

DEVELOPING YOUR ITS PROJECT

The Transportation Equity Act for the 21st Century (TEA-21) requires that all intelligent transportation system (ITS) projects using highway trust funds (including the mass transit account) must “conform” to the National ITS Architecture and ITS technical standards. The implementation of this requirement is found in the [Federal Highway Administration \(FHWA\) Rule and the Federal Transit Administration \(FTA\) Policy](#), which took effect on April 8, 2001.

ITS projects in the region must now comply with these federal ITS requirements. The requirements direct all applicable ITS projects to demonstrate how the project fits into the Regional ITS Architecture and be based on a systems engineering analysis. Assistance in addressing these requirements is provided here.

- [Is Your Project an ITS Project?](#)
- [Meeting the Federal and Regional Regulatory Requirements](#)
- [Fitting Your Project into the Regional ITS Architecture](#)
- [What is Systems Engineering?](#)
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IS YOUR PROJECT AN ITS PROJECT?

The first question is does your project include any intelligent transportation systems (ITS) elements? ITS is defined as advanced information processing, communications, sensing, or control technologies. Examples include interconnecting traffic signals, transit signal priority systems, variable message signs, closed-circuit television cameras, automatic passenger counters, and traffic signal control software.

MEETING THE FEDERAL AND REGIONAL ITS REQUIREMENTS

The Transportation Equity Act for the 21st Century (TEA-21) requires that all intelligent transportation system (ITS) projects using highway trust funds (including the mass transit account) must “conform” to the National ITS Architecture and ITS technical standards. Information on the federal and regional ITS regulatory requirements are found here.

- [Are You Using a Funding Source that Requires Compliance with the Federal Regulations?](#)
- [What are the Federal ITS Requirements?](#)
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Are You Using a Funding Source that Requires Compliance with the Federal Regulations?

Does the project use (or will it use) funds from the Federal highway trust fund including the mass transit account? These include funds from such sources as the National Highway System (NHS) Program, Surface Transportation Program (STP), Congestion Management and Air Quality (CMAQ) Program, and Federal Transit Administration (FTA) Program to name several.

The Section 940.7 of FHWA ITS Rule (shown in the text box to the right) also provides for some additional exceptions. Item (2) may be of interest to project sponsors who are updating existing systems. Finally, any ITS project that has advanced to final design by April 8, 2001 is exempt.

While some projects may be exempt from the federal ITS requirements, project sponsors are encouraged to determine how their project can fit into the Puget Sound Regional ITS Architecture and follow the systems engineering analysis process. Compliance with the architecture will provide a path to sharing information with other transportation organizations and the general public on a regional basis. A comprehensive systems engineering analysis is typically done as a matter of course on any transportation engineering project involving the application of advanced technology. The federal ITS requirements provide another source for guidance and a convenient checklist.

CHAPTER I OF TITLE 23 CODE OF FEDERAL REGULATIONS

SUBCHAPTER K INTELLIGENT TRANSPORTATION SYSTEMS

PART 940--INTELLIGENT TRANSPORTATION SYSTEM ARCHITECTURE AND STANDARDS

§ 940.7 Applicability

- (a) All ITS projects that are funded in whole or in part with the highway trust fund, including those on the National Highway System (NHS) and on non-NHS facilities, are subject to these provisions.
- (b) The Secretary may authorize exceptions for:
 - (1) Projects designed to achieve specific research objectives outlined in the National ITS Program Plan under section 5205 of the TEA-21, or the Surface Transportation Research and Development Strategic Plan developed under 23 U.S.C. 508; or
 - (2) The upgrade or expansion of an ITS system in existence on the date of enactment of the TEA-21, if the Secretary determines that the upgrade or expansion:
 - (i) Would not adversely affect the goals or purposes of Subtitle C (Intelligent Transportation Systems Act of 1998) of the TEA-21;
 - (ii) Is carried out before the end of the useful life of such system; and
 - (iii) Is cost-effective as compared to alternatives that would meet the conformity requirement of this rule.
- (c) These provisions do not apply to funds used for operations and maintenance of an ITS system in existence on June 9, 1998.

What are the Federal ITS Requirements?

The Transportation Equity Act for the 21st Century (TEA-21) requires that all intelligent transportation system (ITS) projects using highway trust funds (including the mass transit account) must “conform” to the National ITS Architecture and ITS technical standards. The implementation of this requirement is found in the [Federal Highway Administration \(FHWA\) Rule and the Federal Transit Administration \(FTA\) Policy](#), which took effect on April 8, 2001. The FHWA Rule and FTA Policy are virtually identical in content. Separate agency actions were needed because of the differences in the way the two agencies administer projects.

The federal ITS requirements direct all applicable ITS projects to demonstrate how the project fits into the Regional ITS Architecture and be based on a systems engineering analysis. Systems engineering is a

structured process that considers the total life cycle among alternatives, technical merits, costs, and the relative value of alternatives.

Additional information on [conformance with the federal ITS requirements is found on the US DOT ITS web site](#).

What are the Regional ITS Requirements?

Puget Sound Regional Council has taken responsibility for ensuring compliance with the FHWA ITS Rule and FTA ITS Policy for ITS projects in the four-county region of King, Kitsap, Pierce, and Snohomish counties. As part of its current duties, Puget Sound Regional Council reviews transportation projects of regional significance and all projects funded with state and/or federal Highway Trust Funds during the development of the [regional transportation improvement program \(TIP\)](#). The Regional Council has inserted the monitoring requirements of the federal ITS requirements into the TIP development process.

The ITS compliance screening applies only to projects that include ITS elements and meet the applicability requirements of the federal ITS requirements. The overall approach is based on “self-certification” by project sponsors affirming that they will comply with the ITS requirements. The project sponsor has the final responsibility for meeting the federal ITS requirements for their project. An official that could commit the organization to compliance (i.e., Public Works Director, Transportation Director) is required to authorize the certification.

The self-certification takes place at two points in the project development cycle.

1. **Planning:** When a project is submitted for addition to the regional TIP at the planning level, the project sponsor would provide a short description of how their ITS project would fit into the Regional ITS Architecture and agree to conduct a systems engineering analysis for the project during the design phase. If the project were not currently addressed in the Regional ITS Architecture, the Regional Council would work with the project sponsor to modify the Regional ITS Architecture to encompass the project.
2. **Design (Prior to Construction):** Many of the details about the ITS elements of a project are developed in greater detail during the design phase. Toward the end of the design phase, the project sponsor would “self-certify” that the systems engineering analysis was completed and provide the Regional Council with information on the final project ITS architecture and its relationship with the Regional ITS Architecture. Again, this would be done during the regional TIP development process as part of a project submission. FHWA or FTA may independently request additional documentation on the systems engineering analysis before funds are released for construction.

The self-certification requirements will be in place for the update to the 2001- 04 TIP.

FITTING YOUR PROJECT INTO THE REGIONAL ITS ARCHITECTURE

One of the primary federal ITS requirement is to demonstrate how your project fits into the [Puget Sound Regional ITS Architecture](#). The Regional ITS Architecture defines a regional framework for ensuring institutional agreement and technical integration for the implementation of ITS projects with the Puget Sound region. It is designed to provide guidance and serve as a resource in the development of local ITS projects.

The recommended approach to demonstrating that a project fits into the Regional ITS Architecture is illustrated in the [process flow diagram](#) and contains the following steps.

