Thurston Region System Architecture

Technical Memorandum #2

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Thurston Regional Planning Council

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Executive Summary

Background

In December 2000 a regional study was undertaken to develop a plan that will guide the deployment of Intelligent Transportation Systems (ITS) in Thurston County, Washington. The study focuses on urban areas within Thurston County including the cities of Olympia, Lacey, Tumwater, Yelm, Tenino, Bucoda, Rainier, and Rochester (see Figure E-1). The major activities undertaken as part of this study included:

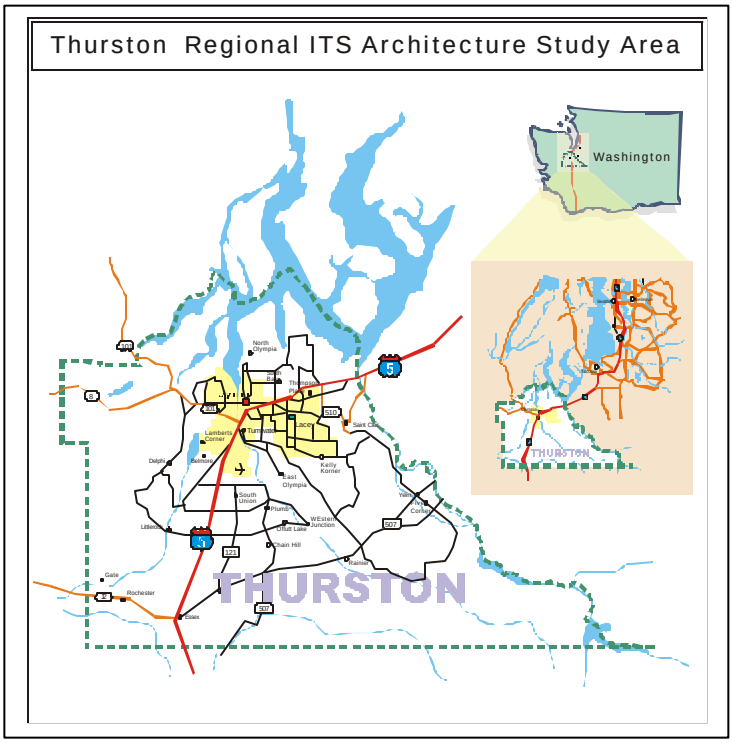

Figure E-1: Thurston Region Study Area

- ?? Collection and coordination of ideas from the participating agencies in the study area through engagement and facilitated discussion of stakeholder input via workshops and one-on-one or group interviews;
- ?? Definition of transportation issues and needs for the area;
- ?? Development of a User Needs, User Services and User Requirements Report (Tech Memo #1);
- ?? Development of a Regional System Architecture (TM #2);
- ?? Development of a Public Transportation System Architecture & Strategic Plan (TM #3);
- ?? Development of a Thurston Region Implementation Plan; and
- ?? Development of a Final Report.

Why an ITS Architecture?

This report summarizes the development of a regional ITS architecture for the area. This system architecture provides a framework from which to define and illustrate how system components interact to achieve the system goals, and provides useful information for the development of projects that implement the physical and functional aspects illustrated by this same framework.

The Federal Highway Administration (FHWA) issued an architecture rule on January 8, 2001 that required the development of a regional ITS system architecture, consistent with the National ITS Architecture, as a precursor to receipt of future federal funding for ITS projects. Regions

that already have ITS projects in place (like the Thurston Re gion) have up to four years from the date of this rule to develop an ITS architecture. Though this program was initiated prior to the enactment of this regulation, development of this architecture was intended to meet both the requirements and the spirit of the FHWA regulation.

The architecture describes the information sharing interactions between systems but does not prescribe specific technologies. For example, a system architecture might indicate the need for deployment of surveillance assets along a freeway or arterial but will not specify the type (e.g., inductive loops, video surveillance, radar, etc.) of technology to be used.

The following summary presents a discussion of the regional ITS architecture and inherent capabilities that are a mixture of existing, planned and future capabilities—it does not distinguish between these operational or planning states in this summary—that distinction is made in subsequent reports for public transportation (TM #3) and the Implementation Plan.

What's in an ITS Architecture?

The Thurston Region architecture was developed using a structured process (see Figure E-2) that incorporates the activities listed above, and sequentially "maps" local problems and needs into

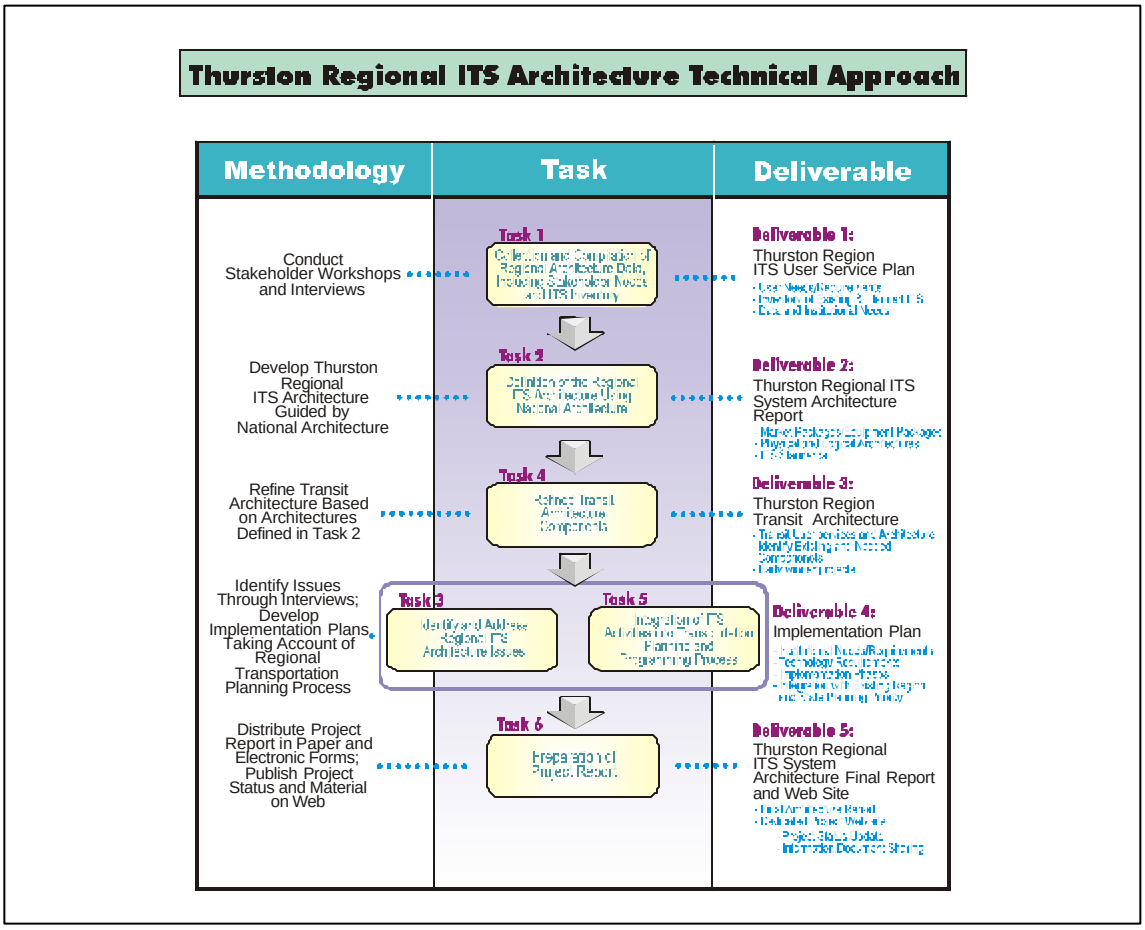

Figure E-2: Architecture Development Process

the National ITS Architecture to develop a regional architecture for the area. The architecture is expressed in separate views: **Physical** and **Logical**—each viewpoint provides useful information about ITS organizational and functional concepts to the multifaceted regional audience.

Physical Architecture

The **physical architecture** is based on 19 separate subsystems; these are grouped functionally into four separate categories: Center Subsystems, Roadside Subsystems, Traveler Subsystems, and Vehicle Subsystems.

Center Subsystems are typically located in fixed facilities; these subsystems support the operations, management, administration, and supporting functions for the transportation system. These center subsystems each communicate with other centers to enable coordination between modes and across jurisdictions within a region. These center subsystems also communicate with roadside and vehicle subsystems to gather and provide information, and control roadside devices that are interfaced with the center subsystems. The major center subsystems in the Thurston region include:

- ?? *Traffic Management Center* (WSDOT Tacoma Traffic Operation Center, Thurston County, Regional Cities Traffic Departments);
- ?? *Transit Management Center* (Intercity Transit, and various special needs transportation services);
- ?? *Emergency Management Center* (Thurston County EOC, Thurston County 911 Call Center, Washington State Patrol, Local Police and Fire, and communications support provided by CAPCOM);
- ?? *Commercial Vehicle Center* (WSDOT Weigh-in-Motion, Height-Size); and,
- ?? *Archived Data Management Center* (WSDOT regional ITS data archive, Thurston County, Regional Cities and Jurisdictional Counties archived data collection).

Roadside Subsystems provide the direct interface to the roadway network, vehicles traveling on the roadway network, and travelers in transit. Each of the roadway subsystems includes functions that require communications and data distribution to and from the roadside to support direct surveillance, traveler and status information dissemination, and control plan execution. All roadside subsystems interface to one or more of the center subsystems that govern overall operation of these same roadside devices. The roadside subsystems also generally include direct user interfaces to drivers and transit users, and short-range wireless interfaces to the Vehicle Subsystems to support operations. The major roadside subsystems in the Thurston region include:

- ?? Closed-circuit television surveillance;
- ?? Real-time traffic detectors;
- ?? Coordinated traffic signals;
- ?? Dynamic message signs;
- ?? Highway advisory radios;

?? Weather, pavement and environmental sensors; and,
?? Commercial vehicle operation implementations such as weigh-in-motion stations.

Traveler Subsystems include the devices typically owned and operated by the traveler as well as those devices emplaced by a public or private sector entity to distribute general or specific-purpose traveler information. Though this equipment and these devices are often general purpose in nature, and suitable for use in a variety of tasks, in this case the equipment is specifically used for gaining access to traveler information within the scope of the ITS architecture. For transit specific traveler information, examples include information kiosks and small electronic signs used to provide bus schedule, fare, and real-time bus arrival time information—the latter often based on bus location data and awareness of schedule adherence.

These portable or fixed traveler information subsystems access the traveler information through their interface to the information provider--which can be either one of the publicly operated center subsystems, or more commonly an Information Service Provider subsystem. A range of information service options, levels of equipment sophistication, and information services for free or for a fee are considered and supported. Specific equipment included in this subsystem class includes personal computers, telephones, hand-held computers (e.g., Palm, Visor, etc.), broadcast and cable television, broadcast radio, information kiosks, electronic signs at bus terminals or major employer stops, and any other communications-capable consumer products that can be used to supply information to the traveler. The major traveler subsystems in the Thurston region include:

?? Real-time en-route traffic information service on major freeways;
?? Personal information access via Internet and personal communication devices; and,
?? Remote traveler information broadcast via television and radio.

Vehicle Subsystems are all vehicle-based and share many general driver information, vehicle navigation, and advanced safety systems functions. The vehicle subsystems communicate with the roadside subsystems and center subsystems to both collect data and display information to the driver. In the following descriptions, the Personal Vehicle Subsystem description includes general traveler information and vehicle safety functions that are also applicable to at least the four identified fleet vehicle subsystems—Commercial, Emergency, Maintenance and Transit Vehicle Subsystems. These fleet vehicle subsystems all include automatic vehicle location (AVL) and two-way communications functions that support efficient fleet operations. Each of the three fleet vehicle subsystems also includes functions that support their specific service area. The major vehicle subsystems in the Thurston region include:

?? Transit vehicle automatic vehicle location (AVL);
?? Emergency vehicle traffic signal pre-emption;
?? County maintenance vehicle AVL; and,
?? Commercial vehicle electronic clearance.

Using these general descriptions and the systems engineering process encapsulated in the National ITS Architecture, a customized regional architecture was developed for the Thurston

region that represents the existing transportation infrastructure now as well as providing a view of that system in the future.

The physical architecture provides agencies with a physical representation, though not a detailed design, of the important ITS interfaces and major system components. The principal elements in the physical architecture are the 19 subsystems, and the architecture flows that connect these subsystems and terminators into an overall structure. An architecture flow is an abstraction of the information exchange that includes the collection of individual data items that "flow" between the subsystems.

Figure E-3 presents the high-level physical architecture for the area. This style of architectural illustration is often referred to as the "sausage diagram"--this figure presents the major subsystems as they are envisioned for the Thurston area. The "sausages" in this diagram represent the various communication approaches, not necessarily the exact technologies that are used to connect the subsystems. More technically detailed physical architecture diagrams for each subsystem represented in the sausage diagram are presented in Section 2 of this Technical Memorandum.

Logical Architecture

The **logical architecture** identifies the functional processes to be performed by subsystems, and defines the flows of data and the interfaces between the subsystems. It decomposes the functionality of the various ITS systems in place, or to be deployed, and expresses those functional elements as the data flow between systems, and the process specifications for the work performed by the component systems.

Figure E-4 below, depicts the relationship between the logical and physical architecture. A physical architecture is a graphical representation of the ITS "system."

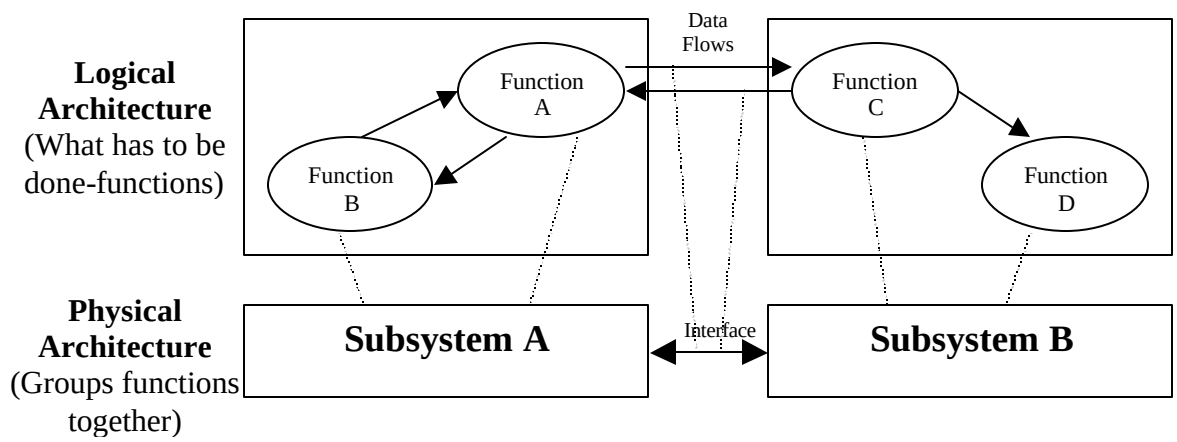

Figure E-4: Relationship Between Physical and Logical Architecture

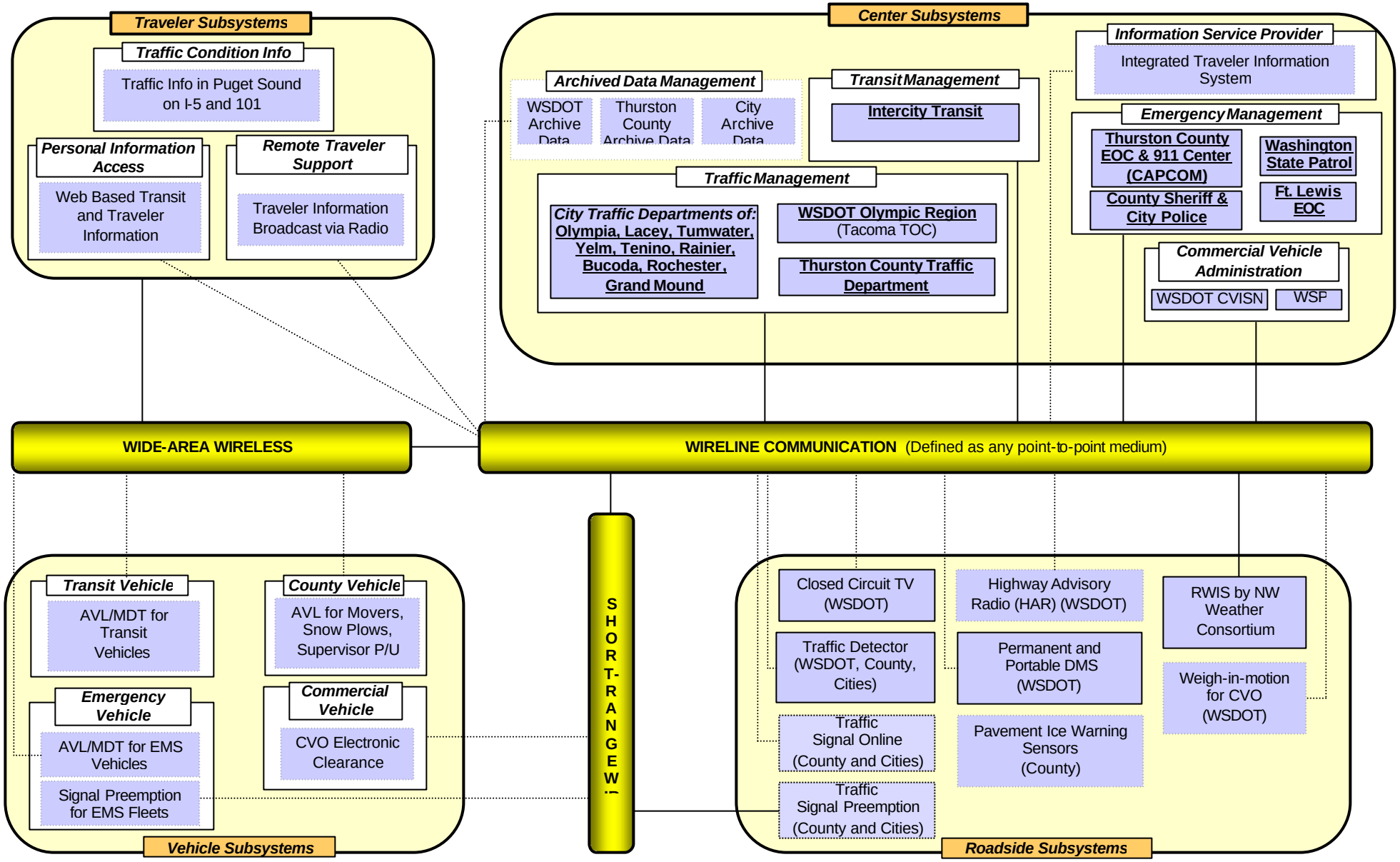

Figure E-3: Thurston Region High-Level Physical Architecture

Figure E-5 presents a simplified high-level representation of the Thurston region logical architecture. It combines the functionality of all existing, planned or future ITS systems in the region into eight high level processes, these are: Manage Traffic, Manage Transit, Electronic Payment Services, Driver and Traveler Services, Emergency Services, Commercial Vehicle Operations, Vehicle Monitoring and Control, and Manage Archived Data. Detailed logical architecture diagrams for each of these process areas are presented in Section 3 of this Technical Memorandum.

