)
- Commercial Vehicle Operations (CVO)
- Emergency Management (EM)
- Maintenance and Construction (MC)

The Vermont Statewide ITS Architecture contains 157 separate customized market package diagrams. Figure 3 is an example of a customized ATMS market package showing the service Regional Traffic Control for the element VTrans State TOC. This diagram indicates the interfaces and information flows between the VTrans State TOC and other traffic management elements in the state (or in bordering states/province).

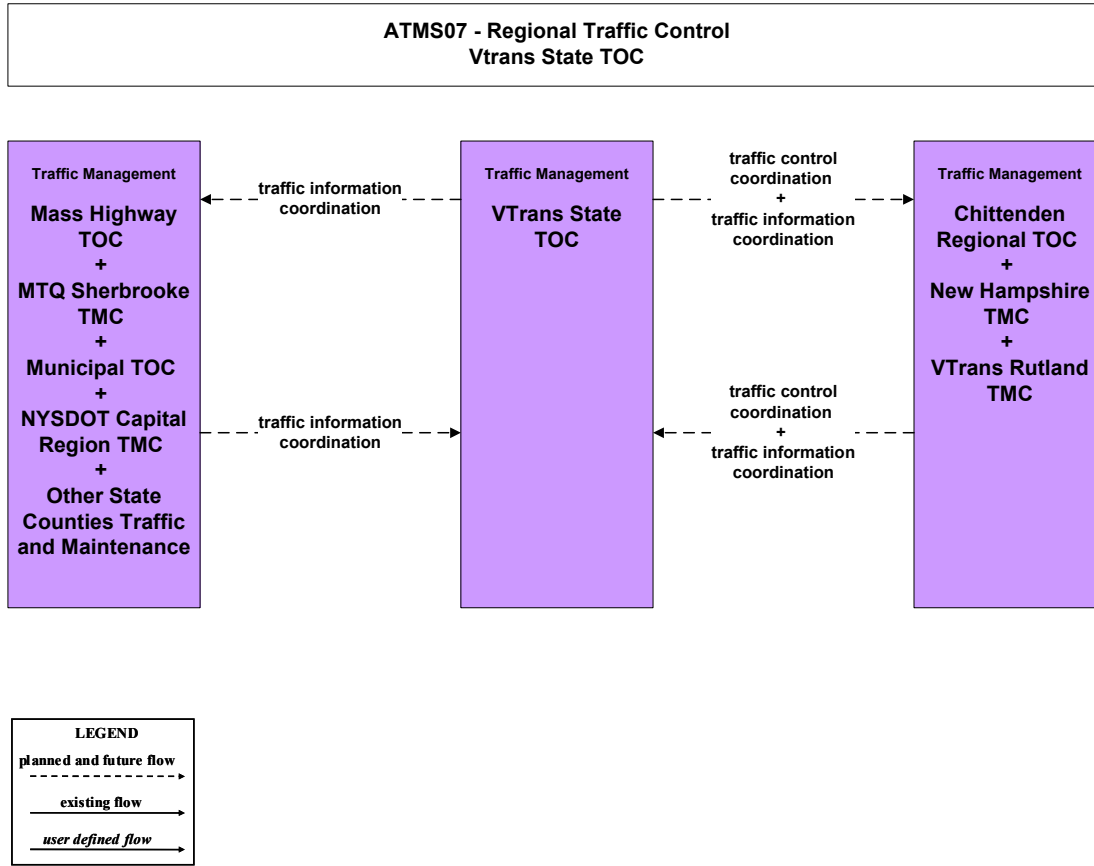


Figure 3: Example of Customized Market Package

An analysis of the customized market packages by functional area reflects the following summary statistics. The first column represents Functional Area name for the Market Package diagrams. The second column identifies the number of Market Package diagrams in the Vermont Statewide ITS Architecture for each corresponding functional area.

Table 3. Number of Customized Market Package Diagrams by Functional Area

Functional Area	Number of MP Diagrams
Advanced Traffic Management Systems	38
Maintenance and Construction	28
Advanced Public Transportation Systems	40
Advanced Traveler Information Systems	6
Commercial Vehicle Operations	13
Emergency Management	16
Archived Data	6
Totals	157

A more detailed discussion of the market packages identified for the project is given in Section 5 of the Vermont Statewide ITS Architecture document and in Section 5 of the Vermont Strategic Plan for ITS Deployment document.

Operational Concept

An Operational Concept documents each stakeholder's current and future roles and responsibilities in the operation of the regional ITS systems. The operational concept documents these roles and responsibilities across a range of transportation services. The detailed output, covered in Section 3.2 of the Vermont Statewide ITS Architecture document addresses the following areas of ITS:

- Traffic Signal Control
- Freeway Control
- Incident Management
- Transit Management:
- Traveler Information
- Emergency Management
- Maintenance and Construction Management
- Archive Data Management
- Electronic Payment

An example of these roles and responsibilities for VTrans Operations Division in providing Freeway Control is:

- Monitor traffic sensors on freeways
- Monitor surveillance cameras on freeways
- Operate traffic information devices on freeways (e.g. DMS and Highway Advisory Radios- HAR)
- Provide traffic information reports to other agencies
- Enter traffic information into CARS

Functional Requirements

An ITS Architecture is a functional architecture. The information exchanged between ITS elements in the architecture is driven by functions resident in each of the ITS elements defined in the architecture. The functions describe the tasks or activities performed by the ITS elements and “what” is done with the information received by the ITS element. For the Vermont Statewide ITS Architecture, both high level functions and detailed functional requirements are defined for the elements in the inventory.