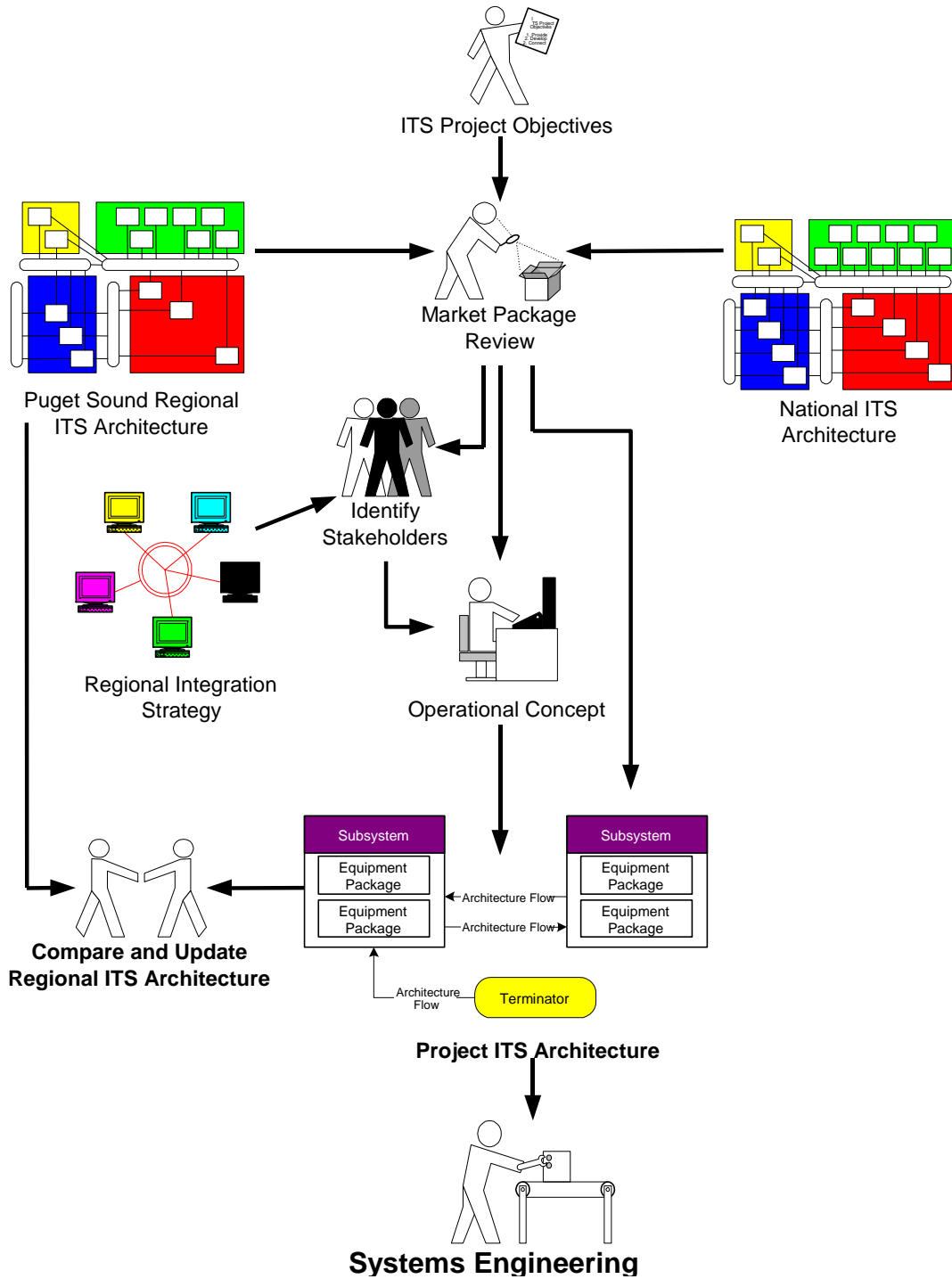
1. Review [market packages](#) in the [National](#) and [Puget Sound Regional ITS Architecture](#) to determine which market packages will best meet the requirements of your project.
2. Review the [Regional ITS Integration Strategy](#) to determine how your project could be integrated into the overall regional deployment of ITS applications. This will help you identify other organizations and ITS applications to which your project may need a connection.
3. Determine which agencies, organizations and [stakeholders](#) beyond your own organization could be involved in the project.
4. Develop an [operational concept](#) for the project using the results of the market package review and identification of stakeholders to be included in the project. The operational concept defines the institutional relationships and the high-level information flows among the organizations required for the deployment and operation of the project.
5. Develop a [project ITS architecture](#) diagram that indicates subsystems (entities and stakeholders), equipment packages and information exchanges to define using the National ITS Architecture market package definitions and diagrams as a basis. [Examples ITS architecture diagrams](#) are available as a starting point.
6. Identify any market packages, interface requirements, and information exchanges provided by the project that are not currently included in the Regional ITS Architecture.
7. Work with the Regional Council to update the Regional ITS Architecture, if required.
8. The results of this activity feed into the rest of the [systems engineering analysis](#) effort that would be performed during the design of the project.

What is the Regional ITS Architecture?

The Regional Council has completed the developed of the [Puget Sound Regional ITS Architecture](#) and a detailed [ITS Transit Architecture](#). The Regional ITS Architecture defines a regional framework for ensuring institutional agreement and technical integration for the implementation of ITS projects with the Puget Sound region.

The Regional ITS Architecture is based upon the [National ITS Architecture](#). The National ITS Architecture, adopted in 1996 and periodically updated, provides a technical and institutional framework to guide the coordinated deployment of ITS by public agencies and private organizations alike. The National ITS Architecture is not a design, rather it defines the framework around which multiple design approaches can be developed, each one specifically tailored to meet the unique needs of the region or project. The National ITS Architecture also defines the functions that must be performed to implement a given service, the physical entities or subsystems where these functions reside, the interfaces/information flows between subsystems, and the communication requirements for the information flows. The National ITS Architecture may be found on-line at www.iteris.com/itsarch/

Fitting into the Regional ITS Architecture



What is a Market Package?

In the National ITS Architecture, market packages provide an accessible, deployment-oriented perspective to the national architecture. Market packages are specific ITS projects that are tailored to fit - separately or in combination - real world transportation problems and needs. The market packages also include a depiction of the relationship and data flow between different entities providing the “service” provided by the deployment of the market package.

- For additional details see the [On Line National ITS Architecture](#)

Regional ITS Integration Strategy

The [Puget Sound Regional ITS Strategy](#) provides guidance for the Puget Sound region in the management and investment of ITS applications to achieve a regionally integrated system. Accordingly, the strategy acknowledges the requirement to transition legacy systems, accommodate new systems and provide for links to other stakeholders. The complexity of the undertaking requires multiple activities and a phased approach to meet the overall objective of an integrated system. The recommended strategy can be summarized into the following elements:

1. Use the Smart Trek ITS Backbone as the initial mechanism for the sharing of real-time transportation system and other related information among jurisdictions and private information service providers (ISPs).
2. Transition to structured, emerging National Transportation Communications for ITS Protocol (NTCIP) center-to-center (C2C) interfaces among transportation management systems for the future sharing of information and device control coordination.
3. Continue sharing of common ITS applications and systems among regional transit agencies and build links to other traffic management and other information sources.
4. Build information interfaces between transportation management systems and emergency management centers.
5. Connect local commercial vehicle regulatory functions to the Washington State deployment of the Commercial Vehicle Information Systems and Network (CVISN).
6. Use Smart Trek as basis for the deployment of a regional multi-modal traveler information system (RMTIC) and the new three-digit traveler information telephone number (511) to provide basic traveler information to the general public.
7. Accommodate the electronic flow of information to private ISPs through the deployment of a common interface standard via the ITS Backbone.
8. Build electronic links to other transportation stakeholders including ports, rail operators, clean air agency, toll agencies, and freight management organizations.
9. Capture and archive real-time transportation system data for future analysis and to support transportation planning.

Each element of the ITS integration strategy are discussed in the Puget Sound Regional ITS Strategy report.

Other Stakeholders to Consider

The Puget Sound Region has many different public and private entities providing transportation related services, data management, and coordination. A convenient way to characterize these organizations is to use the center subsystem descriptions found in the physical architecture portion of the [National ITS Architecture](#). Accordingly, the regional stakeholders can be categorized as follows:

- **Traffic Management (state, county, local):** The Traffic Management Subsystem operates within a traffic management center or other fixed location. This subsystem communicates with the Roadway Subsystem to monitor and manage traffic flow. Incidents are detected and verified and incident information is provided to the Emergency Management Subsystem, travelers (through Roadway Subsystem Highway Advisory Radio and Dynamic Message Signs), and to third party providers.
- **Transit Management (transit agencies, ferry system):** The transit management subsystem manages transit vehicle fleets and coordinates with other modes and transportation services. It provides operations, maintenance, customer information, planning, and management functions for the transit property. It spans distinct central dispatch and garage management systems and supports the spectrum of fixed route, flexible route, and paratransit services.
- **Emergency Management (police, fire, ambulance, etc.):** The Emergency Management Subsystem operates in various emergency centers supporting public safety including police and fire stations, search and rescue special detachments, and Hazardous Materials response teams. This subsystem interfaces with other Emergency Management Subsystems to support coordinated emergency response involving multiple agencies. The subsystem creates, stores, and utilizes emergency response plans to facilitate coordinated response.
- **Information Service Provider (ISP):** This subsystem collects, processes, stores, and disseminates transportation information to system operators and the traveling public. The subsystem can play several different roles in an integrated ITS. In one role, the ISP provides a general data warehousing function, collecting information from transportation system operators, and redistributing this information to other system operators in the region and other ISPs. In this information redistribution role, the ISP provides a bridge between the various transportation systems that produce the information and the other ISPs and their subscribers that use the information. The second role of an ISP is focused on delivery of traveler information to subscribers and the public at large. Information provided includes basic advisories, real time traffic condition and transit schedule information, yellow pages information, ridematching information, and parking information.
- **Commercial Vehicle Administration:** The Commercial Vehicle Administration Subsystem performs administrative functions supporting credentials, tax, and safety regulations. It issues credentials, collects fees and taxes, and supports enforcement of credential requirements. This subsystem communicates with the Fleet and Freight Management Subsystems associated with the motor carriers to process credential applications and collect fuel taxes, weight/distance taxes, and other taxes and fees associated with commercial vehicle operations. The subsystem also receives applications for, and issues special Oversize/Overweight and Hazardous Materials permits in coordination with other associated authorities.
- **Fleet and Freight Management:** The Fleet and Freight Management Subsystem provides the capability for commercial drivers and dispatchers to receive real-time routing information and access databases containing vehicle and cargo locations as well as carrier, vehicle, cargo, and driver information. In addition, the capability to purchase credentials electronically shall be provided, with automated and efficient connections to financial institutions and regulatory agencies, along with post-trip automated mileage and fuel usage reporting. The Fleet Management Subsystem also provides the capability for Fleet Managers to monitor the safety of their commercial vehicle drivers and fleet. The subsystem also supports application for Hazardous Materials credentials and makes information about Hazardous Materials cargo available to agencies as required.