Application of ITS Standards

This document concludes with a discussion on ITS standards. These standards can be thought of as the glue that pulls the various pieces of the architecture together. Well-defined standards are fundamental to the establishment of nationally compatible and interoperable ITS deployments. ITS Standards will enable deployment of consistent, non-interfering, interoperable and reliable systems on local, regional and national levels.

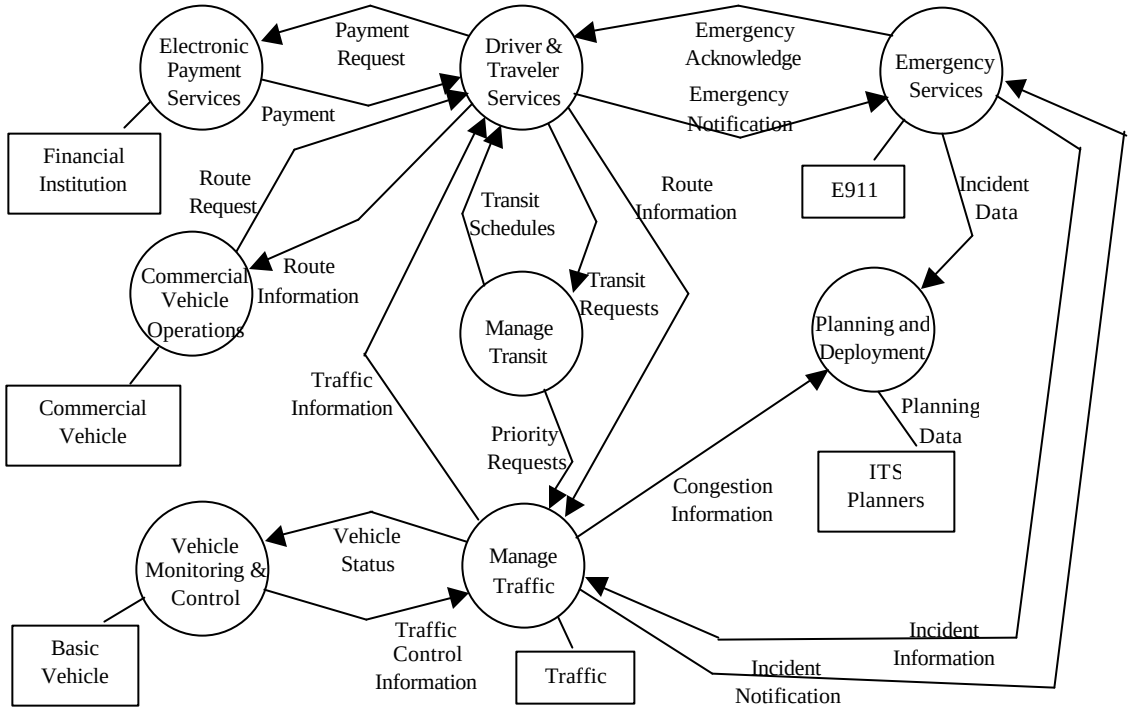

Figure E-5: Simplified High Level Logical Architecture

In the National ITS Architecture, the logical architecture presents a functional view of the ITS user services. It defines the functions or processes that are required to perform the selected ITS user services, and the information or data flows that need to be exchanged between these

functions. The physical architecture partitions the functions defined by the logical architecture into systems and subsystems. In order to accomplish the functions outlined in the logical architecture, some communication must take place between the elements of the physical architecture. These communication links in the physical architecture are defined by the architecture flows between the subsystems. The standards are the "rules" for implementation of these architecture flows—the architecture flows are the pieces of the regional architecture puzzle that identify where the standards apply, and define how the communications must take place between the various subsystems in the National ITS Architecture.

There are approximately ninety (90) unique ITS standards have been identified as relevant in the implementation of the systems in the National ITS Architecture. Recently, the U.S. DOT's Joint Program Office (JPO) has placed major emphasis on defining and associating these standards based on application areas grouped by the National ITS Architecture interfaces (e.g., center-to-center, center-to-roadside, etc.). This makes the discussion of ITS standards more deployment oriented, and more easily traceable to well defined ITS services or systems.

The table below presents the National ITS Architecture Interfaces, the interfaces between subsystems, and the application areas that fall under them. A detailed listing of each interface together with the associated application areas included in that interface, and the standards applicable to the Thurston region architecture can be found in Section 5 of this Technical Memorandum.

National ITS Architecture Interface	Associated Application Areas
Center – to – Roadside	1. Data Collection and Monitoring 2. Dynamic Message Signs 3. Environmental Monitoring 4. Ramp Metering 5. Traffic Signals 6. Vehicle Sensors 7. Video Surveillance
Center – to - Center	1. Data Archival 2. Incident Management 3. Rail Coordination 4. Traffic Management 5. Transit Management 6. Traveler Information
Center – to – Vehicle/Traveler	1. Mayday 2. Transit Vehicle Communication 3. Traveler Information
Roadside – to- Vehicle	1. Signal Priority
Roadside – to - Roadside	1. Highway Rail Intersection

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1.0 Introduction

Ultimately, the goal of deploying intelligent transportation systems (ITS) in the Thurston region is to improve efficiency and safety of the transportation system in the area through deployment of advanced technologies and systems management techniques. ITS technologies offer benefits ranging from improved safety on the existing transportation infrastructure to better status information to users of the transportation facilities (travelers and transportation management professionals), allowing them to better plan their travel itineraries. ITS technologies also provide managers of the transportation systems the ability to "do more with less" by squeezing more out of existing infrastructure by using the information provided from ITS solutions.

To be successful, deployments of ITS technologies must involve more than just the transportation professionals (State department of transportation, city and county transportation engineers) in the Thurston region. All regional stakeholders, including emergency management, transit, traveler information providers, the media, etc. must be involved and integrated to gain the greatest benefit from an integrated regional deployment of ITS technologies. A blueprint is needed for the development of an integrated system because multiple interest stakeholders are involved -- all with different systems and technologies in place and planned for the future. Without such a blueprint, the transportation system in the Thurston region would simply be a collection of isolated systems, none interacting with each other or sharing information/data between them.

An ITS architecture describes how various systems are connected electronically, what data is shared, and functionally how this interconnected system is used to accomplish a particular goal (e.g., improve emergency response times to accidents/incidents). The creation of an ITS architecture is important because the cost of deploying technologies is expensive, and growing rapidly. Also, the decisions made in the early stages of procuring and deploying ITS technologies can have significant impacts on the costs and functionality of future deployments. Planning ahead for future regional needs and designing each system for future flexibility is the purpose of an ITS architecture.

The National ITS Architecture defines the functions (e.g., transit itinerary planning, emergency response routing) that must be performed to implement given requirements of the region, expressed as user services in the National ITS Architecture. The National ITS Architecture also details the physical systems or subsystems where these functions reside (e.g., the emergency vehicle or transit operations facility). The regional architecture under development for the Thurston region will translate local needs and issues into the terminology and system descriptions of the National ITS Architecture.

1.1 Architecture Development Process

The approach employed to develop a regional ITS architecture for the Thurston region that is consistent with the National ITS Architecture and meets the needs and issues specific to the Thurston region is outlined in the figure below:

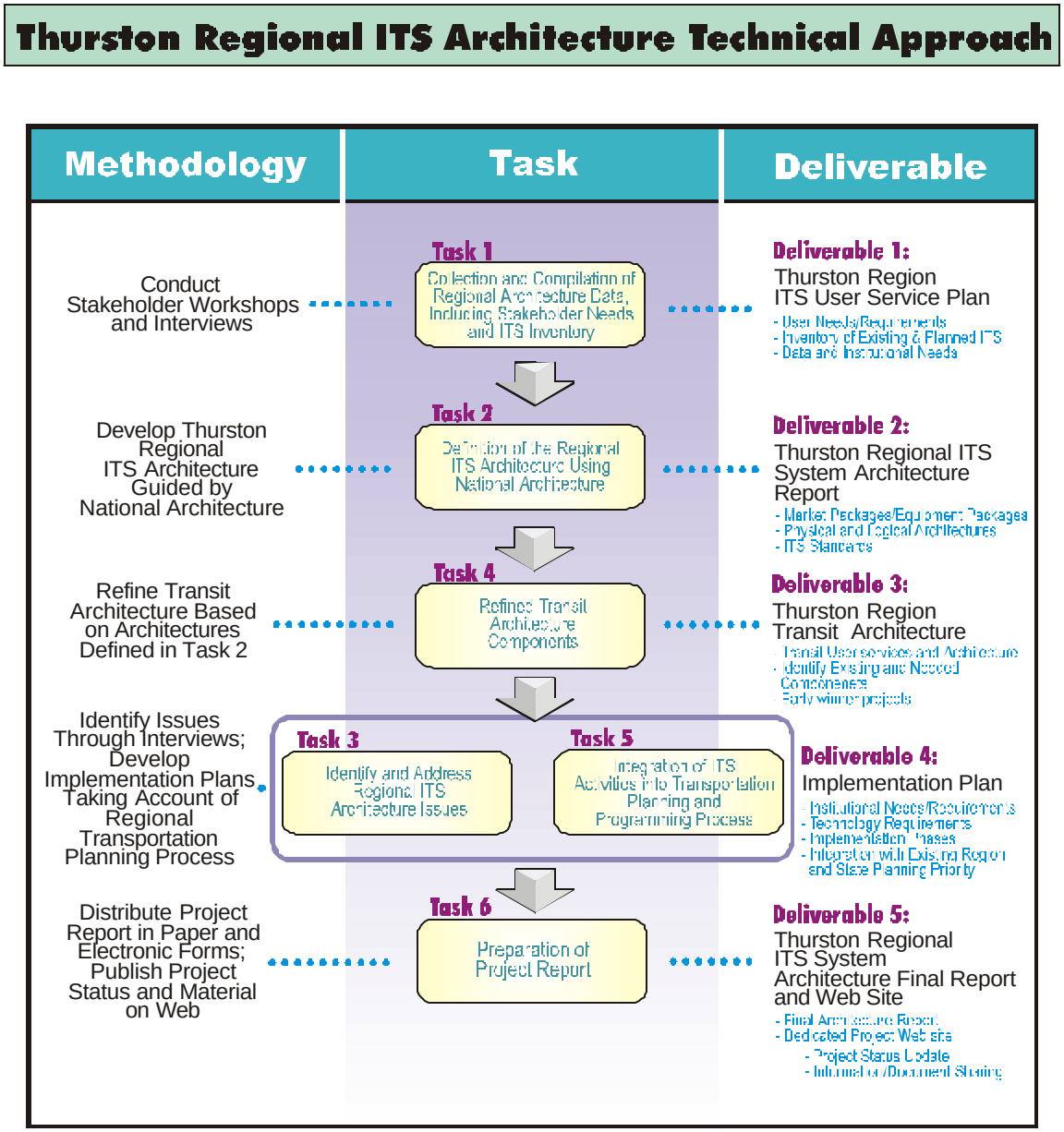


Figure 1-1: Thurston Region ITS System Architecture Approach

Technical Memorandum (TM) 1 has been drafted, then reviewed and revised once prior to finalization. The purpose of TM 1 was to describe and document the first steps undertaken in the development of the regional ITS architecture for the Thurston region. The report identified the stakeholders, summarized the needs of the various stakeholders, expressed those needs in National ITS Architecture terms as User Services (US), mapped those US to User Service Requirements (USR) and provided an inventory of existing and planned ITS deployments in the region.

The next step in the process will be the development of the regional architecture document summarized in this TM. The architecture will lay out the regional ITS system as it is today and

as it is envisioned to be in the future. It will identify who will share information and how that information will be shared. Future reports include TM# 3, Refined Public Transportation System Architecture and Strategic Deployment Plan, which will focus on a transit specific component of the architecture. The fourth in the series of documents includes the development of an Implementation Plan, that provides a strategic roadmap for the implementation of ITS technologies in the region that is consistent with, and built upon, the regional architecture. The project will conclude with a final report that summarizes the activities undertaken as part of the project, provides a concise summary of the overall direction and objectives of ITS deployment in the Thurston region, and integrates the discussion and presentation of the several deliverables.

1.2 Architecture Development Products

The Thurston Region ITS System Architecture, defined in detail in this document will focus on a regional system architecture based on local needs, issues and programs and built around the National ITS Architecture. As described earlier, the system architecture is developed using the needs and user services that were identified in TM 1 by Thurston's regional stakeholders. After careful analysis of these user needs and services, the specific needs and services were grouped into key functional areas based on the type of need/service. These functional areas will be used as a basis for the development of the system architecture and will enable the project team to address the architecture in a systematic fashion. The table below provides a brief summary of the six functional areas:

Functional Area	Description
Traffic and Transportation Management	Management of the traffic for arterials and the freeway systems including functions like traffic surveillance, traffic control, incident management, demand management, etc.
Public Transportation Management	Management of transit services (both fixed route and para-transit), special needs public transportation, and school bus transportation such as transit vehicle tracking, vehicle dispatch, passenger and fare management, demand responsive operations, etc.
Electronic Payment	Management of fare collection plus advanced payment of fares and other services.
Freight Mobility	Management of Commercial Vehicles, e.g., electronic clearance, safety checking and the movement of freight.
Emergency Response/Management	Management of emergency services including dispatch and control, responding to incidents, mayday services, etc.
Traveler Services	Collection, processing, and dissemination of traveler information to the public and to relevant agencies in the architecture.
Information Storage and Management	Collection of ITS Planning and operational data into an archive of ITS and non-ITS data including the import of data, cleansing and formatting the data for the archive format, and attaching the appropriate sets of meta-data (descriptive qualifiers) to the incoming archive data.

Using the functional areas described above, the regional architecture for the Thurston region will be developed in four separate, but related components: Physical Architecture, Logical Architecture, Market Packages and Equipment Packages, and Relevant ITS Standards.

1.2.1 Physical Architecture

The physical architecture defines the systems and their interconnections (as expressed by the region's stakeholders), existing and future, defines the types of information that flows between these systems and provides a "big" picture architecture view of each of the functional areas.

1.2.2 Logical Architecture

The logical architecture describes the functional areas from a functional view by relating them to processes that need to take place to deliver a given function.

1.2.3 Market Packages and Equipment Packages

This provides an implementation perspective of the regional architecture by defining "market packages," which are bundles of technology pieces that are grouped together to deliver one or many user services. Market packages are made up of one or more equipment packages and relate to the physical architecture view of the system architecture. The market packages presented in this section will be grouped according to the functions described above. Selected market packages, relevant equipment packages and the implementing centers are also presented in this chapter.

1.2.4 Standards Overview

This section defines the ITS Standards that are currently defined by the USDOT and the National ITS Architecture. The standards are defined by the application area (similar to the functional groups discussed above) and provide detail on the document number, name, and the standard development organization responsible for developing the standard.

1.3 Thurston Area Background

Thurston County is located in southwestern Washington at the southern end of Puget Sound and the greater Seattle-Tacoma metropolitan region. Thurston is home to the City of Olympia-the capital of Washington. Other cities in the county include: Lacey, Tumwater, Yelm, Tenino, Bucoda, Rainier, and Rochester. Figure 1-2 illustrates the Thurston Region and the adjoining counties and cities. The county is traversed by interstate route I-5, a heavily traveled and critical north-south corridor for the movement of commuters, travelers and commercial freight. The majority of the commercial traffic passes through the Thurston Region for destinations in southern Washington, Oregon, California, Mexico, or north to major port and transshipment facilities in Tacoma, Seattle, and into Canada. Another major highway, US 101, serves commercial and private vehicle traffic to and from the rural Olympic Peninsula and coastal Washington.

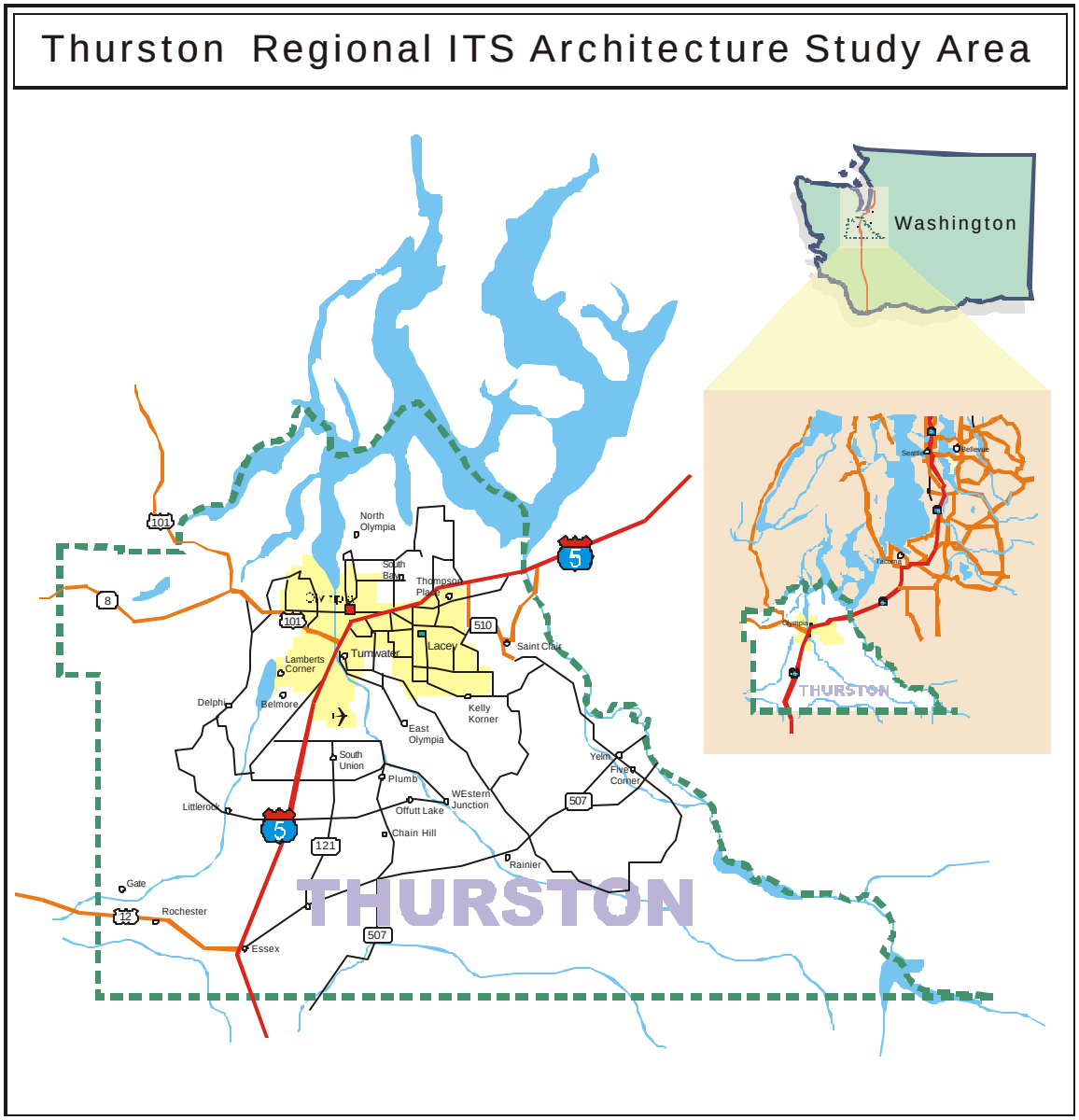


Figure 1-2: Thurston Area Background

The Port of Olympia is the southernmost port facility on Puget Sound and is accessible by rail and truck traffic. The port deals primarily in shipment of timber products originating in Thurston and adjoining counties. The Port also operates the Olympia Regional Airport. This facility provides private aviation and limited freight service--the airport has no regularly scheduled commercial passenger flights.