A more detailed discussion of functional requirements is given in Section 7 (and Appendix C) of the Vermont Statewide ITS Architecture document.

Interfaces and Information Exchanges

Interfaces and information exchanges define the details of how the different ITS elements in the architecture are connected. A system interface answers the question, “What ITS elements are connected?” A set of information exchanges answer the question, “What information and control exchanges (existing and planned) occur between ITS Elements?” Information flows represent these information and control exchanges between ITS elements in the architecture. Considering all the elements in the inventory, a top level interconnect diagram for the Statewide ITS Architecture was created as shown in

Figure 4. This represents a Vermont version of the “sausage diagram” presented earlier.

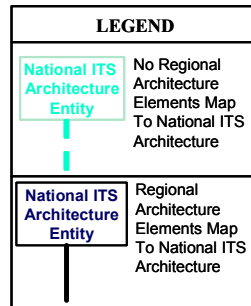
System interfaces were refined through the process of editing the customized market package diagrams. Where stakeholders defined a need for an information or control

exchange, an information flow was placed between system elements. Where no need was identified, the information flows were removed. And, where new local requirements were identified, outside of the scope of the National ITS Architecture, new information flows were created and documented.

The Vermont Statewide ITS Architecture contains 539 interfaces (separate connections between systems) and 1,807 information flows.

The focus of the ITS Architecture is on *external* interfaces between ITS elements. (*External* in the sense that architecture flows that connect different stakeholder ITS elements are “external” to either of the stakeholders.) This focus on external interfaces acknowledges that usually the most difficult and time consuming barrier to deployment of interoperable ITS elements in a region or state is achieving the institutional agreement between stakeholders to exchange specific information between specific ITS elements. An objective of the Vermont Statewide ITS Architecture is to specifically identify these information exchange requirements very early in the process of deployment, so that the time consuming process of achieving prerequisite institutional agreements can proceed as early as possible.

A more detailed discussion of interfaces and information exchanges is given in Section 6 of the Vermont Statewide ITS Architecture document and on the Vermont Statewide ITS Architecture web page.



Remote Traveler Support Subsystem
*Building and General Services Rest Area Traveler Information Centers
Bus Stop Displays
*CCTA Bus Stop Displays
CCTA Transit Transfer Centers
Marble Valley Transit Kiosks
Transit Transfer Centers
*Vermont Smartcard Kiosks
Vermont Welcome Center Kiosks
Personal Information Access Subsystem
Traveler Information Device
Commercial Vehicle Subsystem
Commercial Vehicles
Emergency Vehicle Subsystem
DMV CV Enforcement Vehicles
Municipal Public Safety Vehicles
Private Tow and Wrecker Vehicles
Special Police Vehicles
VSP Vehicles
Maintenance and Construction Vehicle Subsystem
Municipal Maintenance Vehicles
VTrans Maintenance Vehicles
Transit Vehicle Subsystem
Advance Transit Vehicles
*CCTA Demand Response Vehicles
CCTA Fixed Route Transit Vehicles
GMTA Vehicles
Independent School District Buses
Local Transit Vehicles
Marble Valley Transit Vehicles
SSTA Demand Response Vehicles
Vehicle Subsystem
Commercial Vehicles
Private Vehicles

* Elements are planned, not existing.

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Archived Data Management Subsystem	Information Service Provider Subsystem
AOT Traffic Research	*VTrans CARS Information System
CARS Server	VTrans Public Information Office
CODES Database	VTrans Website
Commercial Vehicle Data Archive	Emergency Management Subsystem
Maintenance Activity Tracking System (MATS)	City of Burlington EOC
Vermont DMV Crash Records Archive	E 9-1-1 Board System
*VTrans Central Crash Records Database	Federal Homeland Security Office
VTrans Data Warehouse	*Inland Check Facility
Information Service Provider Subsystem	Municipal Public Safety Dispatch
Advance Transit Website	Other County/State/Province/Federal Public Safety Dispatch
CARS Server	Other Municipal Public Safety
*CCMPO Website	Other State/Province/County Public Safety Dispatch
CCTA Website	Private Tow and Wrecker Dispatch
*Cellular Probe Data Provider	Special Police Dispatch
FORETELL Website	Vermont Emergency Management
GMTA Website	Vermont Enhanced 9-1-1 System
Independent School District Websites	*Vermont Homeland Security Office
Local Transit Websites	Vermont Statewide EOC
Marble Valley Transit Website	VSP Derby Comm Center (Troop B)
Municipal Websites	VSP Headquarters
Private Traveler Information Systems	VSP Rockingham Comm Center (Troop D)
Regional Information Systems	VSP Rutland Comm Center (Troop C)
Vermont Travel Planner	VSP Williston Comm Center (Troop A)
Vermont Vacation Web Site	*VTrans State TOC