The table below was assembled to illustrate the [potential regional stakeholders by center subsystems](#). It should be noted that information service providers (ISPs) could be either public or private organizations. An agency can be an ISP by simply having a website that provides transportation information. Many organizations listed under traffic and transit management act as ISPs. They are not represented under the ISP category.

Potential Regional Stakeholders By Center Subsystems

Traffic Management

State

WSDOT NW Region
WSDOT Olympic Region

Counties

King
Kitsap
Pierce
Snohomish

Cities

Algona
Arlington
Auburn
Bainbridge Island
Beaux Arts Village
Bellevue
Bonney Lake
Bothell
Bremerton
Buckley
Burien
Clyde Hill
Covington
DuPont
Duvall
Eatonville
Edgewood
Edmonds
Enumclaw
Everett
Federal Way
Fife
Fircrest
Gig Harbor
Hunts Point
Issaquah
Kenmore
Kent
Kirkland
Lake Forest Park
Lake Stevens
Lakewood
Lynnwood
Maple Valley
Marysville
Medina
Mercer Island

Mill Creek
Milton
Monroe
Mountlake Terrace
Mukilteo
Newcastle
North Bend
Orting
Pacific
Port Orchard
Poulsbo
Puyallup
Redmond
Renton
Ruston
Sammamish
SeaTac
Seattle
Shoreline
Skykomish
Snohomish
Snoqualmie
Stanwood
Steilacoom
Sultan
Sumner
Tacoma
Tukwila
University Place
WSDOT
Woodinville
Woodway
Yarrow Point

Transit Management

Community Transit
Everett Transit
Kitsap Transit
King County Metro
Pierce Transit
Sound Transit
Washington State Ferries

Emergency Management

Ambulance Services
Hospitals
Local Fire
Local Police
Other Emergency Response
Washington State Patrol
WSDOT Incident Response

Information Service Providers

Agency Operated ISPs
Private ISPs
[Smart Trek](#)

Commercial Vehicle Administration /

Fleet and Freight Management

Burlington Northern Santa Fe
Department of Licensing
Trucking Companies
Union Pacific
Washington State Patrol
WSDOT
Washington Trucking Association

Federal Lands

Mt. Rainier National Parks
Mount Baker/Snoqualmie National Forest

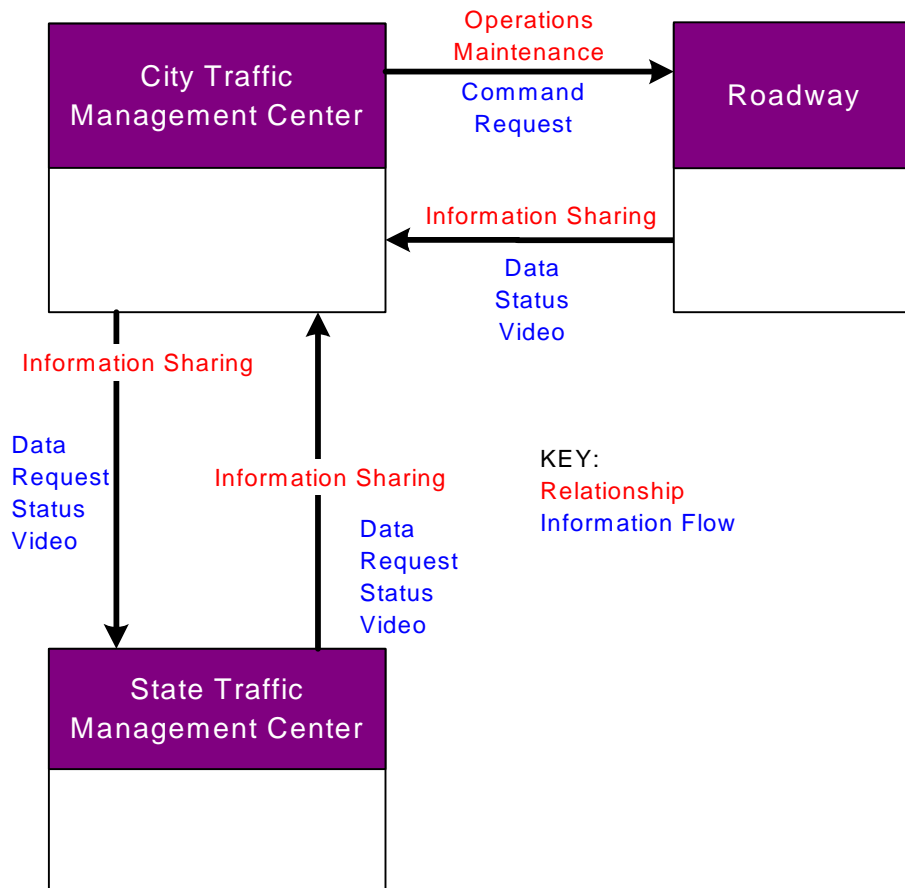
Operational Concept

Develop an Operational Concept

The operational concept defines the relationships among the organizations required for the deployment and operation of the project. Relationships between agencies embody two main components: 1) what roles and responsibilities does each agency play in agency-to-agency relationships and 2) what kinds of data are shared as part of information exchanges. These two components are detailed below.

AGENCY-TO-AGENCY RELATIONSHIPS	INFORMATION EXCHANGES
<p>Consultation: One party confers with another party, in accordance with an established process, about an anticipated action and then keeps that party informed about actions taken.</p> <p>Cooperation: The parties involved in carrying out the planning and/or project development processes work together to achieve a common goal or objective.</p> <p>Coordination: The comparison of the transportation plans, programs, and schedules of one agency with related plans, programs, and schedules of other agencies and adjustment of plans, programs and schedules to achieve general consistency.</p> <p>Information Sharing: The exchange of data, and device status information between parties, for the purpose of coordinated responses, planning, and analysis.</p> <p>Control Sharing: The ability, through operational agreements, to allow for one party to control another party's field devices to properly respond to incident, event, weather, or traffic conditions.</p> <p>Operations: One party fully operates field equipment of a second party, typically because the second party does not operate a control center.</p> <p>Maintenance: One party maintains the field equipment of a second party.</p>	<p>Video: The dissemination of live video and still images from one party's field cameras to another party.</p> <p>Data: The dissemination of data gathered from one party's field devices to another party. Data can include, but is not limited to, traffic data, weather data, parking data, transit data, etc.</p> <p>Command: The ability for one party to control a second party's field devices. Command can include, but is not limited to, changing VMS messaging, changing traffic signal timings, camera control, etc.</p> <p>Request: The ability for one party to solicit either data, or a command change, such as a VMS messaging or signal timings, from another party.</p> <p>Status: The ability for one party to monitor another party's field devices, and receive such information as current signal timing/response plan, current message sets, etc.</p>

The operational concept is based upon the selection of market packages that best meet the project requirements and the identification of other agencies that will participate in the project. Each market package description identifies which entities (i.e. subsystems) are involved in the deployment of the market package. For example, if a local traffic management center wishes to share traffic information and video images with the WSDOT transportation system management center (TSMC), the market package that best addresses this idea is the Regional Traffic Control package. Regional Traffic Control provides for the sharing of traffic information and control among traffic management centers to support a regional control strategy. The operational concept would capture the institutional relationship and high-level data flows between the two organizations that are cooperating in the deployment of the project. This example is illustrated in the figure below.



Many market packages do not require interaction with other organizations, and can be generally implemented as stand-alone applications locally. In these cases, the market package itself defines the operational concept for deployment. However, several market packages have been identified as requiring jurisdictional interaction and the need to define operational concepts. These market packages are:

- Regional Traffic Control
- Regional Parking Management
- Multi-Modal Coordination (Transit Signal Priority)
- Transit Fare Management
- Transit Data Management
- Transit Traveler Information
- Incident Management
- Data Archiving
- Rail Crossing Coordination

In several cases, multiple traffic, transit, and emergency management agencies will need to form relationships with each other to define specific roles and responsibilities for the deployment of the market packages required by the project.