The major industries in the region are: agriculture, timber processing and shipment, state government (including the Evergreen State College), local schools, tourism, and a variety of retail and commercial activities. State government has been, and will continue in the near-term to be Thurston County's principal driver for the local economy.

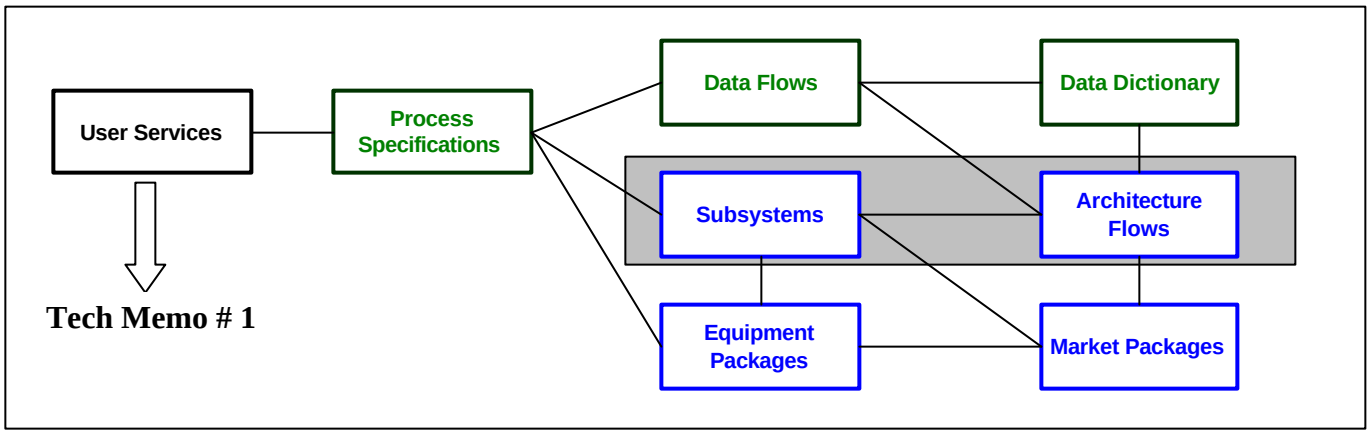
The southern reaches of Puget Sound have a moderating effect of the region's weather in that temperature extremes are not a major challenge. The region does experience significant rainfall (~51" annually in Olympia), and seasonal fog, snowfall and road icing conditions that must be considered in the conduct of transportation systems operations and maintenance activities. Additionally, the county area is approximately 13% incorporated urban and 87% unincorporated rural-with approximately 56% of the county population living in these rural areas (1999 estimate). The providing of essential transportation services, incident and emergency response across this vast rural landscape is a major challenge for the state, county and city jurisdictions of the region.

1.3.1 Other Architectures in the Region

The Puget Sound Regional Council (PSRC) is the Metropolitan Planning Organization (MPO) for the Central Puget Sound region to the north of Thurston County. Beginning concurrently with the Smart Trek Metropolitan Model Deployment Initiative (MMDI), the PSRC has recently completed (June 2001) a regional ITS architecture for the Central Puget Sound. This PSRC architecture includes the ITS deployed and planned for three counties: Pierce, King and Snohomish counties to the north of Thurston; and the approximately 52 jurisdictions included therein. This adjoining architecture is dominated by the operational MMDI and WSDOT legacy ITS deployed along I-5/405 corridors in the major metropolitan areas of Seattle, Tacoma and Bellevue, but several other regional cities are moving quickly with modernizing or first-time deployments of ITS. Likewise, WSDOT is extending their ITS coverage to include more than just interstate corridors.

To the south of Thurston, non-adjacent Clark County, the City of Vancouver, and the greater Portland (Oregon) metropolitan region are in the process of developing their own regional architecture. The MPO in that region is the Regional Transportation Council (RTC) for southwestern Washington, and METRO for greater Portland.

2.0 Thurston Region Physical Architecture



2.1 Overview

This section describes the physical architecture of the Thurston region based on the conventions set forth by the National ITS Architecture. The highest level of architecture is presented in Figure 2-1 using a "Sausage Diagram" that depicts the physical entities involved in the operations of a fully integrated regional ITS system. The subsystems or the physical entities are organized by their characteristics in four categories, namely, Center, Roadside, Vehicle, and Traveler subsystems. The Center Subsystems represent operational entities such as a traffic management system or transit management system. The Roadside Subsystems represent devices or systems deployed on the transportation infrastructure. The Vehicle Subsystems represent vehicles or mobile entities that utilize the ITS technology in support of their respective operations. The Traveler Subsystems represent traveler information services provided to the traveling public as well as the commercial operators for improving their safety and travel experiences improving the safety and efficiency of their travel experiences.

These subsystems are connected with each other via three general types of the communications to facilitate data and information exchange, including Wire-line, Wide Area Wireless, and Short-Range Wireless communications. Wire-line communications include an array of known "wired" communication methods including telephone lines, copper cables, high-capacity fiber optics, and include wireless point-to-point media such as microwave. The Wide-Area Wireless communications provide wireless data and voice communications over a long distance. The examples of Wide Area Communications include Mobile Radio, and commercially available wireless data services such as the Cellular Digital Packet Data (CDPD). The Short-Range Wireless is typically used to provide data exchange between a mobile unit (e.g., vehicle) and a roadside device. The examples of Short-Range Wireless communication include the emergency vehicle signal pre-emption (infrared transmitter and receiver), electronic tolling (Radio Frequency, RF-based toll tags and overhead readers), and commercial vehicle electronic clearance (same as electronic tolling). As shown in Figure 2-1, the solid lines indicate existing

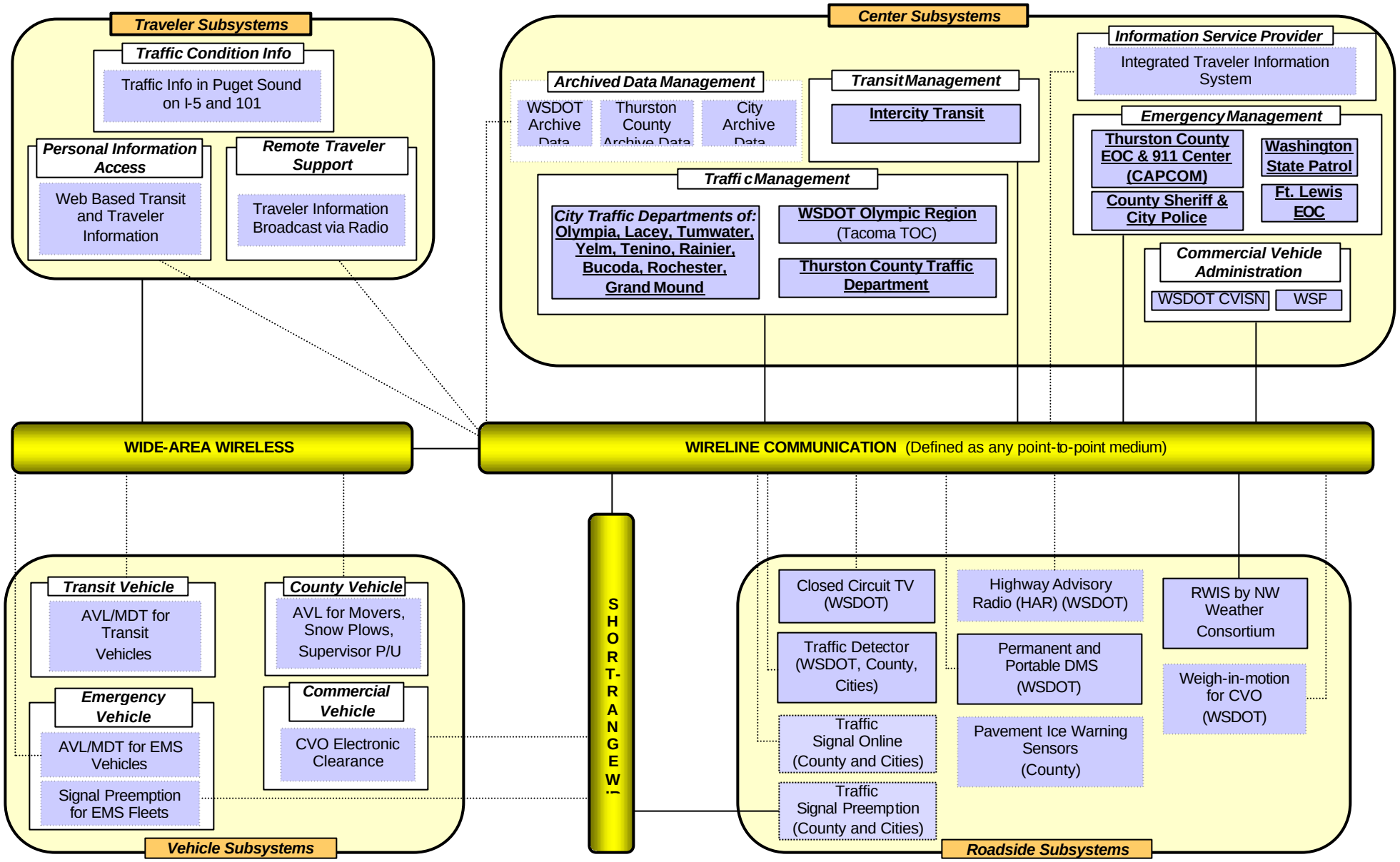


Figure 2-1: Thurston Region ITS Architecture "Sausage" Diagram

communications while dashed lines indicate the planned communications based on the user needs stated by the stakeholders.

The major subsystems depicted in the "Sausage Diagram" include:

?? **Centers Subsystems**
- Traffic Management Center Subsystems
  - WSDOT Tacoma Traffic Operation Center (TOC)
  - Thurston County
  - Regional Cities Traffic Departments (Olympic, Lacey, Yelm, etc.)
- Transit Management Center Subsystems
  - Intercity Transit
  - Various special needs transportation services
- Emergency Management Center Subsystems
  - Thurston County EOC
  - Thurston County 911 Call Center
  - Washington State Patrol (WSP)
  - Local Police and Fire
- Commercial Vehicle Center Subsystems
  - Various WSDOT commercial vehicle administration subsystems
  - Regional Cities/County Over-dimensional truck permitting systems
- Archived Data Management Center Subsystems
  - WSDOT regional ITS data archive subsystem
  - Thurston County, Regional Cities and Jurisdictional Counties archived data collection

?? **Roadside Subsystems**
- Closed-Circuit Television (CCTV)
- Real-time traffic detectors
- Traffic signal for signal coordination and emergency vehicle pre-emption
- Dynamic Message Sign (DMS)
- Highway Advisory Radio (HAR)
- Weather, pavement and environmental sensors
- Commercial vehicle operation implementations such as weigh-in-motion and electronic clearance

?? **Vehicle Subsystems**
- Transit vehicle Automatic Vehicle Location (AVL)
- Emergency vehicle traffic signal pre-emption (vehicle instrumentation)
- County vehicle AVL
- Commercial vehicle electronic clearance (onboard device)

?? **Traveler Subsystems**
- Real-time en-route traffic information service on major freeway
- Personal information access via Internet and personal communication devices
- Remote traveler information broadcast via Television and Radio

The "Sausage Diagram" provides a high-level graphical representation of the ultimate integrated regional ITS system and the major operational entities involved. The following sections present more elaborated architectural depictions with regard to a number of functional areas in the Thurston regional transportation system.

2.2 ITS Physical Architectures of Major Functional Areas

This section presents the major ITS physical architecture components and interactions among components in terms of communications (i.e., data and information exchange) and institutional coordination that are required to provide the intended ITS functions. The development of physical architecture includes the identification of a list of potential ITS technology solutions derived from the user needs. These proposed technology solutions were then incorporated and depicted in a National ITS Architecture compliant format to form a high-level physical architecture of the respective functional area.

2.2.1 Traffic and Transportation Management

The physical architecture of traffic and transportation management was developed based on the following proposed technology solutions identified through stakeholder interviews:

- Expand freeway management in Thurston region that includes traffic surveillance using CCTV and traffic detectors, provision of en-route information via changeable message signs and highway advisory radio.
- Provide queue overflow detector for better control of freeway off-ramp traffic signal; coordinate off-ramp traffic signal timing with intersecting arterial streets.
- Develop corridor-based cross-jurisdictional signal coordination to improve traffic progression on major arterial streets.
- Improve information sharing between WSDOT, County and Cities, including construction and planned and unplanned freeway diversions.
- Install weather (temperature, wind, fog), ice-on-pavement and flood sensors to provide information and warning to motorists on hazardous roadway conditions.
- Improve safety at highway-rail grade crossing using advanced sensors and positive traffic control measures.
- Share traffic management resource within Thurston region (e.g., portable Dynamic Message Sign).
- Implement computerized regional resource management system for Thurston County to more effectively manage and share the resource among the various agencies/jurisdictions.
- Implement Automatic Vehicle Location for Thurston County maintenance and public vehicles to improve operational efficiency.

Figure 2-2 presents the ITS physical architecture for traffic and transportation management and traveler information. The traveler information services are depicted in this architecture because they are closely related to the traffic management functions in terms of the source data. The traveler information architecture components will be further discussed in Section 2.2.6.

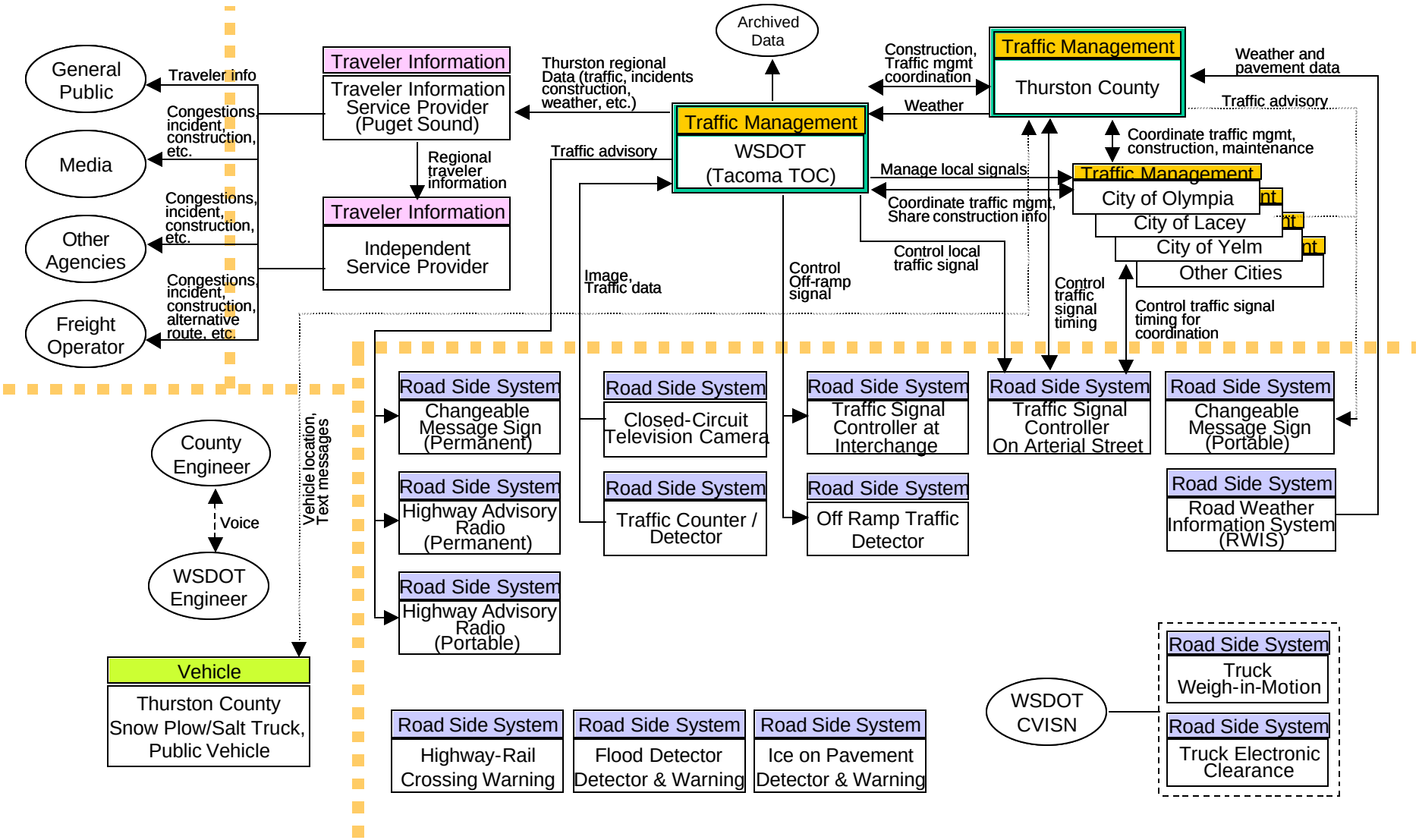


Figure 2-2: Traffic and Traveler Information Architecture Diagram

As shown in Figure 2-2, the major traffic management agencies (centers) in the Thurston region include Washington State DOT (freeways and state routes), Thurston County and Cities (arterial, local, rural roads). WSDOT will extend the freeway management system in the Puget Sound region into the Thurston region. Due to the rural nature of the Thurston region, the freeway management systems will be implemented at selected locations to provide spot solutions with a combination of traffic surveillance and motorist advisory devices, including CCTV, real-time traffic detectors, Dynamic Message Sign (DMS), and Highway Advisory Radio (HAR). At selected freeway interchanges, traffic signal control will be improved to prevent or minimize overflow of the off-ramp traffic into the freeway main lines. Coordination between the off-ramp traffic signal and the traffic signals on the intersecting arterial street system will be provided to improve the efficiency of the freeway interchange. The commercial vehicle ITS technologies such as weigh-in-motion and electronic clearance are currently implemented by WSDOT as part of the Federal CVISN ITS initiatives.