Commercial Vehicle Administration	Traffic Management Subsystem
*Accident Reporting System	CARS Server
AOT Traffic Research	*Chittenden Regional TOC
Commercial Drivers License Information System (CDLIS)	Mass Highway TOC
*E Citation Process	MTQ Sherbrooke TMC
*Excise Summary Terminal Activity Reporting System (EXSTAR)	Municipal TOC
IFTA Clearinghouse	New Hampshire TMC
IRP Clearinghouse	NYS DOT Capital Region TMC
*Other States Credentials Admin and Safety Systems	Other State Counties Traffic and Maintenance
PRISM Central Site	VTrans Central Garage
*Query Central	VTrans Rutland TMC
*Safety and Fitness Electronic Record (SAFER)	*VTrans State TOC
*SafetyNet	Transit Management Subsystem
Solid Hazardous Waste Permitting Database	Advance Transit Dispatch
*US CBP Customs Product Manifest System	*CCTA Demand Response Dispatch
*VT CVIEW System	CCTA Dispatch
*VT CVO Credentials Permitting Interface	CCTA Maintenance Garage
*VT CVO Electronic Permitting System	GMTA Dispatch
	GMTA Maintenance Garage
	Independent School District Dispatch
	Local Transit Dispatch
	Marble Valley Transit Dispatch
	Marble Valley Transit Maintenance Garage
	Other Local Transit Systems
	SSTA Demand Response Dispatch
	Vermont Transit Lines

Maintenance and Construction Management Subsystem
CARS Server
*Chittenden Regional TOC
FORETELL Center Server
Municipal Maintenance Dispatch
Other Municipal Maintenance Dispatch
Other State Counties Traffic and Maintenance
Other VTrans District Maintenance Dispatch
Public and Private Utilities Dispatch
VTrans Central Garage
VTrans District Maintenance Dispatch
VTrans Regional Construction Office
VTrans RWIS Server

Alerting and Advisory Systems
Vermont Statewide EOC
Archived Data User Systems
Archive Data Users
*Crash Records Database Users
Traffic Count Users
Care Facility
Regional Hospitals
Enforcement Agency
*Accident Reporting System
*VT DMV Enforcement and Safety Office

Equipment Repair Facility
VTrans District Equipment Repair Facility
Event Promoters
*Regional Event Operations
Financial Institution
Financial Institutions
Institutions (UVM)

Intermodal Freight Depot
Domestic Intermodal Ports of Entry
International Intermodal Ports of Entry

Maintenance and Construction Administrative Systems
VTrans HQ Operations
Media
TV and Radio Stations
Multimodal Transp. Service Provider
AMTRAK Station Information
Burlington International Airport
Lake Champlain Ferries
Rutland Airport

Other Emergency Management
Other County/State/Province/Federal Public Safety Dispatch
*Statewide Mutual Aid and Incident Management Network

Rail Operations
Railroad Operations Centers
Storage Facilities
VTrans District Storage Facilities
Wayside Equipment
Railroad Wayside Equipment

Vermont Statewide ITS Architecture
"Sausage Diagram"

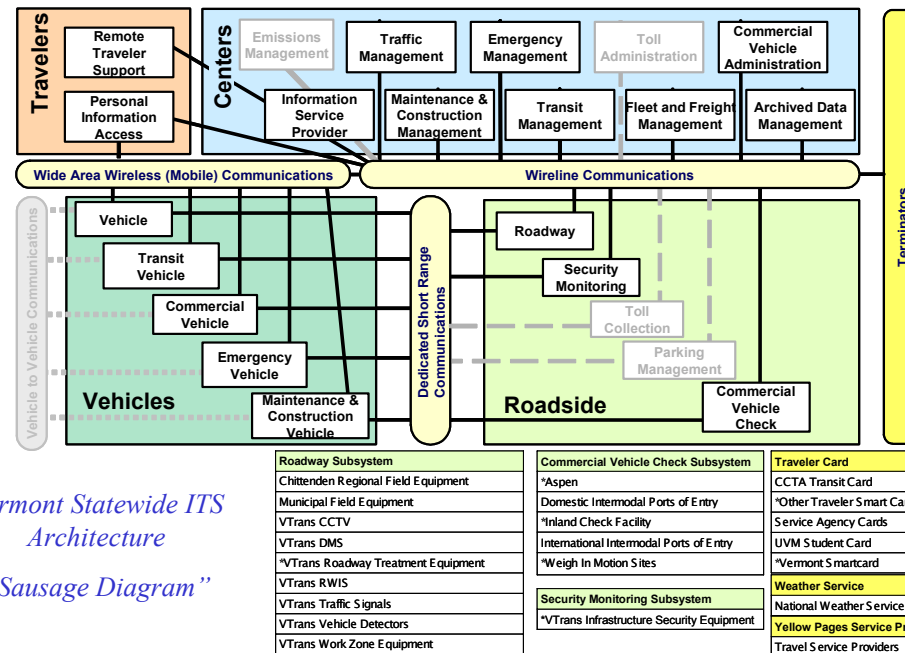


Figure 4 Vermont Statewide System Interconnect Diagram:

Standards

ITS standards establish a common way in which systems and devices connect and communicate with one another. ITS standards are industry-consensus standards that define how ITS system components operate within a consistent framework. Standards are an important tool that will allow efficient implementation of the Statewide ITS Architecture over time. Establishing regional, statewide, and national standards for exchanging information among ITS systems is important not only from an interoperability point of view; it also reduces risk and cost since a region can select among multiple vendors for deployment products. Standards facilitate deployment of interoperable systems at local, regional, and statewide levels without impeding innovation as technology advances and new approaches evolve.

The definition of which ITS standards are relevant to an ITS project can be made initially from the definition of those interfaces from the Statewide ITS Architecture that are included in the project. The information regarding which standards are applicable to each interface is contained on the Statewide ITS Architecture website and in the Turbo Architecture database that describes the architecture.

A detailed discussion of ITS standards and how to incorporate them into the project development process is contained in the Standards Plan document.

Projects

The incorporation of the Vermont Statewide ITS Architecture in the planning process will ultimately yield projects that are linked to the Architecture. Through the deployment of projects produced from the planning process, the ITS services supported in the ITS Architecture will be implemented and made a reality in the transportation system. Project implementation completes the evolution from transportation needs to services, to functional description in the ITS Architecture, to project identification in the planning process, to project definition and deployment. The overarching goal of the Vermont Statewide ITS Architecture development process is for this evolution to take place with the maximum amount of integration that is reasonable so as to efficiently and economically implement the systems required to serve the transportation community and users.

ITS projects were identified for the entire state of Vermont. Additional information from the Chittenden County Metropolitan Planning Organization (CCMPO covers the Burlington region) was gathered and combined with the project information that was received at the state level. Potential projects were also identified through a review of the architecture (to identify services that met identified needs) and through a review of the statewide and regional planning documents (such as the VT - Statewide Transportation Improvement Program (STIP) - FY2004 - FY2006). The ITS Projects identified for the state were mapped to market packages of the Vermont Statewide ITS Architectures.

Then the projects were organized into the following functional areas (using the market package mapping):

- Traffic Management & Maintenance Operations
- Emergency and Incident Management Projects
- Transit/Transit Management Projects
- ATIS Projects
- CVO/CVISN (Commercial Vehicle Information System & Network)
- Miscellaneous Projects (Archive Data, Planning, Demo & Research Projects)

The list of projects was further refined to establish which projects were allocated to the short term (5 years), medium term (5 to 10 years), and long term (over 10 years). This provided a priority for the list of projects denoting a general order for project implementation.

Finally, the team obtained stakeholder feedback on the proposed ITS projects and their prioritization. Obtaining stakeholder feedback was necessary for the following reasons:

- Ensure an ITS Project was consistent with stakeholder needs.
- Confirm estimated timeline or priority for ITS Project deployment.
- Understand the relationship and traceability between ITS projects and the Vermont Statewide ITS Architecture.

The stakeholder feedback was accomplished through a stakeholder workshop where the information was presented and input from the stakeholders was incorporated into the material. The complete list of projects is presented in Chapter 6 of the Vermont Strategic Plan for ITS Deployment.

A small subset of these projects, called *Statewide/Regionally Significant Projects*, are highlighted below. A Statewide/ Regionally Significant Project is one with a short timeframe, AND affecting multiple institutions AND/OR having statewide, regional or extra-regional impact. The Statewide/ Regionally Significant Projects for the Vermont Statewide ITS Architecture are shown in Table 4.

Table 4. Statewide/ Regionally Significant Projects

PROJECT NAME & LOCATION	PROJECT DESCRIPTION	LEAD AGENCY	MARKET PACKAGE
Regional Traffic Signals Entire State of VT	Development of a statewide traffic signal re-timing plan, including: traffic counts, production of synchro files for each intersection, and work orders to implement updated timing schemes, at state-owned signals.	VTrans	ATMS03