A matrix or diagram detailing the relationships between entities including other agencies and jurisdictions plus the identification of which high-level information flows will be supported defines the operational concept for the project. Additional information on this topic is found in Section 4 of the [Regional ITS Architecture](#) document. In addition, searchable [market package databases](#) have been developed detailing existing, planned and potential relationships between jurisdictions for the following market packages:

- Regional Traffic Control
- Regional Parking Management
- Multi-Modal Coordination (Transit Signal Priority)

- Transit Fare Management
- Transit Traveler Information

Market Packages Included in the Puget Sound Regional ITS Architecture

Market Package Name	WSDOT	Commercial Vehicle Operations	Transit	Local Agencies	Emergency Management	PSRC
ITS Data Mart	X	X	X	X	X	
ITS Data Warehouse						X
Transit Vehicle Tracking			X			
Transit Fixed-Route Operations			X			
Demand Response Transit Operations			X			
Transit Passenger and Fare Management			X			
Transit Security			X	X		
Transit Maintenance			X			
Multi-Modal Coordination	X		X	X		
Transit Traveler Information			X			
Broadcast Traveler Information	X			X		
Interactive Traveler Information	X			X		
Dynamic Ridesharing			X	X		
In Vehicle Signing			X			
Network Surveillance	X			X		
Surface Street Control	X			X		
Freeway Control	X					
HOV Lane Management	X					
Traffic Information Dissemination	X			X		
Regional Traffic Control	X			X		
Incident Management System	X			X	X	
Electronic Toll Collection	X					
Emissions Monitoring and Management						X
Standard Railroad Grade Crossing	X			X		
Railroad Operations Coordination	X			X	X	
Parking Facility Management				X		
Reversible Lane Management	X					
Road Weather Information System	X			X		
Regional Parking Management				X		
Electronic Clearance		X		X		
CV Administrative Processes		X		X		
International Border Electronic Clearance		X				
Weigh-In-Motion		X				
Roadside CVO Safety		X		X		
On-board CVO Safety		X				
Hazardous Materials Management		X				

Market Package Name	WSDOT	Commercial Vehicle Operations	Transit	Local Agencies	Emergency Management	PSRC
Emergency Response	X				X	
Emergency Routing				X	X	
Mayday Support					X	

Selected Market Package Data Base

[Market package database](#)

A searchable database has been developed to detail existing, planned and potential relationships between jurisdictions for the market packages listed below. These five market packages are the ones that will require the most interaction among agencies within the region.

- **Regional Traffic Control**: This market package provides communications links and integrated control strategies that enable integrated inter-jurisdictional traffic control between traffic management centers. This market package provides for the sharing of traffic information and control among traffic management centers to support a regional control strategy. The nature of optimization and extent of information and control sharing is determined through working arrangements between jurisdictions. This package provides hardware, software, and wire-line communications capabilities to implement traffic management strategies, which are coordinated between allied traffic management centers. Several levels of coordination are supported from sharing of information through sharing of control between traffic management centers.
- **Regional Parking Management**: This market package supports coordination between parking facilities to enable regional parking management strategies.
- **Multi-Modal Coordination (Transit Signal Priority)**: This market package establishes two-way communications between multiple transit and traffic agencies to improve service coordination. Intermodal coordination between transit agencies can increase traveler convenience at transfer points and also improve operating efficiency. Coordination between traffic and transit management is intended to improve on-time performance of the transit system to the extent that this can be accommodated without degrading overall performance of the traffic network. This market package provides for the deployment of transit signal priority.
- **Transit Fare Management**: This market package allows for the management of passenger loading and fare payments on-board vehicles using electronic means. The payment instrument may be either a stored value or credit card. This package is implemented with sensors mounted on the vehicle to permit the driver and central operations to determine vehicle loads, and readers located either in the infrastructure or on-board the transit vehicle to allow fare payment. Data is processed, stored, and displayed on the transit vehicle and communicated as needed.
- **Transit Traveler Information**: This market package provides transit users at transit stops and on-board transit vehicles with ready access to transit information. The information services include transit stop annunciation, imminent arrival signs, and real-time transit schedule displays that are of general interest to transit users. Systems that provide custom transit trip itineraries and other tailored transit information services are also represented by this market package.

Developing a Project ITS Architecture Diagram

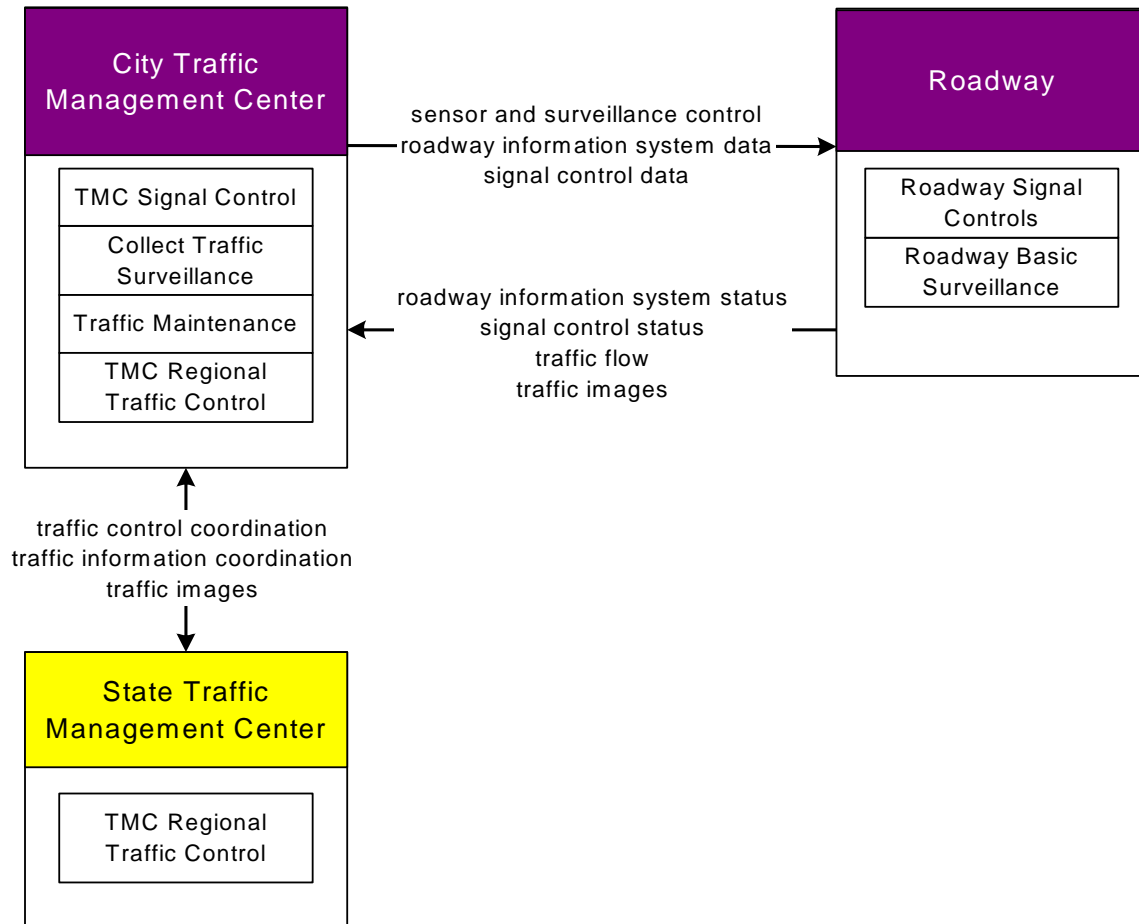
[Example ITS architecture diagrams](#) were developed for a wide range of organizations throughout the Puget Sound region and are linked here. Some depict existing operations and others provide illustrations of how a

local or county jurisdiction might define its project ITS architecture for compliance with the Regional ITS Architecture. These diagrams should provide a useful starting point and checklist for these efforts and are contained in Regional ITS Architecture documents.

Using the selected project market packages and operational concept, a project ITS architecture diagram should be assembled for your project. The diagram should depict the following items:

- Subsystems: “The principle structural element of the Physical Architecture. There are 19 subsystems in the [National ITS Architecture](#), which are grouped into four classes: Centers, Roadside, Vehicles, and Travelers. Example subsystems are the Traffic Management Subsystem, the Vehicle Subsystem, and the Roadway Subsystem. These correspond to existing things in the physical world: respectively traffic operations centers, automobiles, and roadside signal controllers.”
- Equipment Packages: “The building blocks of the Physical Architecture subsystems. Equipment Packages group like processes of a particular subsystem together into an “implementable” package.”
- Architecture Flow Between the Subsystems: “Information that is exchanged between subsystems and terminators in the Physical Architecture. Each architecture flow contains one or more data flows from the Logical Architecture.” Architecture flows are at the next level of detail beyond the five high-level information flows noted above.

An example to link a city traffic management center to a state traffic management center for the sharing of information and video is shown below.



The descriptions of the equipment packages combined with the architecture flows between the subsystems provides an excellent starting point for defining system functional requirements, interface requirements, and information exchanges between the equipment package entities and subsystems involved in your

project during systems engineering analysis. The [National ITS Architecture](#) contains additional detailed information that will assist the project sponsor.