Under this architecture, Thurston County and Regional Cities will coordinate the traffic signals along regional arterials to provide better progression and throughput. Portable Dynamic Signs (DMS) and other traffic control devices will be shared by Thurston County and various Cities to better manage planned and unplanned traffic events. Road Weather Information System (RWIS), ice and flood detectors provide warning of potential hazards on rural roads. On the vehicle side, automatic vehicle location (AVL) and computerized resource management systems are needed to improve the operational efficiency of public vehicles including snow plows/salt trucks and other maintenance vehicles. Additionally, standalone Highway-Rail crossing warning systems provide improved safety at grade crossings.

2.2.2 Public Transportation

The primary public transportation service provider in the Thurston region is Intercity Transit which provides fixed-route and para-transit services. Other public transportation services include special needs transportation services operated by various social agencies and school bus operations. The physical architecture for public transportation was developed to reflect a list of potential technology solutions identified through interviews with the Intercity Transit, special needs transit service coordinators, and school districts. The potential technology solutions for public transportation in Thurston region include:

Intercity Transit

- Electronic payment system, linked with other agencies
- Automated traveler information/trip planning system, linked with other agencies
- Automated passenger counters
- Automated annunciators
- Vehicle tracking and data communications system (w/mobile data terminals)
- Enhanced transfer coordination
- Traffic signal priority
- Enhanced communication/data exchange with traffic/emergency agencies
- Security monitoring
- Flex-route service

- Enhanced vehicle monitoring
- Driver monitoring

Special Needs Transportation

- Integrated smart card system
- Coordination and resource sharing (reservation, dispatch, vehicles) strategies using scheduling and dispatch software, voice and data communications, and vehicle tracking

School Bus

?? Agreements for resource sharing, supported as necessary by communications technologies, scheduling/dispatch systems, and inclusion in regional communications and information systems

Figure 2-3 presents a high-level public transportation ITS physical architecture for the Thurston region. Intercity Transit intends to integrate a number of ITS technologies to improve the operational efficiency of their fixed-route and para-transit services. Automatic vehicle location (AVL) and mobile data terminals (MDT) improve the dispatch efficiency and reliability and provide schedule adherence. Enhanced emergency notification improves incident and emergency response involving transit vehicles. Operational coordination between Intercity and Pierce Transit will provide reliable coordinated transfer services across regions. Intercity Transit is coordinated with WSDOT and Area Council for Coordinated Transportation (ACCT) on regional transportation planning issues. The special needs transportation services can be better coordinated and managed using AVL/MDT (for fleet management) and Smart Card technology (for complex billing applications).

2.2.3 Electronic Payment and Fare Collection

Electronic payment and fare collection are identified as the potential solutions for improving transit, para-transit and special needs public transportation services. The complex billing transactions involving multiple special needs transportation service providers and multiple cost sharing jurisdictions present a major challenge in managing the critical regional transportation services. A combination of computerized ride reservation system and smart card technology is expected to automate and improve the billing process. The electronic payment and fare collection architecture component is represented in Figure 2-3 as part of the public transportation ITS physical architecture. The Smart Card system will be compatible with the Smart Card technology being proposed in the Puget Sound region and will provide electronic payment services beyond transportation applications.

2.2.4 Freight Mobility

The need for better routing of increased commercial freight vehicle activities on the arterial streets in the industrial areas and Port of Olympia was evident in the interviews with various stakeholders. It was determined that some of the ITS technologies that are applied to the traffic and transportation management like improved signal timing, will benefit freight mobility and can

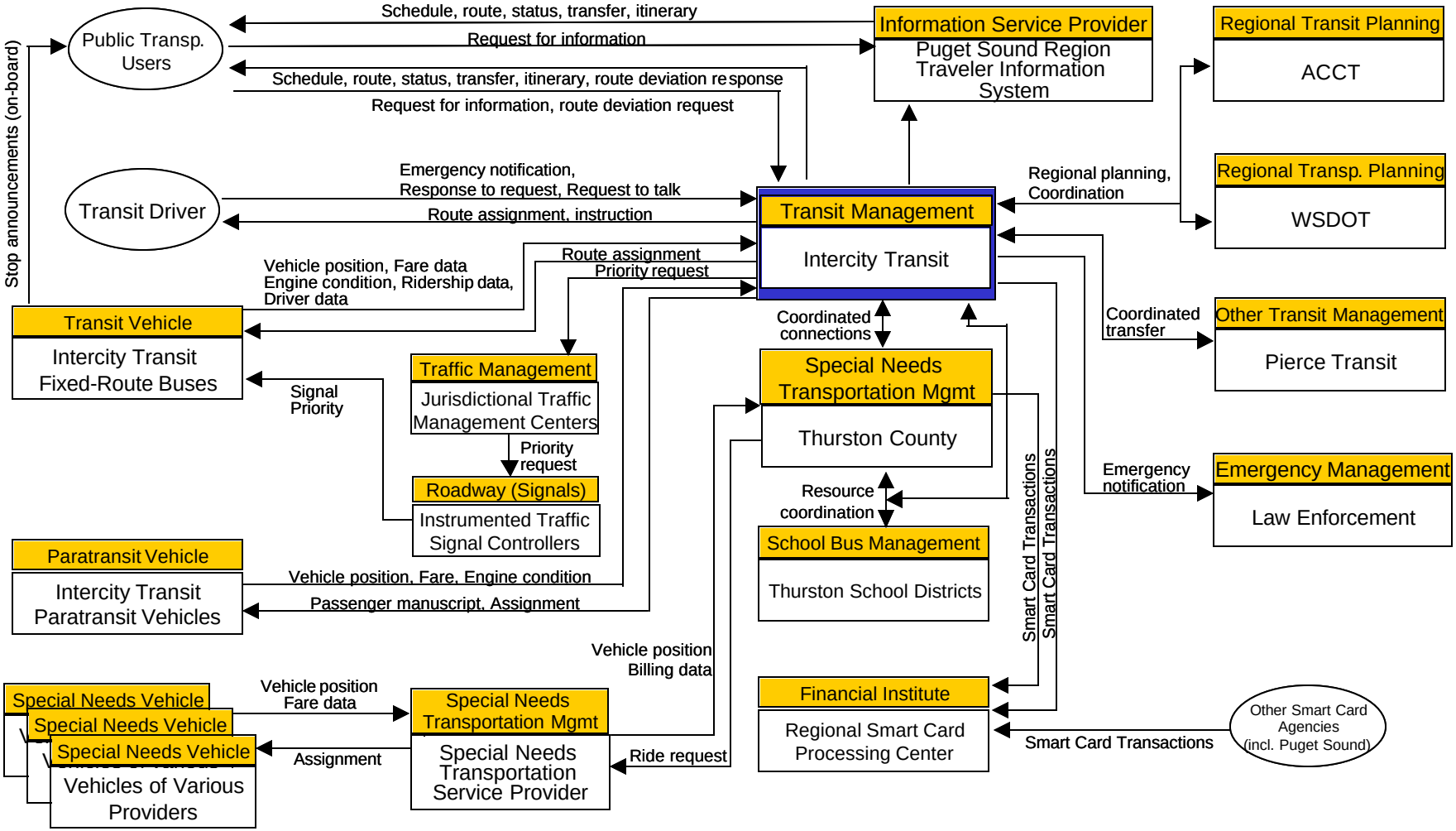


Figure 2-3: Public Transportation Management Architecture Diagram

be applied to address this problem. Other recommendations include coordination at the regional transportation planning level to form a set of policies in response to the growth of freight operations and the dedication of freight routes in the regional streets to minimize the impacts to commercial and residential areas.

Several existing freight-related ITS architecture components under WSDOT's CVISN initiatives are documented in this architecture (see Figure 2-1 and 2-2), including commercial vehicle administration/credentialing, weigh-in-motion, and electronic clearance provided by WSDOT.

2.2.5 Emergency Response and Management

The primary stakeholders of emergency management in Thurston region include Thurston County Emergency Operation Center (EOC), the 911 Call Center and CAPCOM, which facilitates the communications between EOC and other incident response agencies. The major incident response agency is the Washington State Patrol (WSP) who responses to all incidents on freeways and most County roads. Other incident response agencies include the fire department and local police. The possible technology solutions were identified through stakeholder interviews and project workshop, including:

Center-to-Center

- Coordinated incident response and management procedures
- Electronic data exchange between agencies (WSP, State, County, City, 911 Call Center, etc.)
- Computer-aided incident response management system
- Communication patches between agencies
- Data access to the status of regional trauma centers
- Access to CCTV for emergency response
- Information clearing house for exceptional condition
- Improved coordination with regional emergency broadcast system for exceptional condition

Roadway Implementation

- Portable message signs
- Permanent changeable message signs
- Portable HAR (short-range FM broadcast)

Vehicle Implementation

- AVL for all emergency response vehicles
- Mobile Data Messaging system (e.g., MDT) for fire and EMS
- Digital image or video from emergency response vehicle

Figure 2-4 presents a high-level ITS physical architecture for emergency management and incident response in Thurston region. The proposed architecture provides electronic data exchange between the Thurston County EOC/911 and various incident response agencies including WSP, fire departments, and local police agencies. While the individual incident response agencies retain their control over their mobile resources, the incident response efficiency can be greatly improved by the use of AVL and MDT technologies on the emergency response vehicles. The computerized incident management system and real-time electronic data exchange between Thurston County EOC/911 and various response agencies will improve resource management and coordination among those agencies. In addition, the selected/ approved incident data can be shared with traveler information providers as part of the real-time traveler information services.

The existing emergency vehicle traffic signal pre-emption system will be expanded to cover more arterial corridors under this architecture. Traffic management/operations agencies such as WSDOT, Thurston, and Regional cities will be better coordinated with Thurston county EOC/911. In particular, temporary traffic control measures (e.g., diversions, en-route message advisory to motorists, etc) can be implemented by the traffic operations staff in support of the incident management activities. Traffic surveillance systems, where available, can be used to verify incidents and monitor the response progress.

In the case of exceptional conditions such as earthquakes, tsunamis and other regional disasters, the enhanced Thurston regional emergency management system will act as a focal point in providing critical information to a "regional crisis information clearance house." The information provided/forwarded by the Thurston EOC may include availability of various emergency management resources, status of major transportation system conditions, etc.

2.2.6 Traveler Services

Functionally speaking, the Thurston regional traveler information system consists of traffic/ traveler data collection, data fusion, and traveler information dissemination. As shown in Figure 2-2, the collection of traffic data mainly relies on the automatic sensors deployed for traffic management applications. In addition, weather and construction related information is among the most desirable traveler information. The electronic data exchange between traffic management agencies provides a means to automatically collect and compile relevant data for traveler information services.

Different from traffic management and operations, raw traffic and sensor data must be processed to produce useful traveler information. The role of a regional Information Service Provider (ISP) is to take data from various sources and produce traveler information for dissemination to users. This architecture proposes to coordinate the Thurston area with the Puget Sound regional traveler information system. This can be achieved by sharing cost of the Puget Sound system to expand and include the contiguous Thurston area. Therefore, the system could share the existing infrastructure (e.g., web server) and dissemination methods with incremental costs to Thurston region.

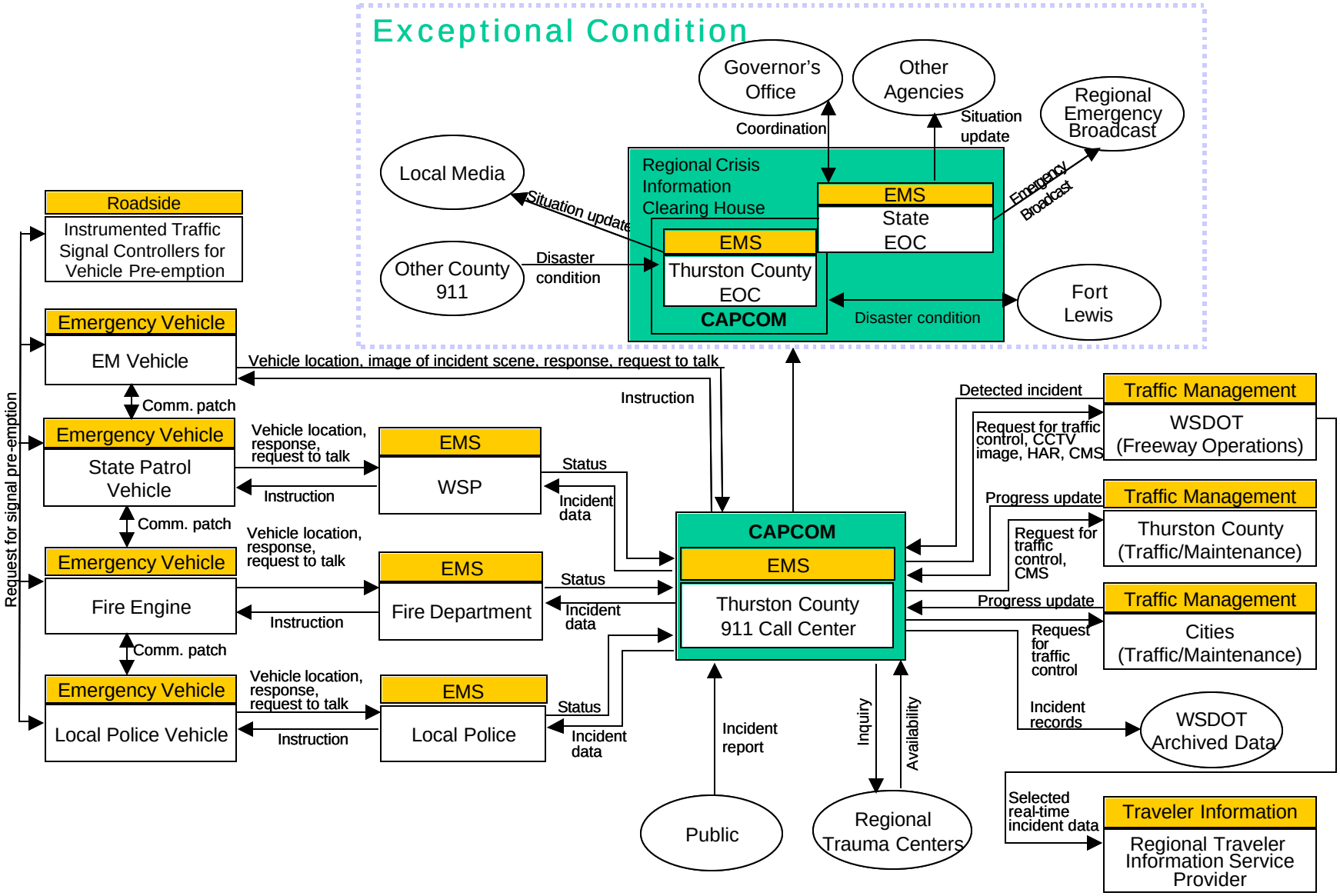


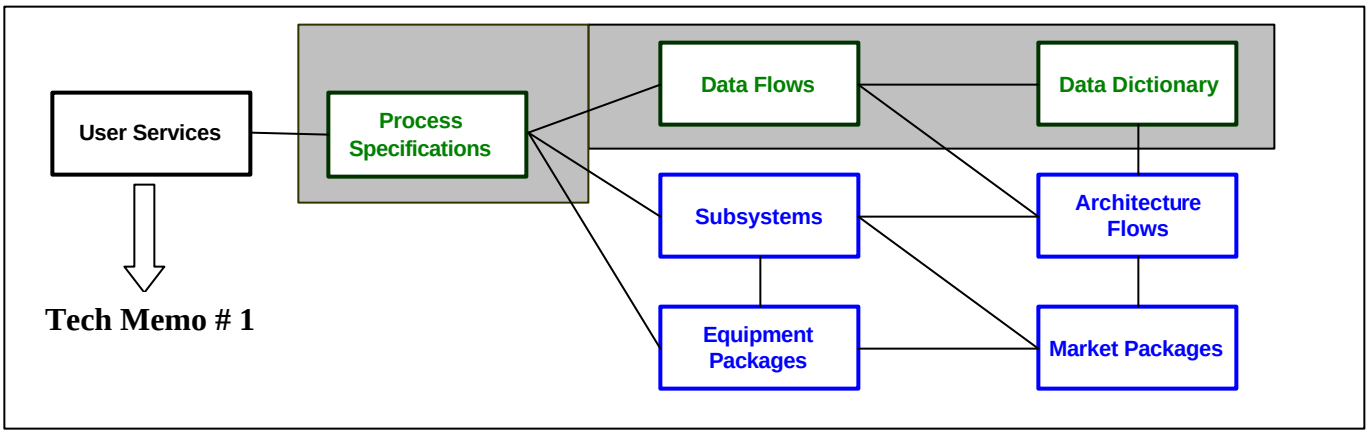
Figure 2-4: Emergency Response and Management Architecture Diagram

The traveler information system will utilize the established dissemination methods in the Puget Sound including Internet, interactive telephone service, kiosk, public display device, TV, radio, pager, and fax on demand. The primary traveler information users in the Thurston region include freight operators, school districts, the general public, and the media-some users will be served by broadcast information and others will be served on-demand.

2.2.7 Information Storage and Management

One of the regional ITS needs identified in the stakeholder interview was the storage and management of data produced by the various ITS systems. The potential use of the archived ITS data is to conduct evaluations on ITS system performance or to be used in the transportation planning process to improve the forecasting of future transportation needs, and justification for investment to meet those needs. A regional data archive is envisioned in the proposed architecture to assist the collection, processing, and distribution of the archived ITS data for various agency's use. This architecture component is related to all ITS subsystems described in this section.

3.0 Thurston Region Logical Architecture



3.1 Overview

A logical architecture is best described as a tool that assists in organizing complex entities and relationships. It focuses on the functional processes and information flows of a system. Developing a logical architecture helps identify the system functions and information flows, and guides development of functional requirements for new systems and improvements. A logical architecture should be independent of institutions and technology, i.e., it should not define where or by whom functions are performed in the system, nor should it identify how functions are to be implemented, only what those functions are.

The logical architecture of the National ITS Architecture defines a set of functions (or processes) and information flows (or data flows) that respond to the user service requirements discussed in TM 1. Processes and data flows are grouped to form particular transportation management functions (e.g., manage traffic) and are represented graphically by data flow diagrams (DFDs), or bubble charts, which decompose into several levels of detail. In these diagrams, processes are represented as bubbles and data flows as arrows.

3.2 Logical Architecture

The Thurston region's ITS Logical Architecture was developed based on the User Services identified in TM 1 in conjunction with the concepts and common language established in the National ITS Architecture.

The logical architecture is a graphical representation that describes what has to be done (functions) by the system and identifies the major processes required to achieve the system objectives. It is also intended to deliver the identified User Services and define the information, or data flows that are shared between these major processes.