PROJECT NAME & LOCATION	PROJECT DESCRIPTION	LEAD AGENCY	MARKET PACKAGE
Traffic Management Information Center (TMIC) Enhancements CCMPO Project	Will upgrade the central control software and hardware systems of previously deployed ITS or ATMS systems. Intent is to combine all desktop control systems into a single regional traffic management system. Intended to create the Chittenden Regional TOC.	CCMPO	ATMS01 ATMS03 ATMS06 ATMS08 ATMS13
Regional Traveler and Tourism Information System	Intended as a tourism system that is centralized and consolidates and distributes static and real-time traveler, weather and tourist information for transportation agencies and the general public. Would also have capabilities of providing travel options based on tourism destination. Would also provide transit opportunities and would present travel time comparisons between bus, rail, and vehicle.	VTrans, ConnectVermont	ATMS06 ATIS1 MC03 MC04 EM06 EM10
Maintenance and Construction Management for Ski Areas Ski Area Application	Intended to include MCI vehicle tracking for snow removal, road weather data collection for travelers, processing and distribution of weather information to travelers and maintenance operations, and tracking and scheduling winter maintenance (snow plows, roadway treatment, etc.).	Private, VTrans	MC01 MC03 MC04 MC06
RWIS - High Priority Stations	Intended to be for the deployment of Road Weather Information Systems (RWIS) throughout all districts. Deployments vary from full RWIS deployment (complete with sensors, cameras, etc.) to just cameras. High priority areas include Searsburg, Manchester, Brattleboro, Marlboro, Fair Haven, Mendon, Mount Holly, Royalton High, Hancock, Williston, Colchester, Cabot, Bolton, Brookfield, Sheffield, Topsham/Groton, Georgia, Milton, Derby and Jay.	VTrans	MC03 MC04
Deployment/Installation of a Transportation Management Information Center (TMIC)	Intended to deploy a Transportation Operations Center (TOC) to control and communicate with various ITS systems, including RWIS, DMS, CCTV, transit, etc. Statewide it will include an electronic version of statewide width or load restrictions posted on the CARS system (for online permitting purposes). Intended to be a joint venture with Vermont Emergency Management that will oversee and coordinate the collection and dissemination of traffic and weather data and information.	VTrans, DPS-VEM	ATMS01, 03, 04, 06, 07, 08, 13, 21 CVO04 MCO3, 04
ITS Data Warehouse	Data collecting and storage of ITS system component. Phase I - CAPS, FORETWLL, WINK data Phase II - ATMS, Signals and Incident Management	VTrans, MPO	AD2

PROJECT NAME & LOCATION	PROJECT DESCRIPTION	LEAD AGENCY	MARKET PACKAGE
E911 - Statewide System	Implementation of E911 throughout the state. Supports ITS services for Automated Crash Notification ("Mayday") service, communications with PSAPs, and coordination of PSAP Disaster Recovery Contingency Plans (DRCPs).	DPS	EM01EM03E M08ATMS08
Various Multimodal Centers	Intended to be for the development and construction of the various multimodal centers within the state of Vermont. Includes Burlington, Brattleboro, Bellows Falls, Montpelier, Winooski, Ferrisburgh, and Milton.	Varies	APTS7
Transit Signal Priority - Initial Design Effort	Intended to be for the development and deployment of transit signal priority devices on transit buses throughout the state (in coordination with the owners of regional traffic signal systems).	Varies	APTS7
Traveler Information for Ski Resorts Ski Resort Application	Includes such services as broadcast traveler information, interactive traveler information, ISP-based route guidance, and yellow pages service provider. Interoperability with ConnectVermont and TRIO.	Private, ConnectVermont, TRIO	ATIS1 ATIS2 ATIS5 ATIS7
Transit Deployment for Ski Resorts Ski Resort Application	Intended to deploy transit vehicle tracking capabilities on existing transit vehicles (or newly requisitioned vehicles) to be able to determine real-time travel information for transit vehicles, avl systems for fixed route transit vehicles and transit traveler information for static scheduling and real time arrival information. Already happening with CCTA, Marble Valley. Public Private Partnerships	Private	APTS1 APTS2 APTS3 APTS4 APTS8
TRIO/CARS Implementation	Intended to furnish travelers (citizens, tourists, etc.) with real-time information on traffic, road conditions, construction, weather, lodging, etc. Includes GIS, DMS, HAR, FM radio, wireless/wireline telephones, PDAs, Amber Alert, and 511. Module 11 includes a Regional truck management, which includes CARS (to provide capabilities for electronic routing of oversize/overweight commercial vehicles). Future capabilities include permitting, modes application- transit vehicle tracking for schedule performance, and trip planning.	VTrans	ATIS1 ATIS2 ATIS5 ATIS7
ConnectVermont	Intended to be a self-standing traveler information system for the state of Vermont (associated with the Rural ITS Architecture). Also intended to communicate with TRIO. Expanding to include AHS, ANR, AG (Agriculture), Parks and Recreation	VTrans	ATIS1 ATIS2 ATIS7

PROJECT NAME & LOCATION	PROJECT DESCRIPTION	LEAD AGENCY	MARKET PACKAGE
ITS/CVO at I-91 Port of Entry	To incorporate ITS/CVO architecture and CVISN/PRISM into the Port of Entry facility on I-91 at the Vermont/Mass border. Would include screening for credentials, weight, length, etc.. and would address other security issues (cargo, credentialing, etc....). (Guildford) Coordination with ANR (for snakes)	DMV	CVO05
Rutland ITS Project	Intended to develop and deploy several ITS applications in the Rutland area, including WIM, RWIS, Incident Management Process Improvements, and flood sensors/warning signs. Virtual operations center, VMS/DMS,	VTrans	CVO06ATMS 01, 08, 12, 21MCO03
Radio Communications System	Radio Communications System - project for state police, state EMS, and all other EMS branches and personnel. Provide a new two way radio system that has interoperability functions between agencies and includes mobile data terminals.		