Example ITS Architecture Diagrams

Example ITS architecture diagrams are provided for the following organizations and situations. *{note add link to diagrams from the list below as individual PDFS from Appendix B-separate file—or combine into one document if necessary to have live links}*

- [Washington State Department of Transportation](#)
- [Typical County with Traffic Operations Center](#)
- [Typical City with Traffic Operations Center](#)
- [Typical Traffic Management Center-to-Center Interface](#)
- [Detailed Transit Architecture \(one for each agency in the region\)](#)
- [ITS Backbone](#)
- [Regional Multi-Modal Traveler Information Center \(RMTIC\)](#)
- [Local Link to Commercial Vehicle Information Systems and Network \(CVISN\)](#)
- [Typical Emergency Management Service Provider](#)
- [Archived Data Management](#)

Washington State Department of Transportation

The [WSDOT ITS architecture](#) involves two separate Traffic Management Subsystems representing the Northwest and Olympic regions. Coordination exists between the two centers with each operating their own roadway devices, and having links to various transit agencies. Each center also has links for coordination to counties and cities.

Typical County with Traffic Operations Center

[Typical county architectures](#) have several key components. One is the close coordination with other traffic management agencies on the state, county and local levels, and links to the roadway system. This includes both links to county owned roadways as well as those owned by other jurisdictions. This represents a county's unique role of providing comprehensive operations and maintenance functions to other jurisdictions. The diagram also illustrates connections to transit, emergency, and commercial vehicle entities.

Typical City with Traffic Operations Center

The [City of Seattle ITS architecture](#) was chosen as a representation of a city with a Traffic Operations Center. This diagram illustrates a city operating roadside equipment, with links to transit agencies, emergency agencies, parking management, commercial vehicle administration, as well as a link to traffic management on the state level.

Typical Traffic Center-to-Center Interface

A [typical center-to-center interface architecture](#) is represented most simply by illustrating two centers with distinct roadways. Each agency operates their own equipment but with the coordinated ability to share data and control with another agency. Other sources of data could also be shared across this interface such as input from other centers or information service providers.

Transit Architecture

Transit architecture diagrams graphically represent the technology that each transit agency in the region is currently supporting or expects to enhance/implement in the next one to five years. As defined in the National ITS Architecture, the physical architecture includes the four subsystems that are applicable to the transit agencies in the Puget Sound region: 1) traveler, 2) center, 3) vehicle, and 4) roadside. These diagrams are described in more detail in the Puget Sound Regional ITS Transit Architecture.

- [Community Transit](#)
- [Everett Transit](#)
- [King County Metro](#)
- [Kitsap Transit](#)

- [Pierce Transit](#)
- [Sound Transit \(Sunder\)](#)
- [Sound Transit \(LINK\)](#)
- [Washington State Ferries](#)

ITS Backbone

The [ITS Backbone architecture](#) illustrates the Backbone as a central entity for centers to publish real-time data, for the purpose of agency to agency data exchange. The diagram illustrates the relationships and data flows that correspond to the ITS Backbone. More information on the ITS Backbone is found in the Puget Sound Regional ITS Architecture.

Regional Multi-Modal Traveler Information Center (RMTIC)

The [architecture for the Regional Multi-Modal Traveler Information Center \(RMTIC\)](#) application consists of both static and dynamic data inputs. Various information service providers (ISPs), such as traffic, transit, and private, will share static information with the RMTIC. This includes such information as transit schedules, construction notices, detour routes etc. Another input link to the RMTIC application is from the ITS Backbone. This link will allow RMTIC to capture real-time dynamic data from the various traffic, transit, and emergency field devices. This data could include traffic conditions, and bus locations through AVL.

The function of the RMTIC is to process and format all incoming static and dynamic data and make it available to the general public. Dissemination of data requires the RMTIC to be linked to the Traveler Subsystems. More information on the ITS Backbone is found in the Puget Sound Regional ITS Architecture.

Local Link to CVISN

Individual jurisdictions throughout the region regulate and permit the movement of commercial vehicles on their highway network. Permits are issued by each local jurisdiction with limited coordination with other local jurisdictions or state regulatory agencies. The bulk of commercial vehicle regulatory activity occurs at the state level where responsibilities are shared among WSDOT, WSP, and the Department of Licensing. To add to the complexity, trucks that travel outside the state are subject to the regulations of the states in which they travel.

FOR MORE INFORMATION

Commercial Vehicle Information Systems and Networks (CVISN) Web Site
<http://www.avalon-ais.com/itscvo/cvisn.htm>

Johns Hopkins University Applied Physics Laboratory CVISN Program
<http://www.jhuapl.edu/cvisn/>

Introductory Guide To CVISN
<http://www.jhuapl.edu/cvisn/downdocs/#general>

The US Department of Transportation, Federal Motor Carrier Safety Administration (FMCSA) has embarked on a program called CVISN (Commercial Vehicle Information Systems and Networks). CVISN refers to the collection of information systems and communications networks that support commercial vehicle operations (CVO). “These include information systems owned and operated by governments, motor carriers, and other stakeholders. FMCSA’s CVISN program is not trying to create a new information system, but rather to create a way for existing and newly designed systems to exchange information through the use of standards and available communications infrastructure. The CVISN program provides a framework or “architecture” that will enable government agencies, the motor carrier industry, and other parties engaged in CVO safety assurance and regulation to exchange information and conduct business transactions electronically. The goal of the CVISN program is to improve the safety and efficiency of commercial vehicle operations”.¹

The three agencies in Washington who are responsible for aspects of CVO are participating in the implementation of CVISN, which would include the eventual sharing of information with private fleet

¹ Kim E. Richeson, Introductory Guide to CVISN (POR-99-7186) Preliminary Version P.2, February 2000

management systems. Local jurisdictions are encouraged to take advantage of this national development information to gain access to relevant commercial vehicle regulatory information. Local agencies could be given access to the state's CVISN system for inquiry purposes. In the future, an interoperable regional permitting and pre-clearance system should be an operational deployment goal.

This architecture illustrates the [local and state responsibilities for local CVISN applications](#). A link is needed between these two entities for the exchange of commercial vehicle information. The state function in this application is a link to the Fleet and Freight Management Subsystem for the purpose of credentials and compliance. The local Commercial Vehicle Administration role is to operate vehicle checks within their jurisdictions for roadside safety inspections. More information on the ITS Backbone is found in the Puget Sound Regional ITS Architecture.

Emergency Management Service Provider

The [Emergency Management architecture](#) represents three emergency market packages: Emergency Response, Emergency Routing, and Mayday Support. This diagram illustrates a typical emergency management center with connections to traffic and transit management entities, as well links to Vehicle and Traveler subsystems.

Archived Data Management

The [Archived Data Management architecture](#) represents both local and regional data storage. Each "center" entity will operate its own internal ITS Data Mart, for storage of its device data. Each center will also have a link to a single regional Data Warehouse, which will act as a repository for region. This figure could be expanded to include input from such entities as parking management, emissions management, etc.

WHAT IS SYSTEMS ENGINEERING?

The Federal ITS requirements mandate that all ITS projects be based on a systems engineering analysis. The analysis should be on a scale commensurate with the project scope - that is, the more complex the project, the more complex the analysis. The requirements for this systems engineering analysis have been defined as the execution of the following seven elements:

1. [Fitting Your Project Into the Regional ITS Architecture](#)
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](#)
7. [Procedures and Resources Necessary for Operations and Management of the System](#)

A comprehensive systems engineering analysis is typically done as a matter of course on any transportation engineering project involving the application of advanced technology. A traditional systems engineering process will have more activities than just the ones included above. However, the above list indicates the subset of activities that will meet the federal ITS requirements.

Fitting Your Project Into the Regional ITS Architecture

As described above earlier in this document, one of the primary federal ITS requirement is to demonstrate how your project fits into the [Puget Sound Regional ITS Architecture](#). The Regional ITS Architecture defines a regional framework for ensuring institutional agreement and technical integration for the implementation of ITS projects with the Puget Sound region. It is designed to provide guidance and serve as a resource in the development of local ITS projects.

To review this section again, please [click here](#).

Identification of Participating Agencies Roles and Responsibilities

The systems engineering analysis must include an identification of the participating agencies roles and responsibilities. The operational concept developed for the project as part of step one of the systems engineering analysis will identify these key relationships. Additionally, where agreements are needed – these should be identified and described in the engineering analysis. Section 5 of the [Regional ITS Architecture](#) document provides a checklist of potential issues for consideration in the development of an agreement. These should be considered during a project’s planning and design stage.

Requirements Definitions

In a traditional systems engineering analysis, requirements are defined as the first step in the design of the project. System requirements lead the way in design by providing a framework for the project – they include:

- Functional Requirements (What is to be accomplished by the project.)
- Performance Requirements (How the functions will be executed, i.e., how fast and how often.)
- Technical requirements (What equipment, standards, mechanical, etc., are required for accomplishing the functions.)

Requirements should be developed for each major component of the project including center, field, vehicle, traveler, and communications hardware, software and equipment. Once again, the project architecture developed in step one can help with the development of requirements.