At the highest level, the logical architecture (Figure 3-1) is illustrated as a single function – manage ITS – that shows external systems or entities (called terminators) that communicate data to or receive data from the ITS functional process. The National ITS Architecture categorizes these terminators into four groups:

?? Users – These include personnel, drivers and travelers who interact with ITS subsystems.
?? Systems – These include non-ITS Centers (e.g., Government Agencies), roadside systems (e.g., traditional signals and sensors), and vehicle systems (e.g., braking and steering systems) that ITS will interact with.
?? Environment – These include air quality, weather, roadway conditions, etc.
?? Other Subsystems – These represent the interactions between multiple, similar subsystems, such as Traffic Management Center-to-Traffic Management Center messages.

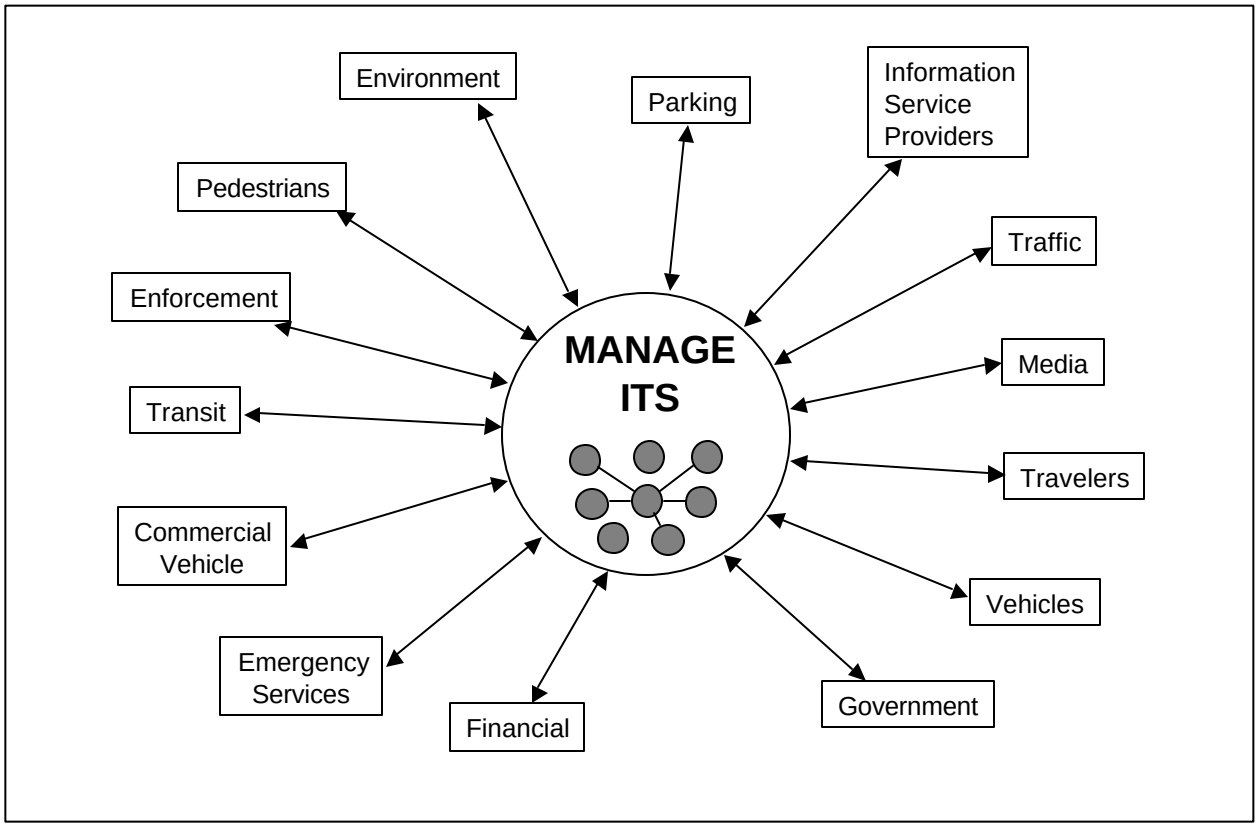


Figure 3-1: Manage ITS

As the logical architecture grows in detail (often referred to as "drilling down"), the high-level function of "managing ITS" is expanded into eight sub-processes that relate primarily to the functional areas described earlier in Section 1:

1. Manage Traffic
2. Manage Commercial Vehicles

3. Provide Vehicle Monitoring and Control
4. Manage Transit
5. Manage Emergency Services
6. Provide Driver and Traveler Services
7. Provide Electronic Payment
8. Manage Archived Data

Each of these eight sub-processes is decomposed ("drilled-down") in successively greater detail. The most detailed processes are then described in Process Specifications (P-Specs), which summarize the processing that takes place to transform input information into desired outputs. The P-Specs provide the essence of the requirements in that they describe how data that flows into a component system of the Logical Architecture is transformed either for use elsewhere, or for output from the Architecture. The P-Specs stand alone in that they completely and rigorously capture the functional requirements of the Architecture.

The processes and the data exchanged between them to provide the required function are illustrated in Data Flow diagrams in the Logical Architecture. These diagrams are often referred to as "bubble" diagrams and they provide a graphical view of how the processes and data flows fit together. An example of a top-level simplified logical architecture is illustrated as Figure 3-2. The circles represent the processes or functions that do the work. The arrows represent the data flows and show how data moves through the system. The rectangles are the external inputs and outputs, called terminators.

3.2.1 Thurston Region Logical Architecture Methodology

The methodology used to develop the Thurston region's ITS logical architecture is based on the National ITS Architecture. First, user needs and requirements for the region, as identified by key stakeholders (presented in TM 1) were compiled and mapped to the structured language of the User Services (US) in the National ITS Architecture. This allowed identification of the ITS US that are relevant to the region (as presented in TM 1). The identification of user services allowed the transition from services to requirements, with the definition of the Thurston region's User Service Requirements (USR). These requirements were then reviewed to determine which were appropriate in meeting the needs and goals of the Thurston region stakeholders. The USR served as a requirements baseline to guide the development of the logical architecture, as they provided a basis for preliminary selection of the most detailed processes (or P-Specs) to be included in the region's ITS logical architecture. The baseline logical architecture was then evaluated, and processes were included that were within the scope of the overall project objectives. The relationship between the US, USR and the associated P-Specs are tabulated and provided in Appendix A. The P-Specs are identified within the National ITS Architecture based on the User Service they are associated with. The detailed Process Specifications definitions are provided in Appendix B.

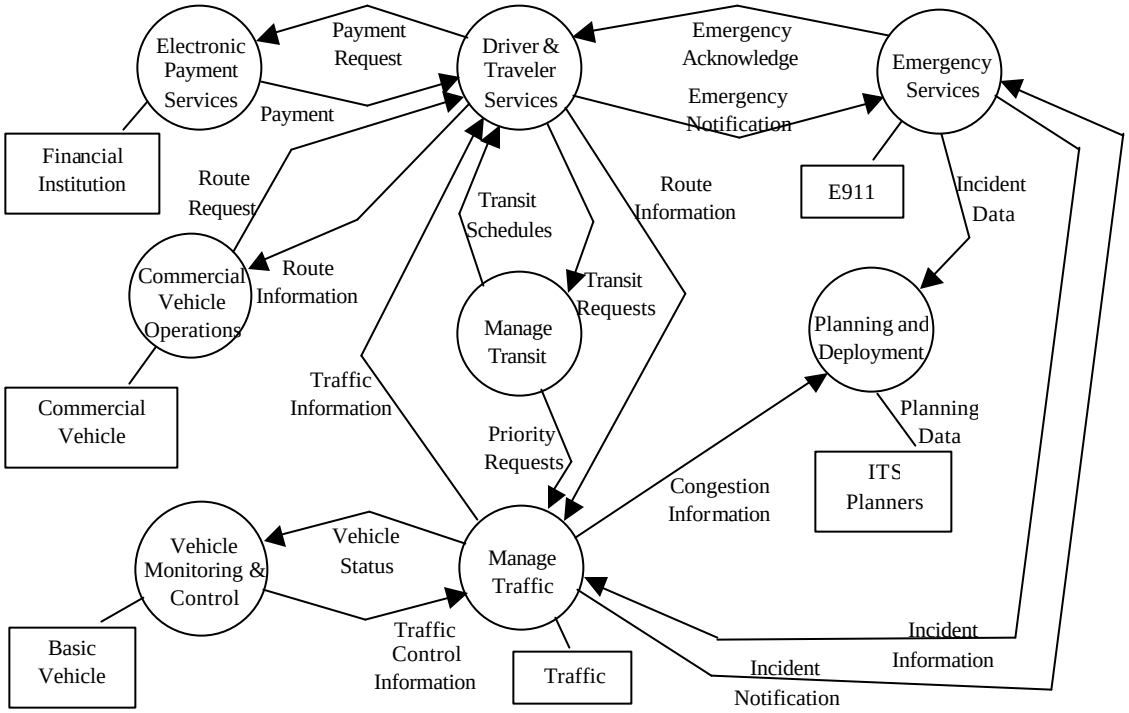


Figure 3-2: Simplified High-Level Logical Architecture Diagram

Next, the input and output data flows associated with each process were reviewed for inclusion in the logical architecture. The data flow diagrams depicting the relationships between the functional processes and data flows relevant to the Thurston Region are presented in this section based on the functional category they represent. The selected Thurston Region data flow descriptions are presented in Appendix C.

3.2.2 Major Functional Processes for the Thurston Region

As described above, the logical architecture consists of processes and data flows. Within the National ITS Architecture, there are eight major functional processes that are broken down into approximately four hundred process specifications. As described in the earlier sections of this document, there are seven main functional/operational groups that were identified as relevant to the Thurston region based on the User Needs and Services. Thurston's region logical architecture will be defined based on these functional groups and the eight functional processes described in the National ITS Architecture will be grouped according to the operational area they fall under.

Described below are the major functional processes distinguished by the operational group.

Traffic and Transportation Management

Manage Traffic - this functional process tree includes all the functionality needed for the management of the traffic on the freeways and arterial streets operated by WSDOT, Thurston County, and the cities in the Thurston region. Included are traffic surveillance, traffic control, incident management, demand management and emissions management functions, management of highway rail intersections, and all associated capabilities. The User Services Requirements included in this functional tree are:

?? 1.6 Traffic Control
?? 1.7 Incident Management
?? 1.8 Travel Demand Management
?? 1.9 Emissions Testing and Mitigation
?? 1.10 Highway Rail Intersections

Public Transportation Management

Manage Transit - this functional process tree performs the management functions which apply to scheduled fixed routed transit services, plus the provision of the flexibly routed transit service (demand responsive transit) and para-transit services operated by Intercity Transit, special needs transportation services, and school bus districts in the Thurston region. The User Services Requirements that are included in this functional process tree are:

?? 2.1 Public Transportation Management
?? 2.2 En-Route Transit Information
?? 2.3 Personalized Public Transit
?? 2.4 Public Travel Security

Electronic Payment

Provide Electronic Payment Services - this functional process tree provides an interface to the Manage Transit function for the management of fare collection plus advanced payment of fares and other services essential to the needs identified by Intercity Transit and special needs transportation services. The User Service Requirement that is included in this functional process tree is:

?? 3.1 Electronic Payment Services

Freight Mobility

Manage Commercial Vehicles- this functional process tree performs the management functions, which are concerned with the efficient management of Commercial Vehicles, e.g., electronic clearance, safety checking and the movement of freight operated by Washington State Patrol and WSDOT Commercial Vehicle Division. The User Services Requirements that are included in this functional process tree are:

?? 4.1 Commercial Vehicle Electronic Clearance
?? 4.3 On-Board Safety Monitoring
?? 4.4 Commercial Vehicle Administrative Process
?? 4.6 Commercial Fleet Management

Emergency Services/Management

Manage Emergency Services - this functional process tree performs the management functions needed for dispatch and control of emergency services responding to incidents, and the management and coordination of regional emergency services operated by Thurston County E911 Call Center, Thurston County EOC, Washington State Patrol, Local Police and Fire and during exceptional conditions. The User Services Requirements included in this functional process tree are:

?? 5.1 Emergency Notifications and Personal Security
?? 5.2 Emergency Vehicle Management

Provide Vehicle Monitoring and Control - this functional process tree performs all of the functionality associated with monitoring and control of the vehicle subsystems, including automatic emergency notification when sensors detect that the vehicle has been involved in an accident for mayday support services. Regional stakeholders that perform these functions include the Thurston County E911 Call Center, Local Police and Fire, and the Washington State Patrol. The User Service Requirement that is included in this functional process tree is:

?? 5.1 Emergency Notifications and Personal Security

Traveler Services

Provide Driver and Traveler Services - this functional process tree provides the multi-modal trip planning, route guidance and advisory functions for all types of travelers and drivers. It also enables then to request for personal emergency notification functions. Identifies regional stakeholder that perform these functions is the Puget Sound Regional Traveler Information System. The User Services Requirements that are included in this functional process tree are:

?? Pre-Trip Travel Information
?? En-Route Driver Information

?? Route Guidance
?? Ride Matching and Reservation
?? Traveler Services Information

Information Storage/Management

Manage Archived Data - this functional process tree manages the flow of operational data into an archive of ITS and non-ITS data. Functions include the import of data, cleansing and formatting the data for the archive format, and attaching the appropriate sets of meta-data to the incoming archive data and will be operated by Thurston County, WSDOT, and other regional cities. The User Services Requirements that are included in this functional process tree are:

?? 7.1 Archived Data Function

3.3 Level 1 Data Flow Diagrams (DFD) and Process Definitions

For Thurston's regional ITS logical architecture, the high level processes were drilled down to the first level (Level 1) Data Flow Diagram (DFD) that identify the various processes and data flows exchanged between the processes based on the functional group. Further decomposition of the DFDs is best left for project-specific requirements, not included in the broader regional architecture.

The following section provides definitions of the main processes (e.g. Manage Traffic, etc) and the sub-processes that fall under them. The DFDs illustrated in this section describe the high level processes that are relevant to the Thurston region, based on the User Service Requirements and P-Specs identified in Appendix A.

3.3.1 Traffic and Transportation Management

As defined in Section 3.2.2, there is only one main process identified in this functional and/or operational group, Manage Traffic. Defined below is the main process and brief descriptions of the sub-processes that are relevant for the Thurston region.

Manage Traffic (Data Flow Diagram (DFD) 1)
This DFD shows the processes that provide the Manage Traffic function. This function is responsible for providing facilities to manage traffic flowing in the Thurston region so that the most efficient use is made of the freeways, arterials, local streets and rural road network. The key points about the function are as follows:

?? collection of traffic data and traffic management of the freeway, arterials, local streets and rural roads operated by WSDOT, Thurston County, and regional cities;
?? collected data to be used by other ITS functions, operations personnel and the media;
?? incident management available based on pre-defined responses;

?? details of incidents available to the media; demand management available based on pre-defined policies and operational data;
?? pollution monitoring available both on a wide area and individual vehicle basis;
?? highway-rail intersection monitoring;
?? smart probe data collected from private and county vehicles;
?? exchange of data with similar functions serving the regional or jurisdictional areas.

There are six processes in this DFD all of which are themselves DFDs. They divide the overall functionality of the DFD between themselves in the following ways. Figure 3-4 illustrates the processes described below (highlighted) and the data flows exchanged between them (also highlighted).

(a) *Provide Traffic Surveillance (1.1)* - these processes provide traffic surveillance, data storage, and communication with the Tacoma TOC, Thurston County and regional cities. Traffic surveillance is provided through devices that obtain data about vehicles and pedestrians on the freeway and arterial streets.

(b) *Provide Device Control (1.2)* - these processes enable traffic control through devices that output information to vehicle drivers and pedestrians on the freeways and arterials served by the function operated by WSDOT. The devices comprise different types of indicators, such as intersection and pedestrian controllers, dynamic message signs (DMS), freeway ramp meter controllers, in-vehicle signage data broadcasting equipment, etc.

(c) *Manage Incidents (1.3)* - these processes are responsible for incident management. They provide for the detection, recording and managing of both current incidents and planned events, as well as generating the responses to incidents as they become current. These functions are operated by the Thurston County E911 Call Center, Washington State Patrol and in some cases the Local Police and Fire. Facilities are provided for the traffic operations personnel to monitor and if necessary override the operation of these processes, particularly for incidents that do not have a pre-defined response.

(d) *Manage Travel Demand (1.4)* - these processes are responsible for the management of travel demand within the freeways and arterials served by the function, operated by WSDOT. The objective of the management process is to enable the network to provide transportation in the most efficient way, which is to minimize the impact on the environment. This will be achieved by monitoring, controlling and influencing the operation of the traffic control, route guidance, public transport and payment functions.

(e) *Manage Emissions (1.5)* - these processes are responsible for the collection, storage and dissemination of data on atmospheric emissions. The Thurston Urban region has been designated by EPA as a PM10 non-containment area since 1987 and was redesignated as a PM10 maintenance area last year. The Thurston Regional Planning Council is very involved in air-quality modeling and the Thurston County area is responsible for maintaining the air quality in terms of PM10 every 3 years. Data collected and monitored by this function is provided to the Manage Traffic and the Manage Emergency functions for further actions.