Agreements

Agreements among the different stakeholder agencies and organizations are required to realize the integration shown in the Vermont Statewide ITS architecture. The architecture development effort identified those agreements that already exist (e.g. those for ConnectVermont and for Amber Alert). The effort also identified many other agreements that might be needed in the future based upon the definition of interfaces between the elements of different agencies.

A more detailed discussion of agreements is given in Section 8 of the Vermont Statewide ITS Architecture document and in Section 7 of the Vermont Strategic Plan for ITS Deployment document.

Statewide ITS System Planning and Deployment Process

The Statewide ITS Architecture provides guidance for planning ITS projects within the state. It also provides information that can be used in the initial stages of project definition and development. To do this, the ITS Architecture must be integrated into the statewide or regional planning processes. As a result of integrating the ITS Architecture into the planning processes, the architecture will link the objectives and needs of the regions with the ITS deployments in the field.

Figure 5 reflects a generic planning process with which all organizations can identify and on which they can base their more detailed process modifications. The right-side of the figure (the Statewide and MPO Planning Process) refers to the process for funding projects that is used by VTrans and the Chittenden County MPO, while the left-side (Other Agency Planning Process) refers to the process used by agencies that fund their projects outside of the traditional transportation planning process (e.g., public safety agencies). Within the state both processes will come into play to fund ITS related

projects. A primary goal of the planning process is to make quality, informed decisions on the investment of funds for regional transportation systems and services.

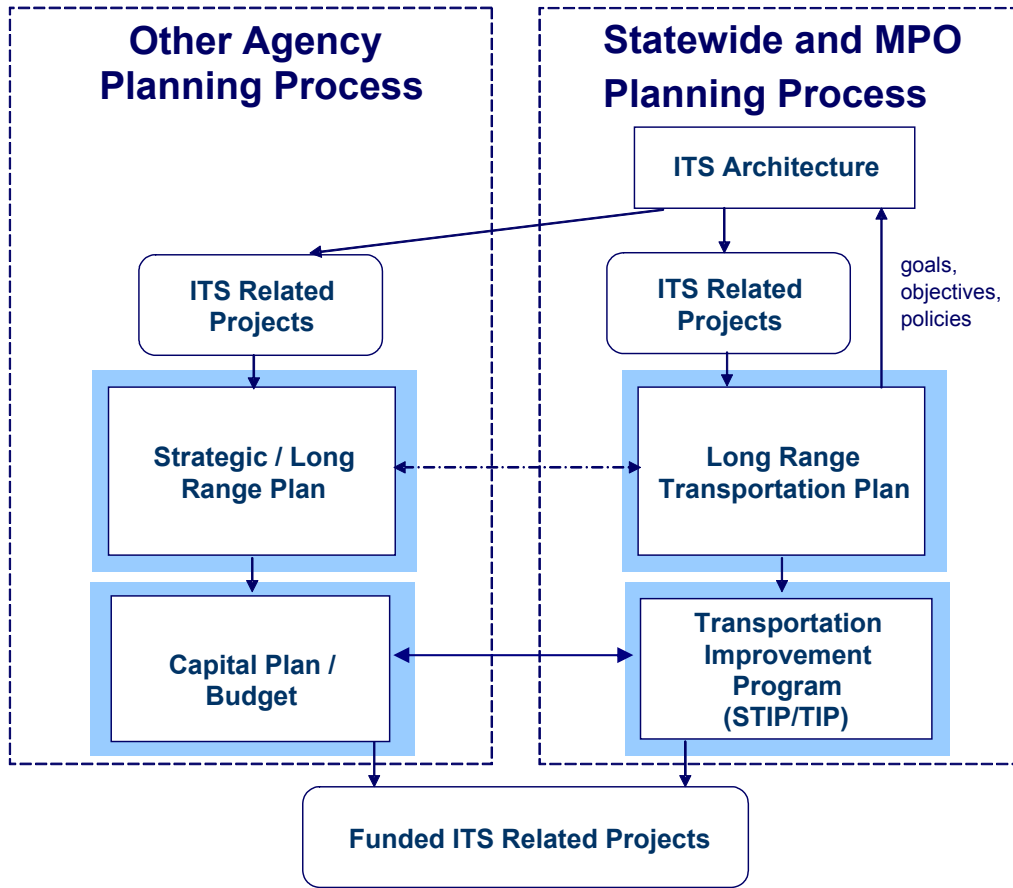


Figure 5. Vermont Statewide ITS Architecture in the Transportation Planning Process

As shown in the figure, the ITS Architecture provides an important input to the planning process by supporting the prioritization of ITS related projects that feed into the respective planning documents.

ITS projects that emerge from the planning process and will use federal funds for all or part of their implementation must perform a project system engineering analysis (PSEA) that has the following requirements (derived from FHWA Rule 940/ FTA Policy):

- (1) Identification of portions of the regional ITS architecture being implemented.
- (2) Identification of participating agencies roles and responsibilities;
- (3) Requirements definitions;
- (4) Analysis of alternative system configurations and technology options to meet requirements;
- (5) Procurement options;
- (6) Identification of applicable ITS standards and testing procedures; and

(7) Procedures and resources necessary for operations and management of the system.