Analysis of Alternative System Configurations and Technology Options To Meet Requirements

Evaluation of different configurations and technology options is an essential activity in any systems engineering analysis. An analysis of alternative system configurations and technologies ensures that the system meets the desired objectives within the available budget and schedule, while maximizing the quality of the system.

The alternative system configuration analysis should give an overview of each option and discuss design factors (both advantages and disadvantages) such as redundancy, expandability, cost, etc. for each. The analysis should document how each option would meet the requirements of the project.

A technology evaluation should also be performed. Often the technology of a system is dependant on the system configuration, so it may be prudent to have a recommended system configuration established prior to starting the technology evaluation. The technology evaluation should identify potential equipment options and for each option, the review should address the following factors:

- **Cost:** The equipment unit costs and quantities need to be examined.
- **Functionality:** Does the equipment meet the identified functional requirements? If no, can the system objectives still be met without the specific function(s)? Does the technology provide additional functions (not identified in the system requirements) that are beneficial now or in the future?
- **Schedule:** What is the lead time required for ordering equipment? Will selection of technology bring forward or delay the schedule?
- **Maintenance:** Does the technology typically require a significant level of effort or cost to maintain? Investigate other implementations of the technology and gather information on maintenance requirements? What is the typical life span of the technology?
- **Expandability and Adaptability:** Technology expandability needs to be reviewed. Does the technology provide additional capacity that can be used in the future? Can additional applications be added? Can the device handle additional interfaces/connections with other equipment?
- **Standards:** Does the selected technology conform to national ITS technical standards?
- **Security:** Security of devices, software and communications should be addressed (i.e., is it needed and what does the technology offer).

Procurement Options

Many agencies currently procure ITS using existing procurement vehicles that were designed for traditional road and bridge design and construction. There are few examples of procurement processes designed specifically for ITS. Often, traditional procurement processes do not adapt well to ITS, which can require more flexibility to suit the uncertain and iterative nature of ITS. The key difference among the various types of ITS procurements is the degree of uncertainty in the project outcome. The relationship between uncertainty and procurement is the focus of this discussion and the key to successful procurements. Even without procurement processes designed specifically for ITS, existing procurement methods can be applied that better respond to the needs of ITS projects.

Project sponsors are encouraged to refer to Procurement Options Section of the [Guidance For Complying With Federal Requirements For ITS Projects In The Puget Sound Region](#) and the [US DOT web site](#) for a detailed discussion of this issue.

Identification of Applicable ITS Standards and Testing Procedures

Technical standards facilitate deployment of interoperable systems at local, regional, and national levels without impeding innovation as technology advances and new approaches evolve. ITS standards are specifications that define how transportation system components interconnect and interact within the overall framework of the National ITS Architecture. They specify how different technologies, products, and components interconnect and interoperate among the different systems so that information can be shared automatically.

ITS standards contain and specify the technical details on how to build and integrate ITS systems and components consistently. The key point is that standards provide the spectrum of technical detail that enables the design and deployment of an integrated ITS system throughout the region. Standards allow different systems to speak to each other in a common language, using common data elements, well-defined data structures or "messages", and well-understood protocols or rules for data exchange and sharing.

U.S. DOT maintains an up-to-date website summary on the status of all [ITS standards](#). Also, Section 7 of [Puget Sound Regional ITS Architecture](#) provides a summary of market packages that are applicable to the region and the relevant standards associated with each.

Procedures and Resources Necessary for Operations and Management of the System

A critical aspect of ITS projects is the need to operate and manage the system once it is installed. The identification of the procedures and resources necessary for operations and management of the system is an important aspect of the project design. Elements to consider include the following:

1. Daily Operating Procedures
2. Operations Training
3. System Monitoring
4. Center Equipment Maintenance
5. Field Equipment Maintenance
6. Spare Equipment Stockpiles
7. Maintenance Activity Tracking
8. Equipment Maintenance Training
9. Maintenance Facilities and Related Tools
10. Data Management
11. Performance Requirements
12. Equipment Upgrades
13. Software Upgrades
14. Staffing Requirements
15. Development of Consensus for Operations That Will Impact Multiple Jurisdictions
16. Development and Approvals of Inter-Agency Agreements

For each of the above, an analysis should be performed to determine staffing and resource levels and budgets to ensure efficient and continuous operation of the system.

EXAMPLE: DEPLOYING A TRAFFIC SIGNAL CONTROL SYSTEM

This section provides an example of how a project sponsor can meet the federal ITS requirements. For this example, the deployment of a traffic signal control system was selected. The example does not include a full systems engineering analysis, but illustrates how the National and Regional ITS Architectures relates to the planning and design of a signal control system project. The following items are addressed:

- [Overview of Illustrative Project](#)
- [Fitting Into the Regional ITS Architecture](#)
- Systems Engineering Analysis Consideration

Overview of Illustrative Project

The example selected for this exercise is the installation of a computerized central traffic signal control system. For the purpose of this example, the “City” has defined the following objectives:

OBJECTIVES FOR ILLUSTRATIVE PROJECT
1. Provide ability to control traffic signals from a central location
2. Provide ability to monitor roadway conditions with sensors and cameras
3. Provide ability to implement transit signal priority (TSP)
4. Support traffic signal preemption for emergency vehicles
5. Provide ability to display messages on dynamic message signs
6. Provide ability to share information with neighboring city and state traffic management centers including video
7. Support ability to store data collected by the traffic signal system for future analysis
8. Support ability to provide traveler information on a web site

Besides just providing traffic signal control, the illustrative project calls for the central system to control sensors, cameras and dynamic message signs on the arterial roadway in the city. The deployment of TSP equipment adds an additional challenge and the need to work with the local transit agency. The objectives also include the desire to share information, including video, with neighboring jurisdictions. Finally, providing information gathered by the traffic control system to the Internet adds more requirements beyond just signal control.

Fitting Into the Regional ITS Architecture

One of the primary federal ITS requirement is to demonstrate how your project fits into the Puget Sound Regional ITS Architecture. The approach to demonstrating that a project fits into the Regional ITS Architecture contains the following steps:

1. [Review market packages](#) in the National and Regional ITS Architecture to determine which market packages will best meet the requirements of your project.
2. [Review the Regional ITS Integration Strategy](#) to determine how your project could be integrated into the overall regional deployment of ITS applications. This will help you identify other organizations and ITS applications to which your project may need a connection.
3. [Determine which agencies, organizations and stakeholders](#) beyond your own organization could be involved in the project.
4. [Develop an operational concept](#) for the project using the results of the market package review and identification of stakeholders to be included in the project. The operational concept defines the institutional relationships and the high-level information flows among the organizations required for the deployment and operation of the project.
5. [Develop a project ITS architecture](#) diagram that indicates subsystems (entities and stakeholders), equipment packages, and information exchanges using the National ITS Architecture market package definitions and diagrams as a basis. Example ITS architecture diagrams are available as a starting point.
6. [Identify](#) any market packages, interface requirements, and information exchanges provided by the project that are not currently included in the Regional ITS Architecture.
7. [Work with the Regional Council](#) to update the Regional ITS Architecture, if required.
8. The results of this activity feed into the rest of the [systems engineering analysis](#) effort that would be performed during the design of the project

Review Market Packages

The next step is to determine which market packages would be appropriate for inclusion in the illustrative project. Using the list of [illustrative project objectives](#) as a guide, [market packages included in Puget Sound Regional ITS Architecture](#) and the [National ITS Architecture](#) were matched against these objectives. The resulting list of applicable market packages with a definition of the selected market package is found below.

Illustrative Review of Market Packages for a Signal Control System

ILLUSTRATIVE PROJECT OBJECTIVES	MARKET PACKAGE NAME	DEFINITION FROM NATIONAL ITS ARCHITECTURE
Provide ability to control traffic signals from a central location	Surface Street Control	This market package provides the central control and monitoring equipment, communication links, and the signal control equipment that support local surface street control and/or arterial traffic management
Provide ability to monitor roadway conditions with sensors and cameras	Network Surveillance	This market package includes traffic detectors, other surveillance equipment, the supporting field equipment, and wire line communications to transmit the collected data back to the Traffic Management Subsystem.
Provide ability to implement transit signal priority	Multi-Modal Coordination	This market package establishes two-way communications between multiple transit and traffic agencies to improve service coordination. More limited local coordination between the transit vehicle and the individual intersection for signal priority is also supported by this package.
Support traffic signal preemption for emergency vehicles	Emergency Routing	This market package supports dynamic routing of emergency vehicles and coordination with the Traffic Management Subsystem for special priority on the selected route(s). The Emergency Vehicle would also optionally be equipped with dedicated short-range communications for local signal preemption.
Provide ability to display messages on dynamic message signs	Traffic Information Dissemination	This market package allows traffic information to be disseminated to drivers and vehicles using roadway equipment such as dynamic message signs or highway advisory radio.
Provide ability to share information with neighboring city and state traffic management centers including video.	Regional Traffic Control	This market package advances the Surface Street Control and Freeway Control Market Packages by adding the communications links and integrated control strategies that enable integrated Inter-jurisdictional traffic control. This market package provides for the sharing of traffic information and control among traffic management centers to support a regional control strategy.
Support ability to store data collected by the traffic signal system for future analysis.	ITS Data Mart	This market package provides a focused archive that houses data collected and owned by a single agency, district, private sector provider, research institution, or other organization. This focused archive typically includes data covering a single transportation mode and one jurisdiction that is collected from an operational data store and archived for future use.