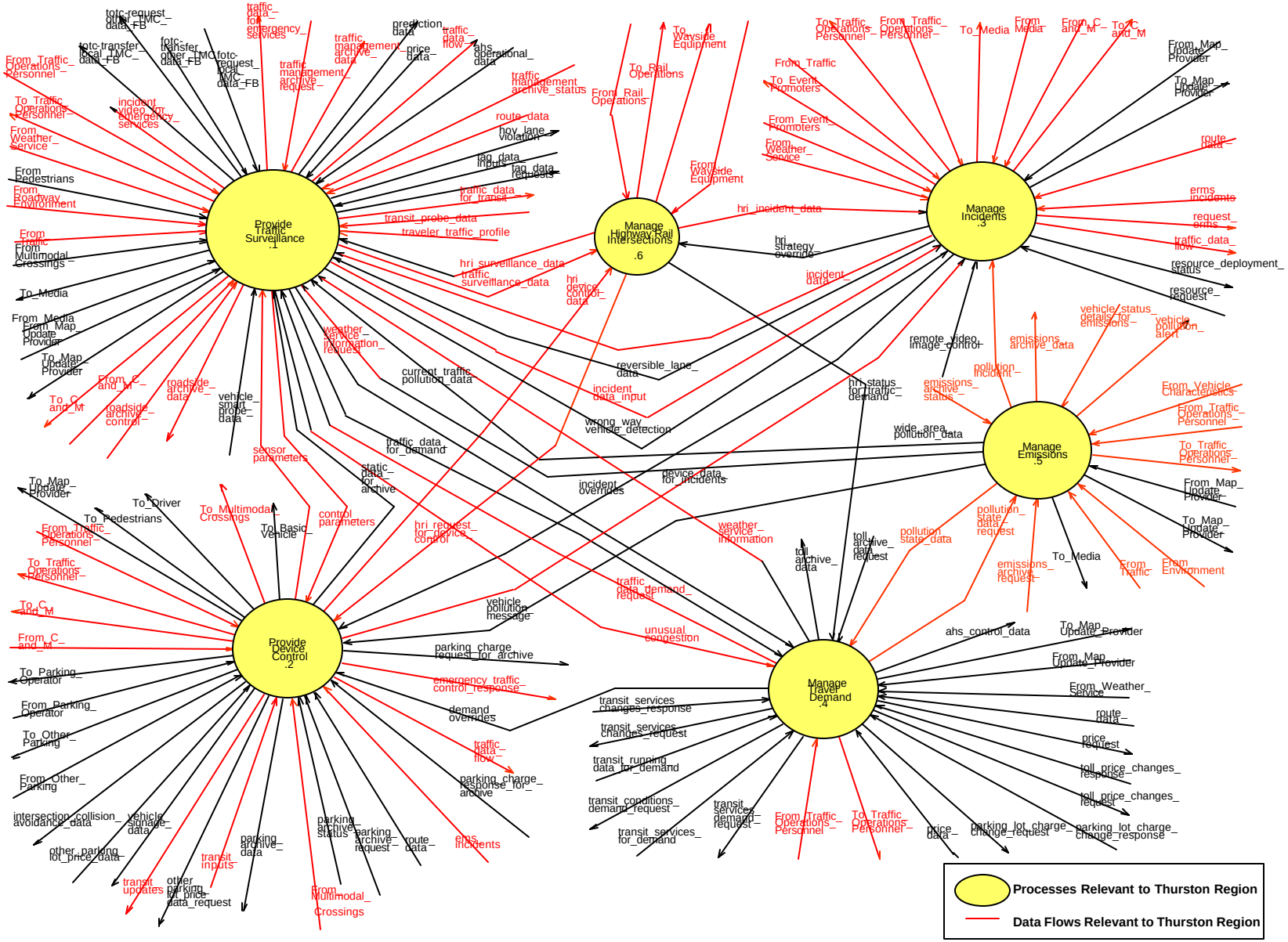


Figure 3-3: Manage Traffic Data Flow Diagram (Level 1 DFD)

(f) *Manage Highway Rail Intersections (1.6)* – the processes in this function have been coupled with other facilities and functions within ITS such as traffic management, route guidance, transit management, electronic payment, etc.

3.3.2 Freight Mobility (DFD 2)

As defined in Section 3.2.2, there is only one main process identified in this functional and/or operational group, Manage Commercial Vehicles. Defined below is the main process and brief descriptions of the sub-processes that are relevant for the Thurston Region.

Manage Commercial Vehicles (DFD 2)
The processes in this DFD make up the Manage Commercial Vehicles function. This function is responsible for providing facilities for the management of commercial vehicle operations. The key points about the function are as follows:

?? facilities provided for commercial vehicle managers and drivers who are their own managers;
?? managers and owner drivers may pre-clear vehicles through roadside check station facilities;
?? CVO roadside facilities can check vehicles for pre-clearance, and safety -- CVO inspectors can override pass/pull-in decisions at roadside facilities;
?? data on vehicles and regulatory actions at roadside facilities recorded on databases;
?? managers can access on-board vehicle data and exchange messages with driver.

There are 4 processes in this DFD. They divide the overall functionality of the DFD between themselves in the following ways. Figure 3-4 illustrates the processes described below (highlighted) and the data flows exchanged between them (also highlighted).

(a) *Manage Commercial Vehicle Fleet Operations (2.1)* - these processes enable commercial fleet managers to plan commercial vehicle routes taking into account the needs of this type of vehicle operated by the Washington State Patrol in coordination with the commercial vehicle division of WSDOT. Having decided on a route, a designated vehicle can be pre-cleared through the roadside check facilities so that it does not have to stop. The manager is provided with facilities to use the route data to set up a set of delivery instructions for the driver. Information can also be exchanged between the manager and the driver, and the manager can up-load and review a copy of the data that has been collected on-board the vehicle by the Provide Commercial Vehicle Data Collection facility.

(b) *Provide Commercial Vehicle Roadside Facilities (2.3)* - these processes provide the functions for the roadside check facilities operated on the main freeway and state routes by the Washington State Patrol. They enable commercial vehicles to be pre-cleared through screening and to carry-out safety checks. If the vehicle is not pre-cleared, or it fails its safety checks then a message will be displayed requesting it to pull into the facility. The inspector at the roadside facility may override the decision to pull-in (or

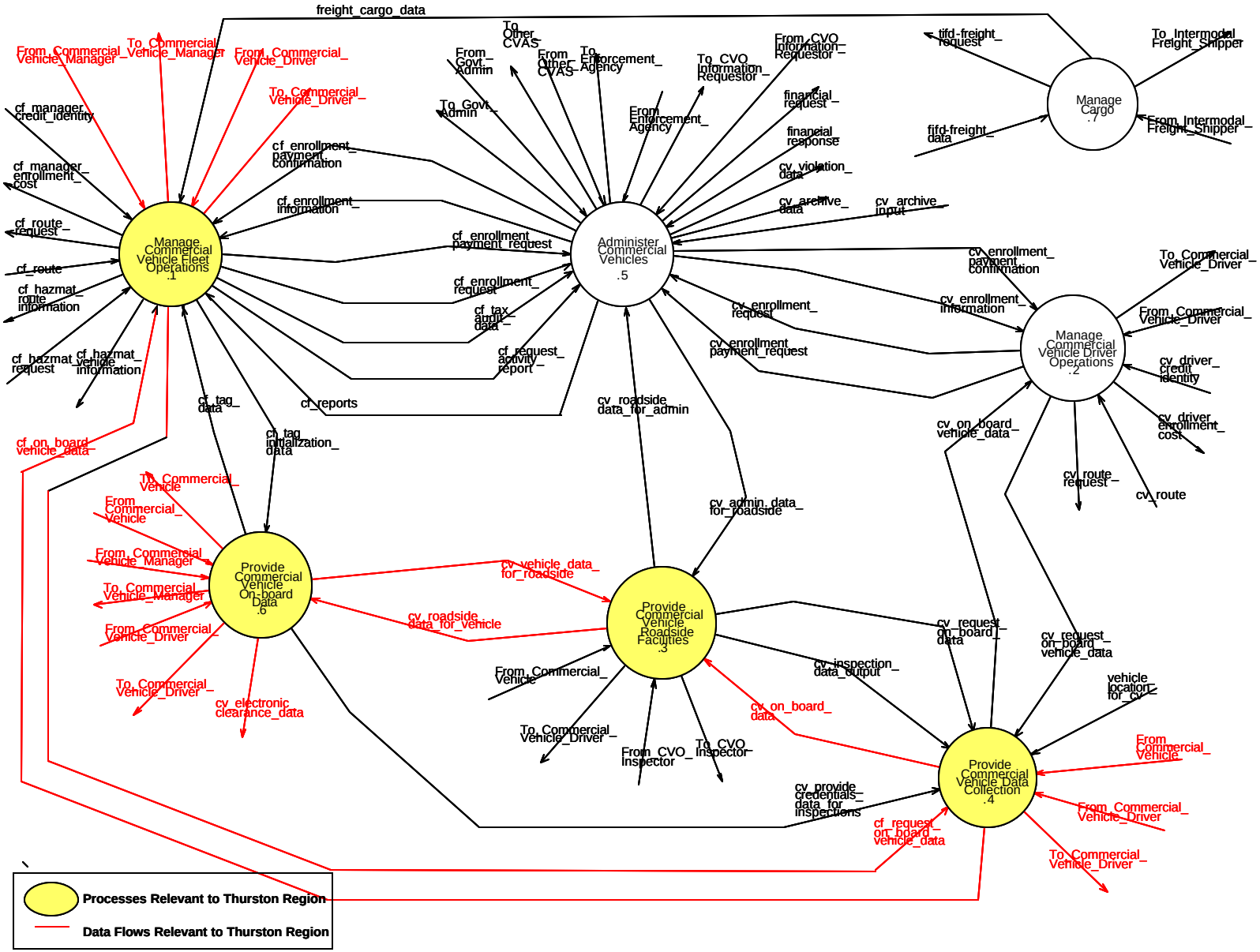


Figure 3-4: Manage Commercial Vehicles Data Flow Diagram (Level 1 DFD)

not) and may also select manual pull-in. Vehicle safety inspections can also be carried out at the roadside using a hand held terminal.

(c) *Provide Commercial Vehicle Data Collection (2.4)* - these processes are responsible for collecting data from on-board sensors and from the driver. The data is kept in an in-vehicle data store, which can be transmitted to the roadside check facility operated by Washington State Patrol to enable safety checks and roadside inspections. The contents of the store can also be sent to the commercial vehicle driver and fleet manager. The manager can also exchange messages of a general nature with the commercial vehicle driver.

(d) *Provide Commercial Vehicle On-board Data (2.6)* - these processes enable the commercial vehicle manager to load the commercial vehicle with data from databases that have stored this data. This data will enable it to be recognized at each roadside check facility operated by the Washington State Patrol, and can be used by the facility for pre-clearance and safety checks.

3.3.3 Public Transportation Management (DFD 4)

As defined in Section 3.2.2, there is only one main process identified in this functional and/or operational group, Manage Transit. Defined below is the main process and brief descriptions of the sub-processes that are relevant for the Thurston Region.

Manage Transit (DFD 4)
The processes in this DFD comprise the Manage Transit function. This function is responsible for the management of transit operations within some or all of the areas served by ITS. The key points about the function are as follows:

?? monitoring of transit services operation - data collected on-board transit vehicles of Intercity Transit vehicles;
?? strategies available for returning late running transit vehicles to normal operation;
?? transit services planned using current operational data and input from various other sources;
?? demand responsive transit provides personalized transport for travelers on request by Intercity Transit and special needs transportation services;
?? security coordination and monitoring provides links to the Manage Emergency Services function;
?? transit driver activities can be assigned using past performance and other factors;
?? transit vehicle maintenance can be scheduled and work assigned to technicians;
?? transit fares can be collected either on-board Intercity Transit vehicles;
?? transit service information and data from approaching transit vehicles available at the roadside.

There are seven DFDs subordinate to this DFD. Overall functionality is divided between them in the following ways. Figure 3-5 illustrates the processes described below (highlighted) and the data flows exchanged between them (also highlighted).

(a) *Operate Vehicles and Facilities (4.1)* - These processes provide information on the current state of operation of Intercity transit vehicles, and how they are performing against the schedules. The processes are responsible for keeping vehicles on schedule and taking action to get them back on schedule when any deviations are found.

(b) *Plan and Schedule Transit Services (4.2)* - These processes provide the management of the route planning and scheduling of both regular and demand responsive transit services of Intercity Transit Operations.

(c) *Schedule Transit Vehicle Maintenance (4.3)* - These processes are responsible for the management of intercity transit vehicle maintenance and the assignment of technicians to carry out the maintenance. They use the operational data provided by the processes in (a) and the maintenance specifications for each type of vehicle.

(d) *Support Security and Coordination (4.4)* - These processes manage the actions which are taken when an emergency occurs on-board an intercity transit vehicle or within the Intercity transit facility, or transit depot. Notification of an emergency may come from transit users via such things as panic buttons, from a transit vehicle driver, or from surveillance equipment located at transit stops and other parts of the transit network. The processes work to pre-defined plans of action for each type of emergency situation and communicate with the Manage Emergency Services function (see DFD 5) for coordination of emergency service activities through Thurston County E911 Call Center and/or Local Police for responses to incidents.

(e) *Generate Transit Driver Schedules (4.5)* - These processes are responsible for the management of intercity transit driver working schedules, routes, etc. Drivers are assigned to their duties based on a number of criteria, including availability, previous experience, performance on previous assignments, seniority, and personal preferences. Activities are monitored by the transit fleet manager who can update the data about individual drivers.

(f) *Collect Transit Fares in the Vehicle (4.6)* - These processes collect fares from transit users on-board an intercity transit vehicle, for the use of current transit services, and advanced payments for transit services. The fare payment processing may be carried out interactively from on-board the vehicle, or may be held until the vehicle reaches a convenient point and then carried out as a batch transaction. The processes support the use of debit/credit cards, including those with stored credit value, as may be issued by transit operators as well as financial institutions.

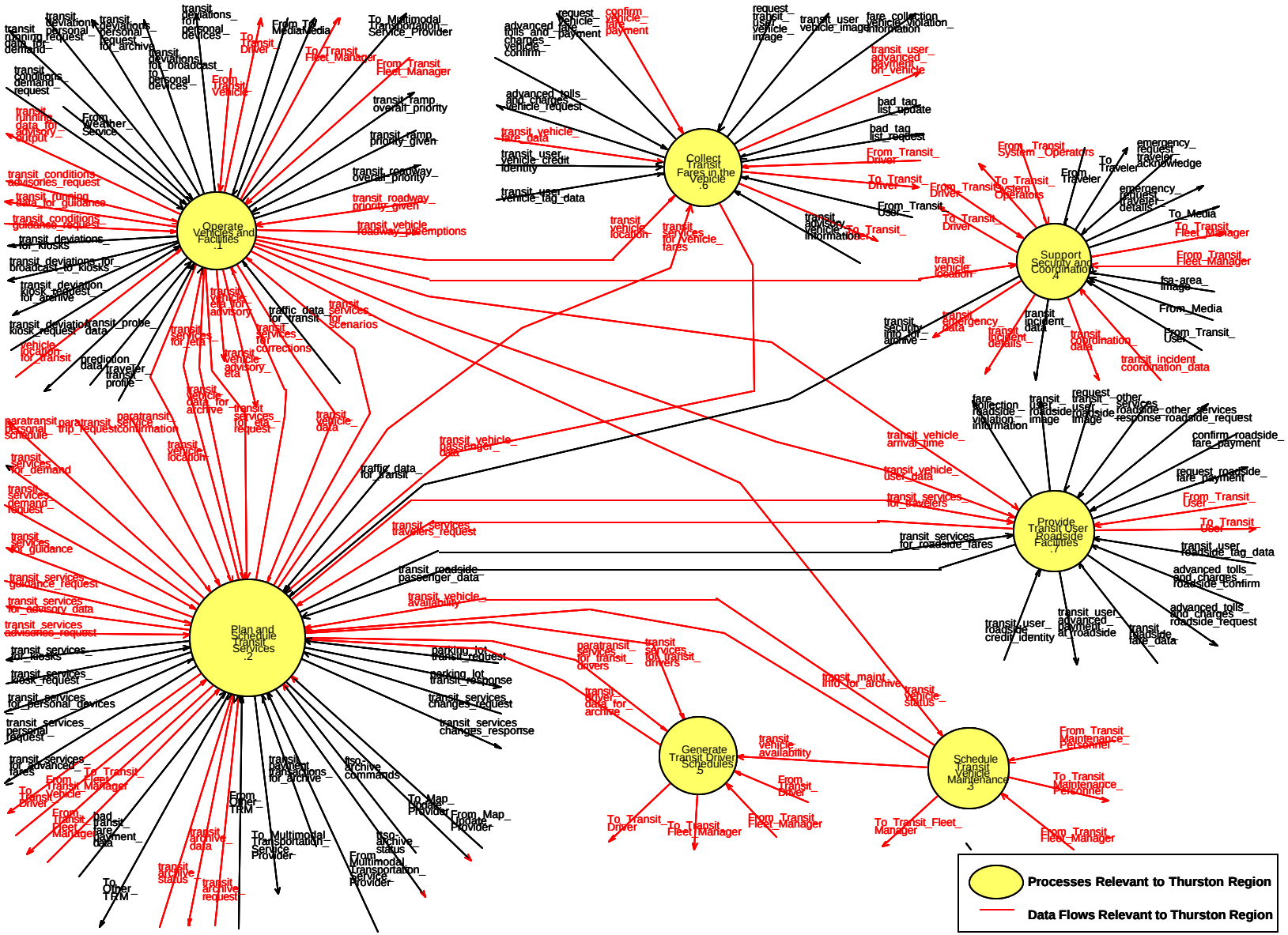


Figure 3-5: Manage Transit Data Flow Diagram (Level 1 DFD)

(g) *Provide Transit User Roadside Facilities (4.7)* - These processes act as the interface through which the transit user can obtain information and pay for the use of services at a roadside location, such as an intercity transit stop. The information provided includes intercity transit services in general, and the time at which the next service is due to arrive at the location. Information provided by intercity transit vehicles approaching the location is also automatically output to the transit user. Payment by the transit user for the use of current transit services and advanced payments for transit services is supported by the processes, as is the use of debit/credit cards, including those with stored credit value, as may be issued by transit operators as well as financial institutions.

3.3.4 Emergency Services and Management (DFD 5)

As defined in Section 3.2.2, there is only one main process identified in this functional and/or operational group, Manage Emergency Services. Defined below is the main process and brief descriptions of the sub-processes that are relevant for the Thurston Region.

Manage Emergency Services (DFD 5)
This DFD shows the processes that provide the Manage Emergency Services function. This function is responsible for the management of the emergency services' response to incidents and communications with law enforcement agencies. The key points about the function are as follows:

?? ITS functions can automatically call-out appropriate emergency services to an incident;
?? confirmation of response action is provided to the emergency services operator;
?? emergency telephone and Thurston County E911 Call Center system can call-out appropriate emergency services to an incident;
?? information about incidents can be exchanged with the Manage Incidents facility;
?? emergency vehicles can be provided priority routing (e.g.,"green waves") along their routes to an incident;
?? incident responses can be coordinated with other Emergency Management Systems;

There are 5 processes in this DFD and they divide the overall functionality between themselves in the following ways. Figure 3-6 illustrates the processes described below (highlighted) and the data flows exchanged between them (also highlighted).

(a) *Provide Emergency Service Allocation (5.1)* - these processes allocate emergency services in response to requests received from a range of inputs, including other ITS functions, plus Emergency Telecommunications Systems, and other Emergency Management Systems operated by Thurston County E911 Call Center, the Washington State Patrol, and the Local Police and Fire.