The Statewide ITS Architecture provides outputs that can be used by project developers to meet many of these requirements. The intent of this PSEA is to have projects follow the systems engineering process. A generic view of the system engineering process is shown in Figure 6.

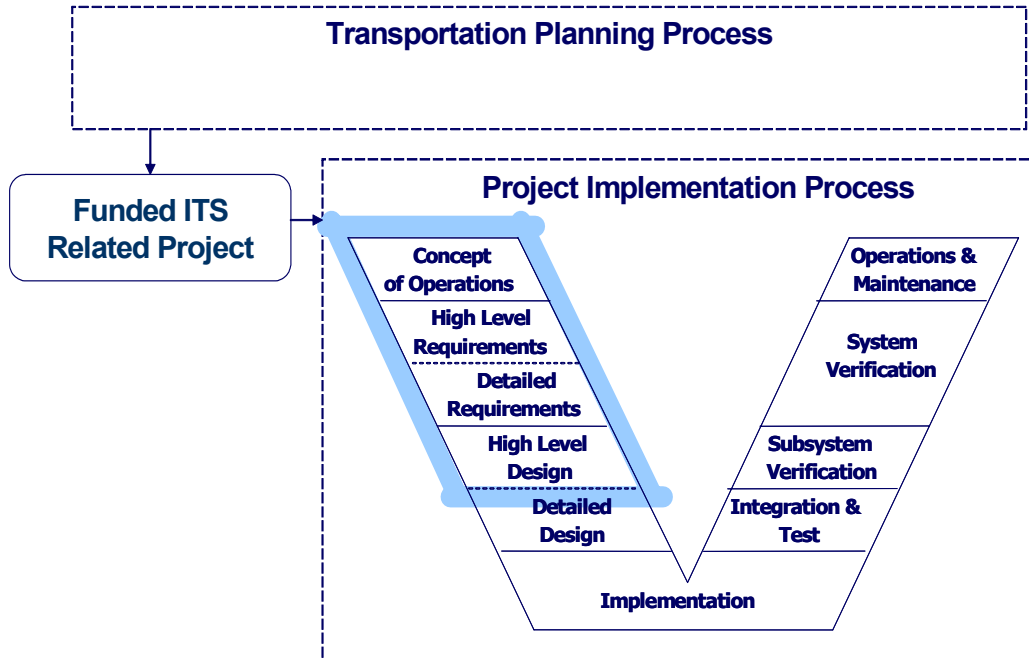


Figure 6. Vermont Statewide ITS Architecture in the Project Implementation Process

The ITS Architecture is most effective in the early phases of the systems engineering process (identified by the selected boxes on the left side of Figure 6). It is a process that can be used to systematically deploy ITS. The Systems Engineering process is more than just steps in systems design and implementation; it is a life-cycle process. The process recognizes that many projects are deployed incrementally and expand over time. This system engineering process can be easily mapped to the VTrans project development process. The details of this mapping, as well as additional information on using the Statewide ITS Architecture in the planning and deployment process is found in Section 3 of the Vermont Strategic Plan for ITS Deployment document.

Documentation of Vermont Statewide Intelligent Transportation Systems Plan

The Vermont Statewide Intelligent Transportation Systems Plan is documented in several forms. The first is a series of reports or documents that include the following:

- Vermont Statewide Intelligent Transportation Systems Plan Update Executive Summary, which is this document and summarizes the results of the project.

- Vermont Statewide ITS Architecture document, which describes stakeholders, elements, interfaces, and requirements relating to the architecture. This document also discusses the process used to provide maintenance of the architecture.
- Vermont Strategic Plan for ITS Deployment document, which describes the Vision, Mission, Guiding Principles, Goals and Objectives of the Vermont ITS Program. The document also discusses the Statewide ITS system planning and deployment process, the ITS project sequencing, and the market package prioritization.
- Standards Plan document, which contains a detailed discussion of ITS standards as well as recommendations for a plan to develop and deploy ITS standards in the State of Vermont.

The second form of documentation is the Turbo Architecture database. This FHWA developed software tool captures the details of the architectures including definition of stakeholders, inventory, market packages, interconnects, interfaces, functional requirements, and standards. An example of the tool's capture of interconnects (for the element Advance Transit Dispatch - which is the dispatch function for Advance Transit) is shown in Figure 7.