<u>ILLUSTRATIVE PROJECT OBJECTIVES</u>	<u>MARKET PACKAGE NAME</u>	<u>DEFINITION FROM NATIONAL ITS ARCHITECTURE</u>
Support ability to provide traveler information on a web site	Broadcast Traveler Information	This market package provides the user with a basic set of Advance Traveler Information System (ATIS) services; its objective is the early acceptance of these services. It involves the collection of traffic conditions, advisories, general public transportation, toll and parking information, incident information, air quality and weather information, and the near real time dissemination of this information over a wide area through existing infrastructures and low cost user equipment (e.g., FM subcarrier, cellular data broadcast).
Support ability to provide traveler information on a web site	Interactive Traveler Information	This market package provides tailored information in response to a traveler request. Both real-time interactive request/response systems and information systems that "push" a tailored stream of information to the traveler based on a submitted profile are supported. A variety of interactive devices may be used by the traveler to access information prior to a trip or en-route to include phone, kiosk, Personal Digital Assistant, personal computer, and a variety of in-vehicle devices.

As the table indicates, the traffic signal system control project can become more complex when the requirements include sharing information with other jurisdictions, agencies, and the general public. It also indicates how the Regional and National ITS Architecture can be of assistance in defining the project.

Review the Regional ITS Integration Strategy

The next activity is to review the regional ITS integration strategy to determine how the project could fit into the overall vision of deploying an integrated system through out the region. Critical to the deployment of an integrated regional ITS system is the specification and development of electronic interfaces for the full exchange of system status information and control data. These interfaces enable the regional sharing of data and information for the purposes of transportation network status and for the future sharing of ITS devices among the transportation management systems operated by local, county, state and transit organizations. In this case, the choice of new ITS standards-based signal control system using the National Transportation Communications for ITS Protocol (NTCIP) center-to-center protocol for the exchange of information with other traffic and transit management centers would be attractive. However, an agreement(s) with other agencies on the use of the technical standard would be required. Additional information on this topic is found in Section 3 of the [Puget Sound Regional ITS Integration Strategy](#).

Determine Stakeholders

The review of the market packages and illustrative project objectives indicate the need for agreements and information exchanges between the City Traffic Management and the following organizations

- Transit Management - implementation of transit signal priority.
- Other City Traffic Management - sharing of information and video images.
- State Traffic Management - sharing of information and video images.
- Emergency Management Organization - implementation of emergency signal preemption.

Develop an Operational Concept

The operational concept defines the relationships among the organizations required for the deployment and operation of the project. Relationships between agencies embody two main components: 1) the agency-to-agency relationship defines what roles and responsibilities each agency has and 2) the kinds of information exchanges that occur between each agency. Based on the project objectives, identified market packages,

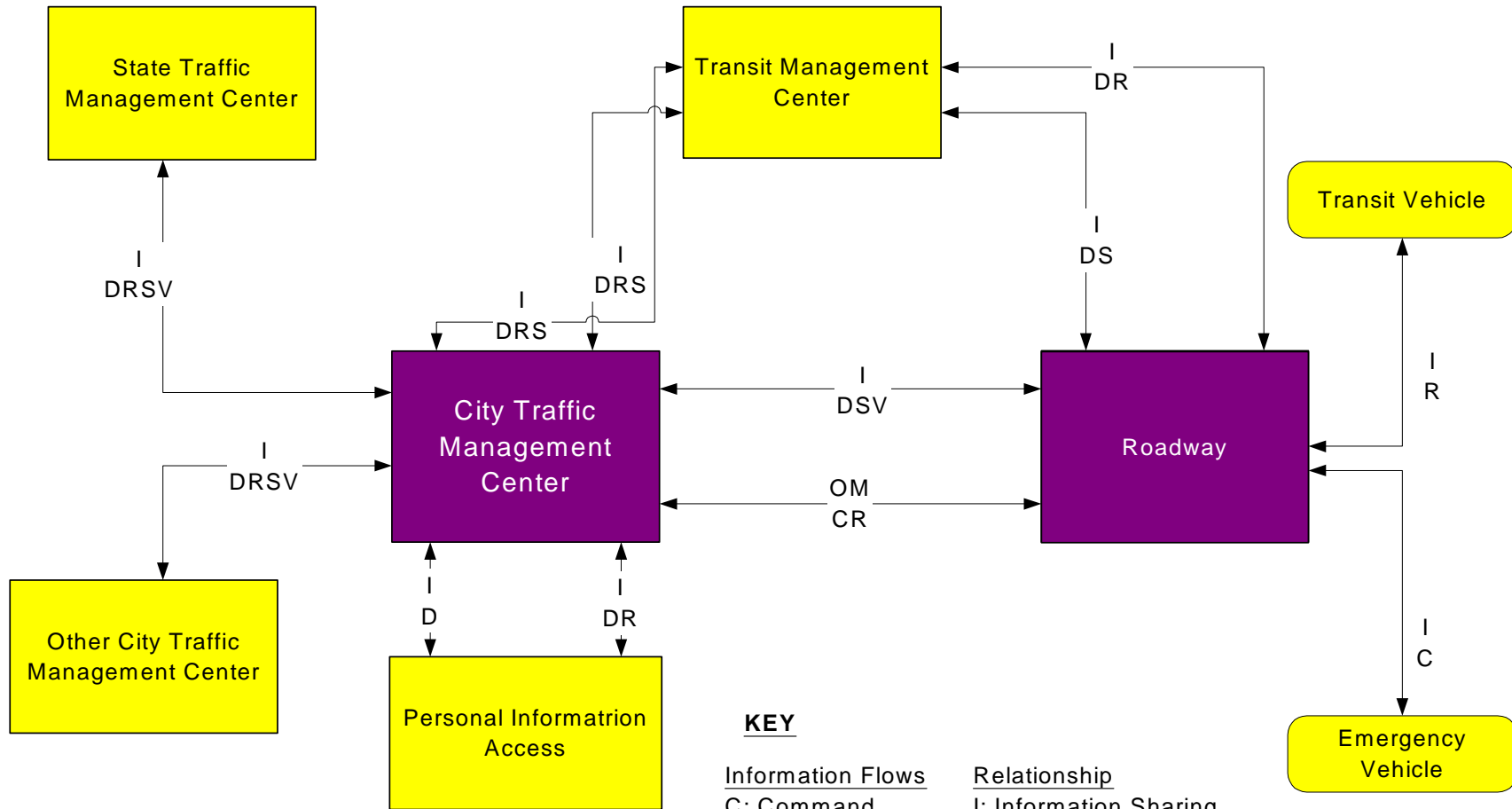
related subsystems (vehicles and roadway), and stakeholders, the following matrix was developed to define both types of interactions between stakeholders and related subsystems. A [graphic of the matrix](#) is also provided.

Illustrative Operational Concept Matrix for a Signal Control System

FROM	TO	AGENCY-TO-AGENCY RELATIONSHIP	INFORMATION EXCHANGES	COMMENTS
City Traffic Management Center	Roadway	Operations Maintenance	Command Request	<ul style="list-style-type: none"> Signal Control Link to Sensors and Cameras
Roadway	City Traffic Management Center	Information Sharing	Data Status Video	<ul style="list-style-type: none"> Link from Field Equipment
City Traffic Management Center	Transit Management Center	Information Sharing	Data Request Status	<ul style="list-style-type: none"> Share Information for Transit Signal Priority (TSP)
Transit Management Center	City Traffic Management Center	Information Sharing	Data Request Status	<ul style="list-style-type: none"> Share Information for Transit Signal Priority (TSP)
Transit Management Center	Roadway	Information Sharing	Data Request	<ul style="list-style-type: none"> Provide Information to Signal Control to Enable TSP
Roadway	Transit Management Center	Information Sharing	Data Status	<ul style="list-style-type: none"> Provide Information on TSP operations
Transit Vehicle	Roadway	Information Sharing	Request	<ul style="list-style-type: none"> Request for Priority by Transit Vehicle
Emergency Vehicle	Roadway	Information Sharing	Command	<ul style="list-style-type: none"> Command for Preemption for Emergency Vehicle
City Traffic Management Center	Other Agency Traffic Management Center	Information Sharing	Data Request Status Video	<ul style="list-style-type: none"> Exchange of Information and Video

FROM	TO	AGENCY-TO-AGENCY RELATIONSHIP	INFORMATION EXCHANGES	COMMENTS
Other Agency Traffic Management Center	City Traffic Management Center	Information Sharing	Data Request Status Video	<ul style="list-style-type: none"> • Exchange of Information and Video
City Traffic Management Center	Personal Information Access (website)	Information Sharing	Data	<ul style="list-style-type: none"> • Send information and images to web site
Personal Information Access (website)	City Traffic Management Center	Information Sharing	Data Request	<ul style="list-style-type: none"> • Request information