(b) *Provide Operator Interface for Emergency Data (5.2)* - this process is responsible for providing the emergency services operator with an interface to the other processes in the Manage Emergency Services function. The process will enable the operator to review and update the data used to allocate emergency services to incidents, applying temporary

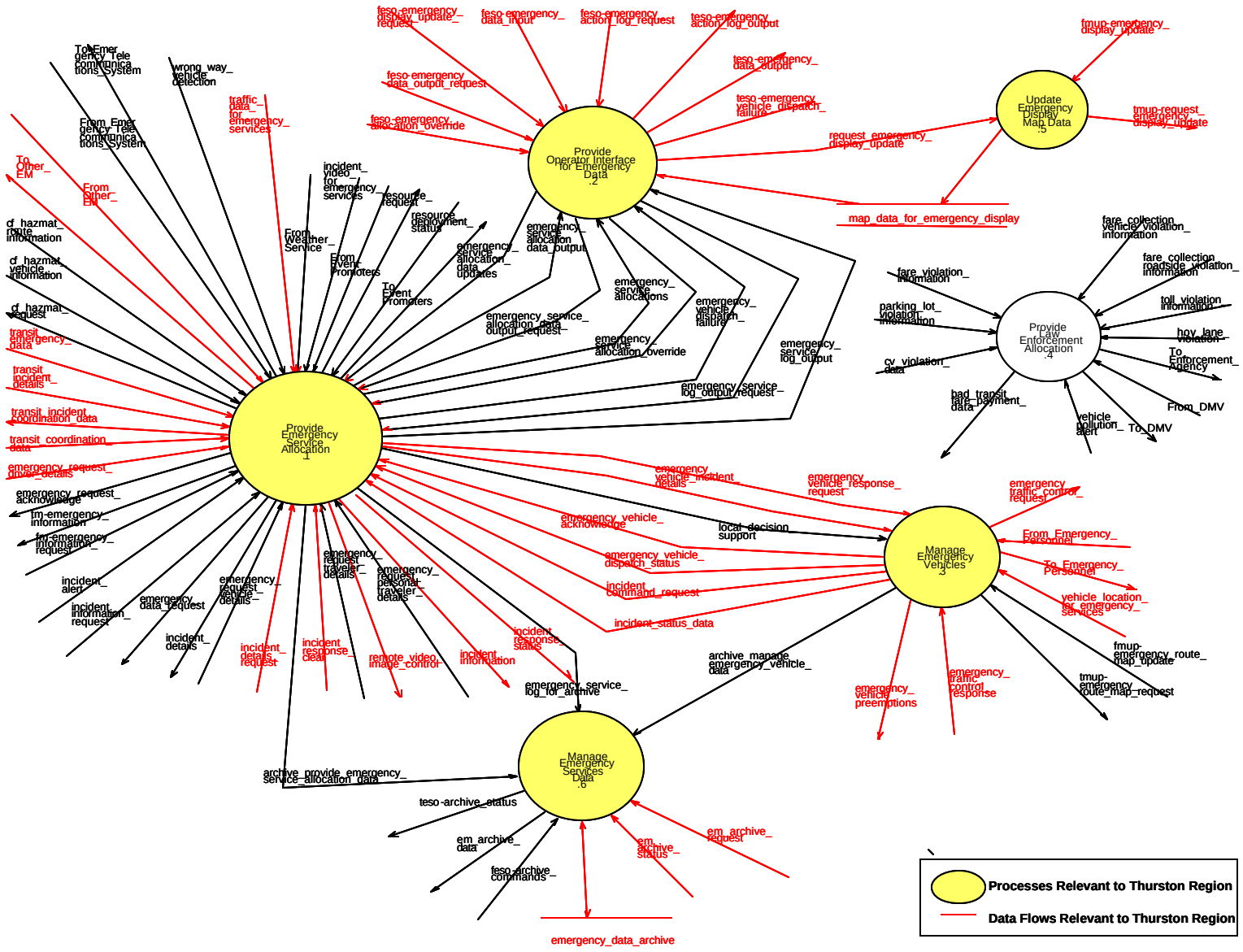


Figure 3-6: Manage Emergency Services (Level 1 DFD)

(c) overrides to current emergency service allocations to suit the special needs of a current incident, and requesting output of the log of emergency service actions. It will also enable the output of a message showing the failure of an emergency vehicle dispatched in response to an incident. These functions are performed by the Thurston County E911 Call Center, the Washington State Patrol, Local Police and Fire, and the Thurston County EOC (i.e., the EOC only during exceptional conditions like an earthquake, flood, etc).

(d) *Manage Emergency Vehicles (5.3)* - these processes are responsible for the management of emergency service vehicles when they are dispatched to an incident by the Thurston County E911 Call Center or the Washington State Patrol. The most appropriate vehicle(s) will be dispatched with instructions to emergency personnel about the incident to which the response is being directed. Once at the incident, emergency personnel can report back with updates on the progress being made with the incident response.

(e) *Update Emergency Display Map Data (5.5)* - this process is responsible for providing updates to the store of digitized map data used as the background for displays of incidents and emergencies produced by processes in the Manage Emergency Services function. The process will obtain the new data from a specialist data supplier or some other appropriate data source, on receiving an update request from the emergency system operator interface process within the function. Regional Stakeholders involved in this process include the Thurston County E911 Call Center and the Thurston County Geo Data Center.

(f) *Manage Emergency Services Data (5.6)* - This process collects emergency service data, emergency vehicle management data, emergency vehicle data, and incident data from the Thurston County E911 Call Center, and the Washington State Patrol. It distributes this data to the Manage Archive Data function performed by the regional cities, counties and WSDOT, where it can be archived and accessed upon request or upon receipt of fresh data.

3.3.5 Traveler Services (DFD 6)

As defined in Section 3.2.2, there is only one main process identified in this functional and/or operational group, Provide Driver and Traveler Services. Defined below is the main process and brief descriptions of the sub-processes that are relevant for the Thurston Region.

Provide Driver and Traveler Services (DFD 6)

The processes in this DFD provide the Provide Driver and Traveler Services function. This function is responsible for providing drivers and travelers with trip planning, traffic and transit information, and route guidance facilities. The key points about the function are as follows:

?? travelers in the Thurston region may plan, confirm and be guided along single mode or multi-modal trips;

?? en-route advisory traffic and transit information provided for drivers and transit users in the Thurston region;

?? travelers in the Thurston region may use home, office, or a personal portable device to receive traveler information.

The six processes are all DFDs and they divide the overall functionality of this DFD between themselves in the following ways. Figure 3-7 illustrates the processes described below (highlighted) and the data flows exchanged between them (also highlighted).

(a) *Provide Trip Planning Services (6.1)* – these processes produce a trip plan to meet the requirements of a traveler's trip request using the Puget Sound Regional Traveler Information System. The trip plan can be multi-modal and is generated using the facilities provided by the processes in (f) below. It may also include demand responsive transit services provided through the Manage Transit function (see DFD 4), ridesharing and the use of services from multi-modal transportation service providers such as heavy rail, airlines, etc. The traveler may be using a home, office or a personal portable device.

(b) *Provide Information Services (6.2)* – these processes provide information to drivers and to transit users in the Thurston region. These users, including Thurston region stakeholder agencies can receive advisory and broadcast information. Advisory information is requested by the driver or transit user, and broadcast information is output automatically. Both types of information may include traffic and transit data obtained from the Manage Traffic and Manage Transit functions – see DFDs 1 and 4 respectively.

(c) *Manage Ridesharing (6.4*) – these processes provide a ride sharing service for personal vehicle users, Intercity transit users and special needs transportation users. Travelers using private cars who have the same destination and expected arrival time will be matched so that they can share rides for all or part(s) of their journeys. This will enable them to make best use of their private cars, possibly taking advantage of being able to travel in high occupancy vehicle (HOV) lanes. The journey details for travelers for whom no match is found will be retained in case a suitable traveler asks for a ride share at a later date. This process will coordinate with the Manage Transit function for transit specific users.

(d) *Provide Guidance and Trip Planning Services (6.6)* – these processes provide route guidance for drivers, plus route guidance and trip planning for travelers using the Puget Sound Regional Traveler Information System. Multi-modal routes are provided to travelers for both on-line personal traveler guidance and for trip planning.

(e) *Provide Driver Personal Services (6.7)* – these processes enable drivers to call emergency services like a mayday service. Processes enable a driver to summon the emergency services like the Thurston E911 Call Center, in the event of an incident involving the vehicle. The call is activated by the driver using a device such as a MAYDAY button in the vehicle. Acknowledgment of the receipt of the call-out request by the Manage Emergency Services function (see DFD 5) is provided through the processes in (b) above.

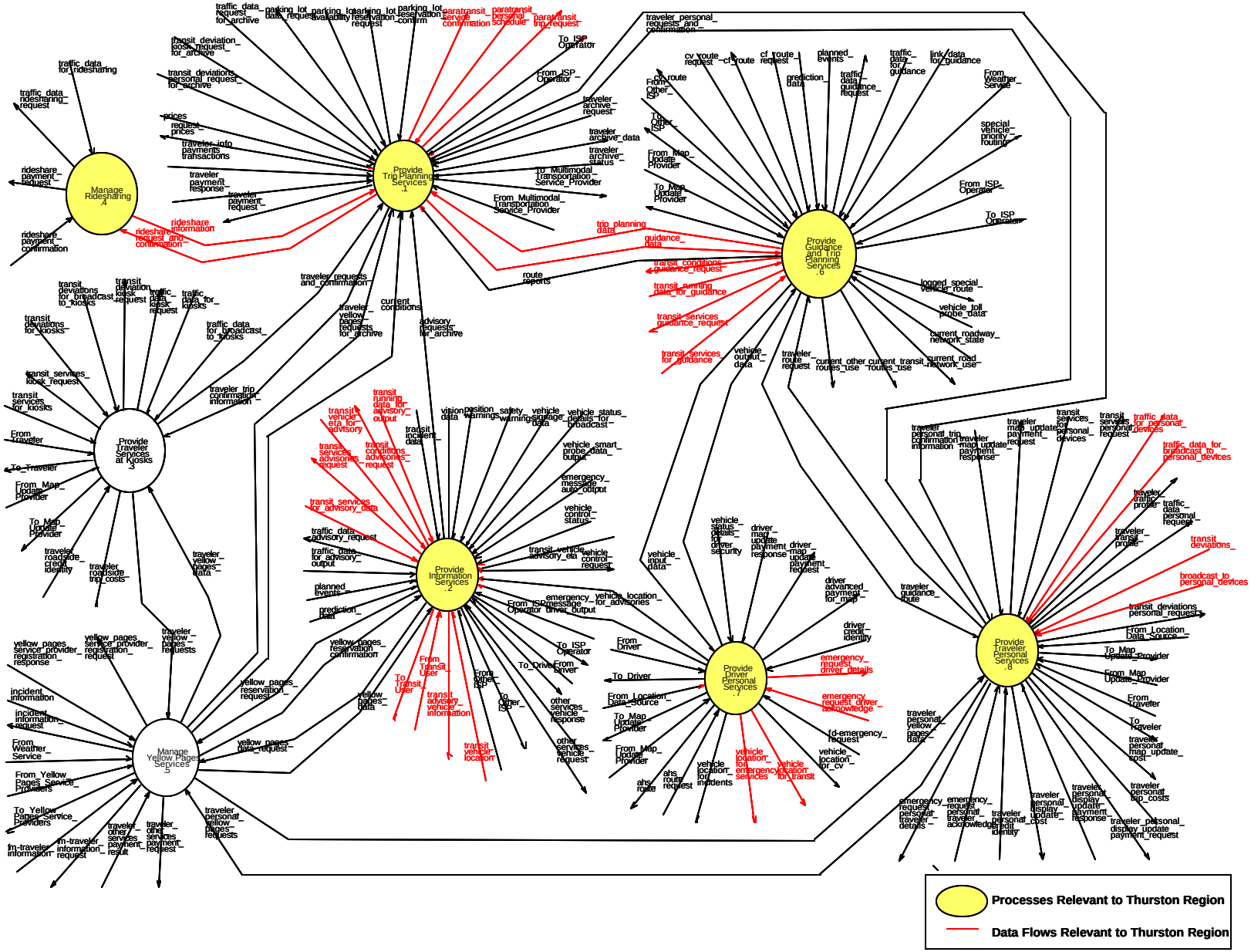


Figure 3-7: Provide Driver and Traveler Services Data Flow Diagram

(f) *Provide Traveler Personal Services (6.8)* – these processes provide the traveler with facilities for on-line guidance, personal security and trip planning. The on-line guidance is provided dynamically from a central service like the Puget Sound Regional Traveler Information System and will enable the traveler to be guided along a multi-modal route. The personal security facility provides the traveler with a mechanism to call emergency services like the Thurston County E911 Call Center in the event of an incident. The call is activated by the traveler using a device such as a "panic" button on a personal portable device. Acknowledgment of the receipt of the message by the Manage Emergency Services function (see DFD 5) is provided through the processes in (e) above. The trip planning facilities are similar to those provided in © above except that they are designed to be used from a traveler's personal device (portable or non portable).

3.3.6 Electronic Payment (DFD 7)

As defined in Section 3.2.2, there is only one main process identified in this functional and/or operational group, Provide Electronic Payment Services. Defined below is the main process and brief descriptions of the sub-processes that are relevant for the Thurston Region.

Provide Electronic Payment Services (DFD 7)
The processes in this DFD are responsible for the Provide Electronic Payment Services function. This function is responsible for enabling drivers, transit users and travelers to pay for their journeys and for other services. The key points about their functions are as follows:

?? facilities are provided for non-stop fare charges collection;
?? drivers and travelers can pay for fares in advance;

There are three processes in this DFD and the overall functionality is divided between them in the following ways. Figure 3-8 illustrates the processes described below (highlighted) and the data flows exchanged between them (also highlighted).

(a) *Provide Electronic Fare Collection (DFD 7.3)* – These processes provide facilities for billing Intercity transit users with the cost of their fares as they pass through boarding points for transport services. They also enable the transit user to pay for these services in advance. Billing can be for fares collected either on-board transit vehicles, or at the roadside. A record of all transactions is periodically sent to the transit system operator and transit fleet manager.

(b) *Carry-out Centralized Payments Processing (DFD 7.4)* – These processes are responsible for maintaining a centralized store of data either managed by Intercity Transit or a Financial Institution, on the prices being charged for transit fares.

(c) *Provide Payment Instrument Interfaces (DFD 7.5)* – These processes are responsible for providing the interfaces through which data can be collected from the payment instruments being used by drivers and travelers. This data may consist of the credit identity or stored credit value depending on the type of instrument being used. The

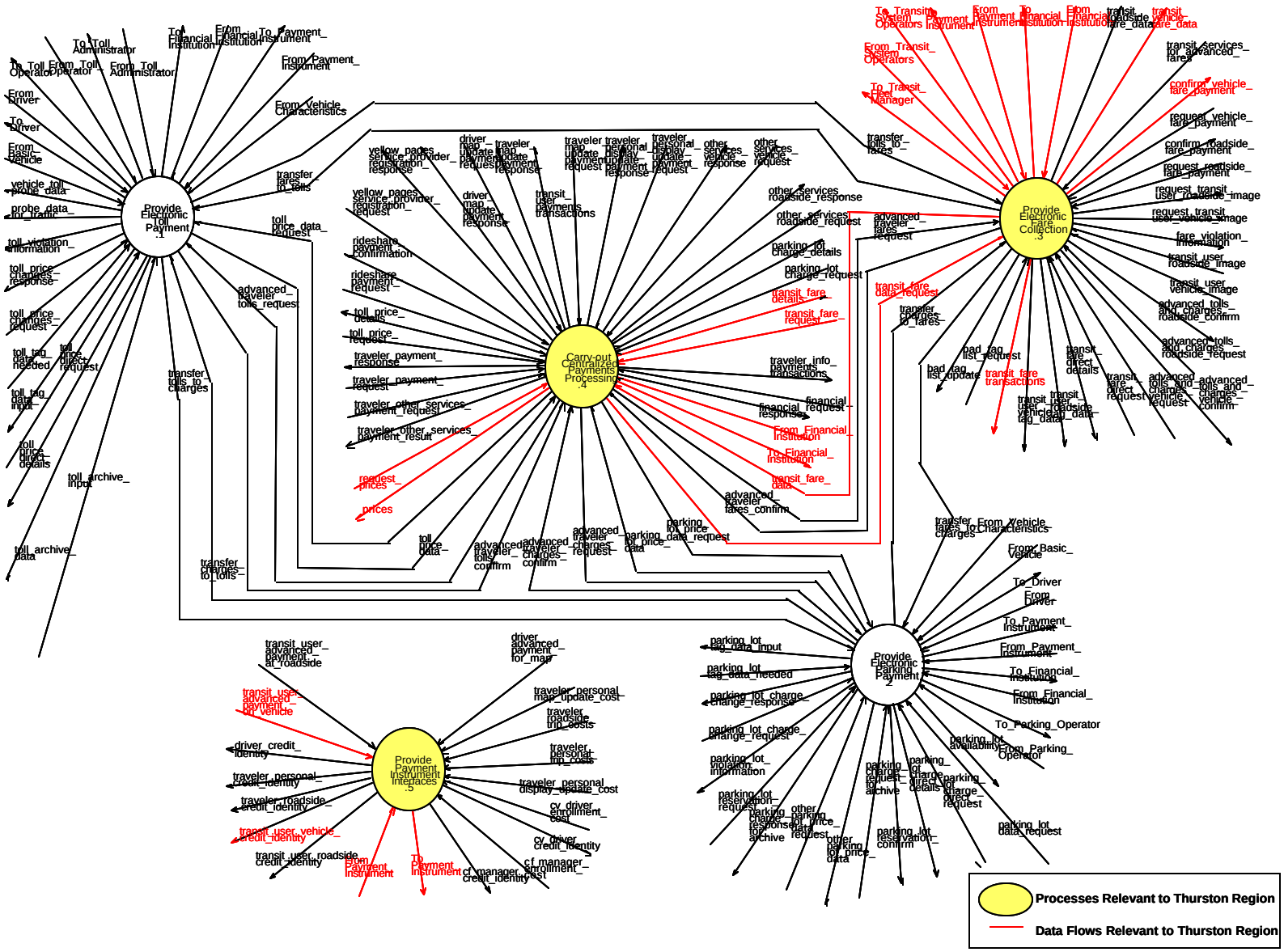


Figure 3-8: Provide Electronic Payment Data Flow Diagram

processes support the reduction in the value of any stored credit that the payment instrument may be carrying in payment for the requested service.

3.3.7 Information Storage and Management (DFD 8)

As defined in Section 3.2.2, there is only one main process identified in this functional and/or operational group, Manage Archived Data. Defined below is the main process and brief descriptions of the sub-processes that are relevant for the Thurston Region.

Manage Archived Data (DFD 8)
This DFD shows the processes that provide the Manage Archived Data function. This function is responsible for providing facilities to collect ITS and related data, archive it, and make it available to other user systems for use in transportation administration, policy evaluation, safety, planning, performance monitoring, program assessment, operations, and research applications. The key points about the function are as follows:

?? data collected from each ITS function and center-type terminators
?? collected data formatted and stored into a permanent data store
?? schema and format of data managed through the interface with the Archived Data Administrator
?? coordination with other archives allows data to be shared across multiple sites
?? user systems request data or a catalog of data
?? user systems request analyses of the archive data such as fusion, mining, or aggregations
?? archive on-demand allows additional data to be selected for import into the archive by users systems
?? roadside data collected directly for archive purposes

There are three processes in this DFD. Overall functionality is divided between them in the following ways. Figure 3-9 illustrates the processes described below (highlighted) and the data flows exchanged between them (also highlighted).