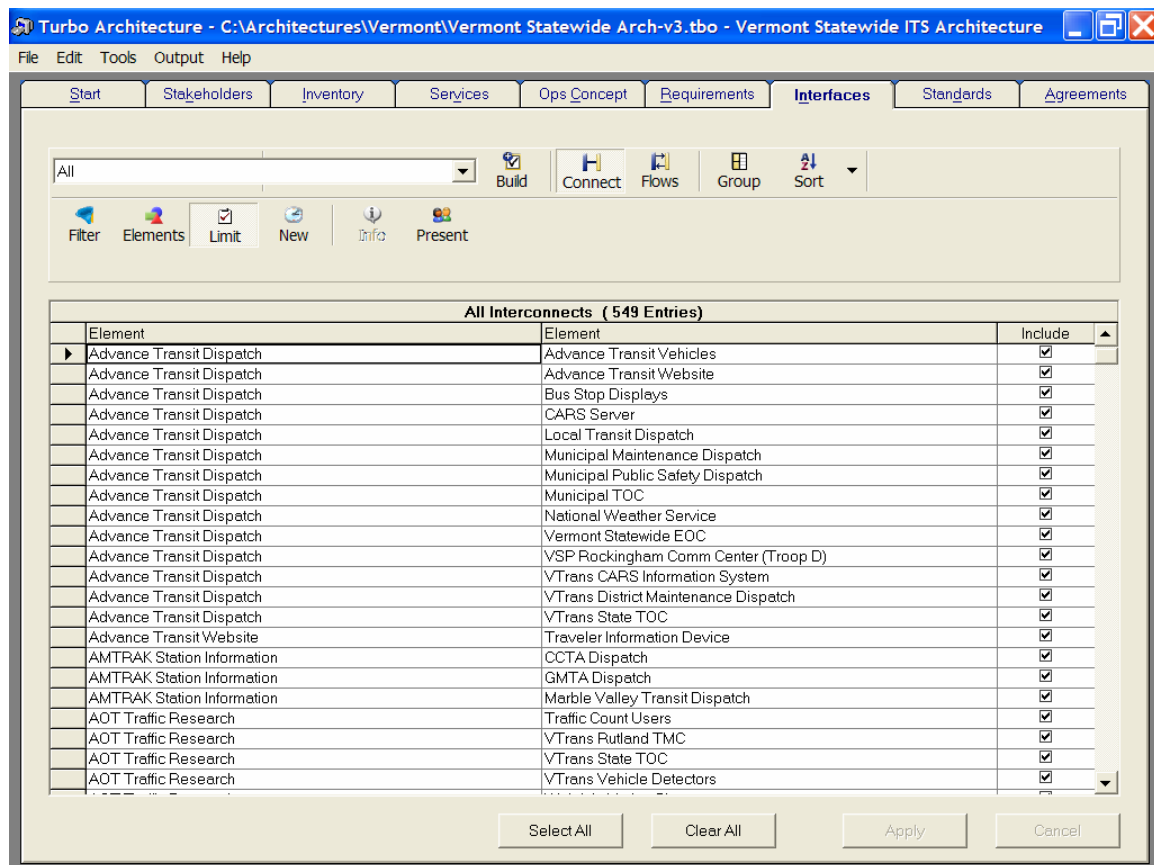


Figure 7. Sample Turbo Architecture Screen Capturing Interconnect Information

The third form of documentation of the Vermont Statewide ITS Architecture is the Vermont Statewide ITS Architecture website. ConSysTec Corporation has developed, posted and hosted the temporary hyper-linked website where the Statewide Architecture, Strategic Plan, and relative documentation (i.e. meeting minutes, other draft architectures, stakeholder comments, etc.) can be found. The website currently resides at http://www.consystec.com/vermont/web/_regionhome.htm. It is the intent of ConSysTec to host this site for at least three years after the conclusion of the project, or until VTrans chooses an alternative site to utilize as a host for the documentation. In addition to hosting the website for VTrans, an html image of the website (which can be used to directly load a web server with the developed website for the Vermont Statewide ITS Architecture and strategic plan) will be delivered to VTrans on CD-ROM.

The website provides in an easy to access hyperlinked format the same detailed descriptions of stakeholders, elements, interfaces, and functional requirements found in the Turbo Architecture database. An example of the details for the VTrans element *Accident Reporting System* is shown in Figure 8.

The screenshot shows a Microsoft Internet Explorer browser window displaying the 'DRAFT Vermont Statewide ITS Architecture' website. The address bar shows the URL: http://www.consys tec.com/vermont/web/el/el_240.htm. The page has a navigation menu on the left with links such as 'Region Home', 'Stakeholders', 'Inventory by Stakeholder', 'Inventory by Entity', 'Sausage Diagram', 'Market Packages by Functional Area', 'Market Packages by Stakeholder', 'Market Package Descriptions', 'Equipment Package Descriptions', 'Architecture Flow Descriptions', 'Project Documents', and 'Send Your Comments'. The main content area is titled 'ITS Element: Accident Reporting System'. It contains a description of the system, its status (Planned), stakeholder (VTrans Program Development), mapping (Commercial Vehicle Administration, Other CVAS, Enforcement Agency), interfaces (VT CVIEW System, VT DMV Enforcement and Safety Office), market packages (CV003 - Electronic Clearance, CV007 - Roadside CVO Safety), and equipment packages (CV Information Exchange, CV Safety Administration). A 'Context Diagram' is also shown, which is a diagram illustrating the system's context and its interactions with other systems.

Figure 8. Example Element Definition on Hyperlinked Website