ILLUSTRATIVE OPERATIONAL CONCEPT FOR TRAFFIC SIGNAL CONTROL SYSTEM



KEY

Information Flows

- C: Command
- D: Data
- R: Request
- S: Status
- V: Video

Relationship

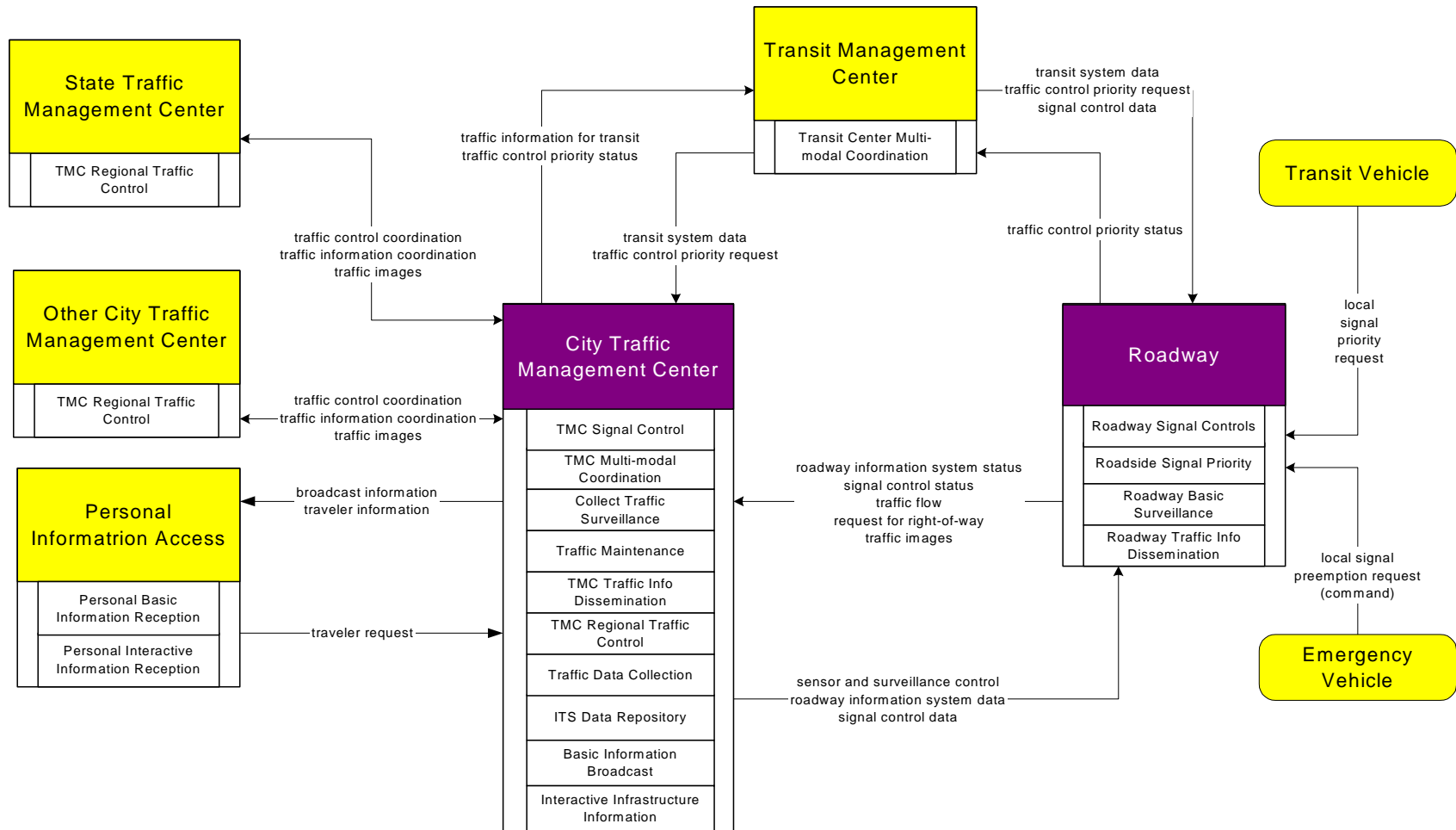
- I: Information Sharing
- O: Operations
- M: Maintenance

Develop a Project ITS Architecture

Based upon the market package review and operational concept, the project ITS Architecture diagram can be assembled. The diagram should include each of the entities identified in the operational concept and the related equipment packages and detailed information (architecture) flows required to meet the project objectives. The individual market package diagrams found in the [National ITS Architecture](#) provide the information on the relevant equipment packages and architecture flows. Only the architecture flows to be supported by the project should be included.

The [project ITS architecture diagram](#) for the illustrative traffic signal control system project is described next. To the center of the diagram is the City Traffic Management Center (TMC). The primary information flows are between the City TMC and the Roadway for the control of field equipment. The City TMC also shares traffic information and video with other TMCs (left and upper corner) and enables the sharing of information for transit signal priority with the Transit Management Center. In this diagram, the Transit Management Center has a direct link to the Roadway to provide information to traffic signal controllers to enable TSP. This architecture reflects the approach to TSP implementation being used by King County Metro where TSP interface units are installed in the traffic signal cabinets. Both transit and emergency vehicles have the ability to request priority from the traffic signal controllers in this diagram. Finally, the City TMC provides information to travelers via the Personal Information Access subsystem. In this case, the information is provided via a web site.

ILLUSTRATIVE PROJECT ITS ARCHITECTURE DIAGRAM FOR TRAFFIC SIGNAL CONTROL SYSTEM



Does the Project Fit Into the Regional ITS Architecture?

Because the illustrative project only depicts selected market packages already included in the Regional ITS Architecture, and supports the regional ITS integration strategy, it clearly fits into the Puget Sound Regional ITS Architecture. At this point, the project sponsor would have addressed all the requirements for demonstrating compliance at the planning level check point in the transportation improvement plan review process.

Systems Engineering Analysis Considerations

As the project enters the design phase, the systems engineering analysis would be completed as an expected project design activity, but also in response to the Federal ITS requirements. The remaining six elements required for the systems engineering analysis would be typically performed as part of a new signal control system design effort. Some key points for selected elements are discussed below.

The high-level **roles and responsibilities** of participating agencies are defined by the operational concept. Once the design phase begins, the project sponsor should work to detail and formalize these understandings. For this illustrative project, issues to resolve could include:

- Access protocols to camera and traffic information
- Selection of technical standards for the exchange of camera images and traffic information
- Selection of TSP control strategy
- Maintenance responsibilities for roadside TSP equipment

System requirements lead the way in design by providing a functional, performance, and technical description of the project. The project ITS architecture provides a convenient starting point for this analysis effort. For traffic signal system projects, peers at other local agencies that have recently deployed newer systems are another source of information.

The definition of system requirements will allow a trade-off analysis to be conducted for **alternative system configurations and technology options**. The requirements provide the evaluation criteria for comparing each option. In selecting new signal systems, future maintenance requirements should be specifically considered.

Standards Development Organizations with support from US DOT are rapidly moving toward the development of **national ITS technical standards**. At this time, US DOT has not formally adopted through the Federal rulemaking process any ITS technical standard that is required for deployment. However, each project sponsor should give serious consideration to requiring these standards to ensure future interoperability and ease of integration with other systems in the region. For a signal system, the key standards of interest are the NTCIP center-to-center and center-to-field. The selection to use NTCIP standards will have a significant impact on the definition of system requirements. Additional information on these standards is found in Section 7 of the [Regional ITS Architecture document](#) and on the [US DOT ITS Standards website](#).

KEY PUGET SOUND REGION ITS DOCUMENTS

The following key documents provide direction and guidance for the Puget Sound region in the development and integration of ITS projects. These reports will furnish interested parties with detailed information on the Puget Sound Regional ITS Architecture and assistance in meeting federal and regional ITS requirements for ITS projects.

- [Puget Sound Regional ITS Architecture](#) is a framework for ensuring institutional agreement and technical integration for the implementation of ITS projects within the region.
- [Puget Sound Regional ITS Transit Architecture](#) provides a more detailed focus on transit applications in the region.
- [Puget Sound Regional ITS Strategy](#) provides recommended path for integrating the individual modal, organizational, and functional ITS applications into an integrated regional whole.
- [Guidance For Complying With Federal Requirements For ITS Projects In The Puget Sound Region](#) assists sponsors of ITS projects in the region comply with the federal ITS requirements. These requirements apply to all ITS projects funded with federal highway trust funds including the mass transit account.

KEY ITS RESOURCES

The US Department of Transportation maintains an ITS web site that is a key source of current information on ITS developments and resources.

- [US DOT ITS Home Page](#)
- [On Line National ITS Architecture](#)
- [National ITS Architecture & Standards Conformity Resource Guide \(draft only so far\)](#)
- [National ITS Standards](#)