(a) *Get Archive Data (8.1)* – This process collects data from each major function within ITS and external sources for archive purposes that may not exist within current ITS data sources. This process responds to requests from the Manage Archive Data Administrator Interface process to import data or data catalogs. This process sends requests for data or a catalog of available data to the other functions and terminators, either a subscription for data or a one-time request. This process receives meta-data along with the data to describe the conditions under which the data was collected or any other information about the operational data. This process can be managed by the regional cities in the Thurston County and coordinate the sharing of information with the jurisdictional counties and Washington State DOT.

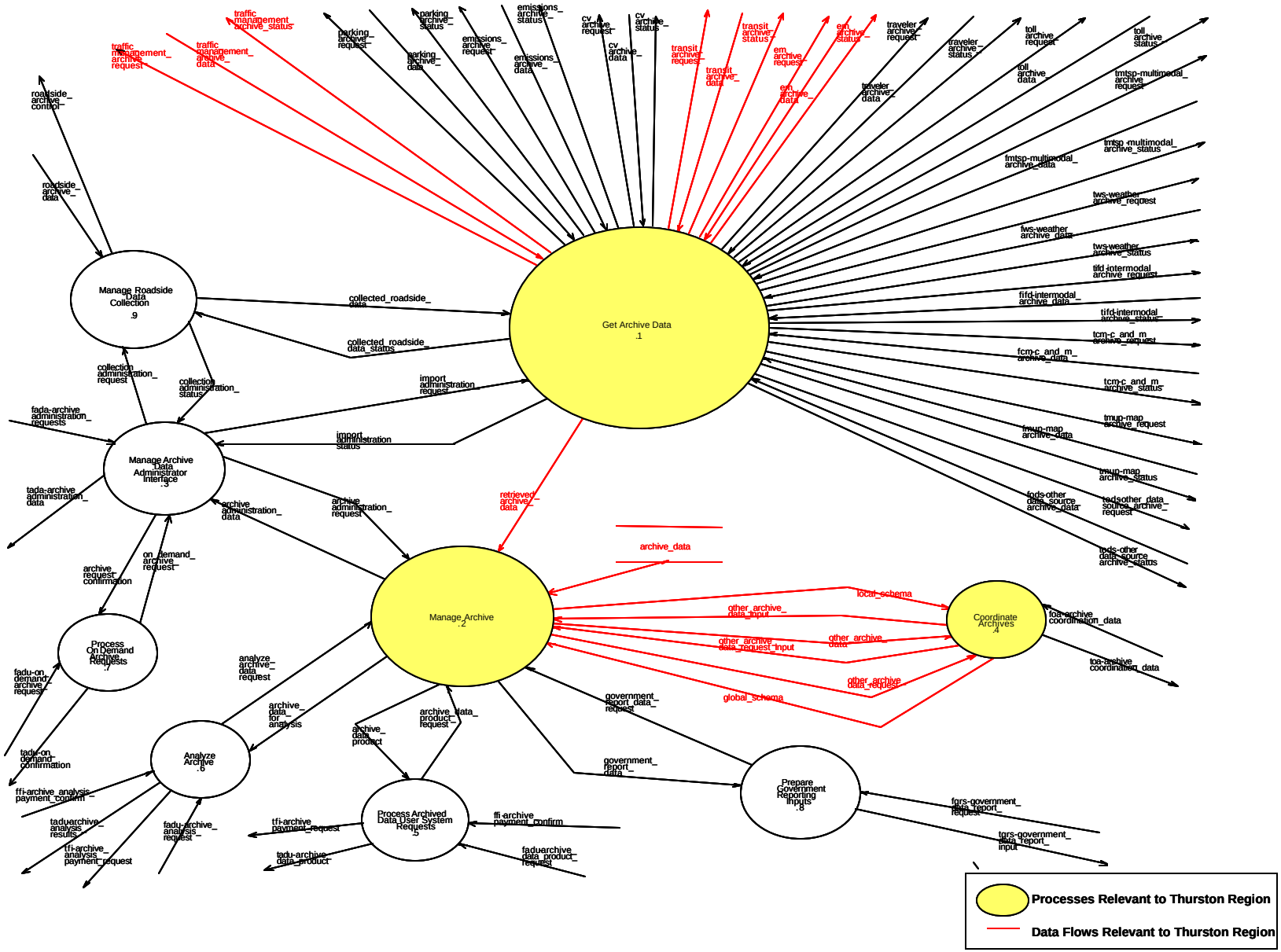
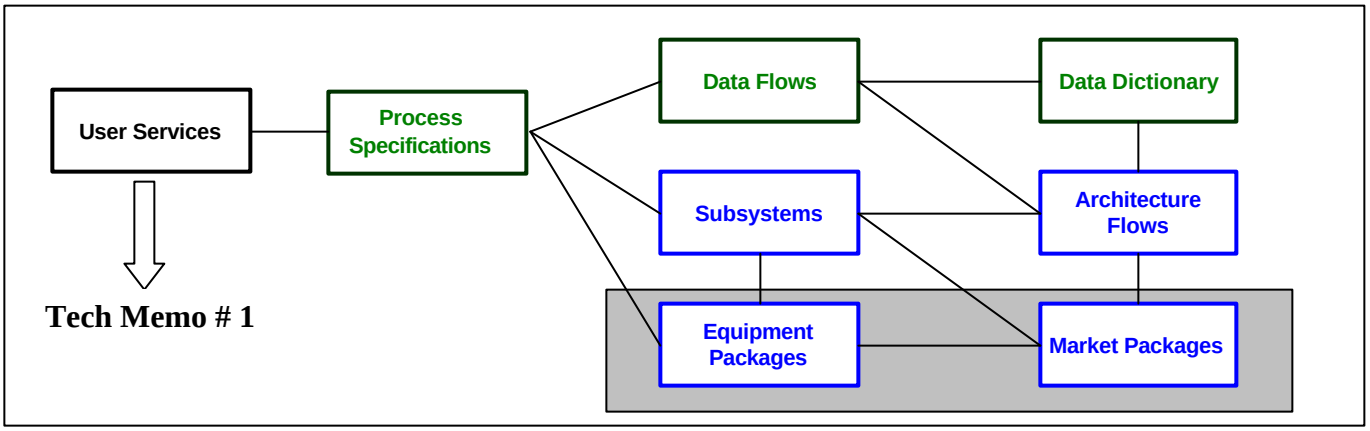


Figure 3-9: Manage Archived Data – Data Flow Diagram (Level 1 DFD)

(b) *Manage Archive (8.2)* – This process stores the collected and formatted data in a permanent archive data store, which will be managed by the regional cities in Thurston County. This process receives the formatted data from the Get Archive Data function accompanied by any updates to the meta-data that would describe the formatting operations performed on the data as it was imported. This process responds to requests from the administrator interface function to maintain the schema of the archive data, set update frequencies, and backup schedules, user authentication schemes, cleansing algorithms. This process provides the administrator interface function with status of the data quality in the archive, frequency reports on use of the archive, updates to the measure of the volume of the data and other data archive metrics.

(c) *Coordinate Archives (8.4)* – This process coordinates the information exchange between different Manage Archived Data functions represented through the Other Archives terminator. This process allows the regional cities in Thurston County to share information with jurisdictional counties and Washington State DOT archives in response to local requests from users systems. This process uses data collected from different archives to build a set of global schema, which are the data archive definitions for the local archive plus any archives known to the local archive.

4.0 Market Packages and Equipment Packages



4.1 Overview of Market Packages

Market package, as defined in the National ITS Architecture are "bundles" of technology services that are often purchased together, as a group. Where a user service addresses the need or "what" the issue is, a market package addresses "how" that need or service is addressed. Some of the thirty-one user services are too broad in scope to be convenient in planning actual deployments and projects. Additionally, they often don't translate easily into existing institutional environments and don't distinguish between major levels of functionality. In order to address these concerns (in the context of providing a more meaningful evaluation), a finer grained set of deployment-oriented ITS service building blocks were defined from the original user services—these building blocks are defined as "market packages".

The previous chapters of this system architecture document focused on the two main perspectives of developing and viewing the architecture, the physical and the logical. The physical architecture focused on the Thurston region stakeholders, depicted their roles in terms of the connections and information sharing communications that need to take place between these entities to manage transportation in the region effectively and efficiently. The logical architecture for the Thurston region defined the architecture in terms of the transportation related functions through processes that are and will be performed by the regional stakeholders.

Market Packages take a different approach to the architecture in that they identify integrated, implementable pieces of the physical architecture. Market packages are defined by sets of equipment packages required to work together (typically across different subsystems). Equipment packages deliver a given transportation service and the major architecture flows between them and other important external systems. In other words, they identify the pieces of the National ITS Architecture required to implement a complete end to end service. Most market packages are made up of equipment packages in two or more subsystems. Market packages are designed to address specific transportation problems and needs and can be related back to the thirty-one user services and their more detailed requirements.

The identification of market packages provides the transition mechanism from the system architecture to the next phase of the project – definition of an implementation strategy for the Thurston Region.

4.2 Identification of Thurston Region Market Packages

A list of sixty-three "generic" market packages is provided in the National ITS Architecture (version 3.0). All sixty-three market packages were examined with regard to their applicability to the Thurston region's ITS User Services (US). The Thurston region's US, as identified in TM 1, were mapped against the sixty-three generic market packages. Using a similar mapping process as suggested for the needs and user services in TM 1, and the National ITS Architecture, this process allowed the identification of the market packages most applicable for the region and based exclusively on the needs and US defined earlier for the Thurston region. The results of this mapping process are presented in Table 4-1.

The market packages identified through this mapping process were examined thoroughly based on the US they addressed and the functional groups and operational areas. Table 4-2 presents those market packages that best address the transportation needs and issues in the region, followed by a brief description of each market package.

Table 4-1: Mapping of User Services to Market Packages

		Thurston Region User Services (WHAT)																													
	Market Packages (HOW)	1.1 Provide Pre-trip Travel Information	1.2 Support En-Route Driver Information	1.3 Support Route Guidance	1.4 Provide Ride Matching and Reservation	1.5 Provide Traveler Services Information	1.6 Support Traffic Control	1.7 Conduct Incident Management	1.8 Support Travel Demand Management	1.9 Support Emission Testing and Mitigation	1.10 Highway-Rail Crossing Safety	1.11 Operations and Maintenance	2.1 Improve Public Transportation Management	2.2 Provide En-Route Transit Information	2.3 Support Personalized Public Transit	2.4 Enhance Public Travel Security	3.1 Electronic Payment Services	4.1 Support Commercial Vehicle Electronic Clearance	4.2 Support On-board Safety Monitoring	4.4 Provide Commercial Vehicle Administrative Processes	4.6 Improve Commercial Fleet Management	5.1 Enhance Emerg. Notification & Personal Security	5.2 Improve Emergency Vehicle Management	6.1 Support Longitudinal Collision Avoidance	6.2 Support Lateral Collision Avoidance	6.3 Enhance Intersection Collision Avoidance	6.4 Improve Vision Enhancement for Crash Avoidance	6.5 Improve Safety Readiness	6.6 Provide Pre-Crash Restraint Deployment	6.7 Support Automated Vehicle Operation	7.1 Support Archive Data Function
Advanced Traffic Management Systems (ATMS)	1. Network Surveillance	•	•	•			•	•																							
	2. Probe Surveillance	•	•	•			•	•						•																	
	3. Surface Street Control						•	•				•																			
	4. Freeway Control						•	•																							
	5. HOV Lane Management																														
	6. Traffic Information Dissemination		•				•	•						•																	
	7. Regional Traffic Control	•	•	•			•	•						•																	
	8. Incident Management System	•	•	•			•	•						•																	
	9. Traffic Forecast/Demand Management	•			•		•	•	•																						
	10. Electronic Fee/Payment Collection																•														
	11. Emissions Monitoring and Management									•																					
	12. Virtual TMC Smart Probe Data		•				•	•																							
	13. Standard Railroad Grade Crossing										•																				
	14. Advanced Railroad Grade Crossing										•																				
	15. Railroads Operations Coordination										•																				
	16. Parking Facility Management																														
	17. Reversible Lane Management																														
	18. Road Weather Information System	•	•	•		•	•																								
	19. Regional Parking Management																														
Advanced Public Transportation Systems (APTS)	1. Transit Vehicle Tracking												•	•																	
	2. Transit Fixed-Route Operations												•																		
	3. Demand Response Transit Operations												•		•																
	4. Transit Passenger and Fare Management												•	•																	
	5. Transit Security												•			•															
	6. Transit Maintenance												•																		
	7. Multi-Modal Coordination	•	•										•																		
	8. Transit Traveler Information		•										•	•	•																
Advanced Traveler Information Systems (ATIS)	1. Broadcast Traveler Information	•	•			•															•										
	2. Interactive Traveler Information	•	•			•																									
	3. Autonomous Route Guidance																														
	4. Dynamic Route Guidance																														
	5. ISP Based Route Guidance																														
	6. Integrated Transportation Mgt/Route Guidance																														
	7. Yellow Pages and Reservation																														
	8. Dynamic Ridesharing																														
	9. In-Vehicle Signing																														
Advanced Vehicle Safety Systems (AVSS)	1. Vehicle Safety Monitoring																							•	•			•	•	•	
	2. Driver Safety Monitoring																							•	•		•	•	•	•	
	3. Longitudinal Safety Warning																							•				•	•		
	4. Lateral Safety Warning																								•			•	•		
	5. Intersection Safety Warning																												•		
	6. Pre-Crash Restraint Deployment																									•			•		
	7. Driver Visibility Improvement																							•	•		•	•		•	
	8. Advanced Vehicle Longitudinal Control																							•			•			•	
	9. Advanced Vehicle Lateral Control																								•		•			•	
	10. Intersection Collision Avoidance																									•	•	•	•	•	
	11. Automated Highway System																							•	•	•	•	•	•	•	
Commercial Vehicle Operations (CVO)	1. Fleet Administration																				•										
	2. Freight Administration																														
	3. Electronic Clearance																	•													
	4. CV Administrative Processes																	•		•											
	5. International Border Electronic Clearance																														
	6. Weigh-In-Motion																														
	7. Roadside CVO Safety																														
	8. On-Board CVO Safety																		•		•										
	9. CVO Fleet Maintenance																				•										
	10. HAZMAT Management																														
Emergency Mgmt (EM)	1. Emergency Response																					•	•								
	2. Emergency Routing																					•	•								
	3. Mayday Support																					•									
Archived Data (ADS)	1. ITS Data Mart	•			•	•	•	•																							•
	2. ITS Data Warehouse	•			•	•							•																		•
	3. ITS Virtual Data Warehouse							•																							•

Table 4-2: Thurston Region ITS Market Packages

Functional and/or Operational Group	Market Package Category	Market Packages
Traffic and Transportation Management	Advanced Traffic Management Systems (ATMS)	?? Network Surveillance (ATMS01) ?? Probe Surveillance (ATMS02) ?? Surface Street Control (ATMS03) ?? Freeway Control (ATMS04) ?? Traffic Information Dissemination (ATMS06) ?? Regional Traffic Control (ATMS07) ?? Incident Management System (ATMS08) ?? Traffic Forecast and Demand Management (ATMS09) ?? Virtual TMC Smart Probe Data (ATMS12) ?? Standard Railroad Grade Crossing (ATMS13) ?? Advanced Railroad Grade Crossing (ATMS14) ?? Railroads Operations Coordination (ATMS15) ?? Road Weather Information System (ATMS18)
Public Transportation Management	Advanced Public Transportation Management Systems (APTS)	?? Transit Vehicle Tracking (APTS01) ?? Transit Fixed Route Operations (APTS02) ?? Demand Responsive Transit Operations (APTS03) ?? Transit Passenger and Fare Management (APTS04) ?? Transit Security (APTS05) ?? Transit Maintenance (APTS06) ?? Multi-Modal Coordination (APTS07) ?? Transit Traveler Information (APTS08)
Electronic Payment	Advanced Traffic Management Systems (ATMS)	?? Electronic Fee/Payment Collection (ATMS10)
Traveler Services	Advanced Traveler Information Systems (ATIS)	?? Broadcast Traveler Information (ATIS1) ?? Interactive Traveler Information (ATIS2)
Freight Mobility	Commercial Vehicle Operations (CVO)	?? Fleet Administration (CVO1) ?? Electronic Clearance (CVO3) ?? CV Administrative Processes (CVO4) ?? CVO Fleet Maintenance (CVO9)
Emergency Services and Management	Emergency Management (EM)	?? Emergency Response (EM1) ?? Emergency Routing (EM2) ?? Mayday Support (EM3)
Information Storage and Management	Archived Data (AD)	?? ITS Data Mart (AD1) ?? ITS Data Warehouse (AD2) ?? ITS Virtual Data Warehouse (AD3)

The description of the Thurston region market packages identified above are provided in Appendix D. As discussed earlier, each market package consists of several equipment packages across several subsystems. Appendix E illustrates the customized Thurston region market package diagrams along with the identification of key subsystems, equipment packages, and the associated flows of information (architecture flows) between equipment packages and subsystems. Descriptions of the Thurston Region equipment packages are provided in Appendix

F along with the associated Process Specifications (P-Specs) for each equipment package to allow traceability to the logical architecture.

4.3 Overview of Equipment Packages

The term "equipment package" was used in the National ITS Architecture development effort to group like functions (P-specs) of a particular subsystem together into an "implementable" package of hardware and software capabilities. Though not prescriptive (i.e., the only way to do it), the equipment packages presented in the National ITS Architecture provide a logical approach to combining functions within a subsystem.

4.4 Identification of Thurston Region Equipment Packages

A list of one hundred thirty-eight (138) "generic" equipment packages is provided in the National ITS Architecture (version 3.0). Similar to the mapping process of user services to market packages, the National ITS Architecture provides a roadmap linking the generic market packages, associated subsystems and the relevant equipment packages.

Using this information as a guide and the selected Thurston Region Market Packages, a list of Thurston region equipment packages were identified. This list was examined with regard to their applicability to the Thurston region's user needs and the process specifications identified in the Logical Architecture. Table 4-3 details the Thurston region market packages, the associated subsystems and the relevant equipment packages. Definitions of these selected equipment packages are included in Appendix F.

Table 4-3: Thurston Region Equipment Packages

Thurston Region Market Packages	Subsystems	Equipment Packages	Implementing Centers
TRAFFIC AND TRANSPORTATION MANAGEMENT (ADVANCED TRAFFIC MANAGEMENT SYSTEMS (ATMS) MARKET PACKAGES)			
Network Surveillance (ATMS01)	Roadway	Roadway Basic Surveillance	Tacoma TOC[1]
	Traffic Management	Collect Traffic Surveillance Traffic Maintenance	WSDOT[1] Thurston County
	Roadway	Roadway Probe Beacons	Private Vehicles Thurston County Maintenance
	Traffic Management	TMC Probe Information Collection	Tacoma TOC Thurston County
	Vehicle	Vehicle Location Determination Vehicle Probe Support	Private Vehicles Thurston County Maintenance Crew Vehicles
Surface Street Control (ATMS03)	Roadway	Roadway Signal Control	WSDOT Thurston County Regional Cities[2]
	Traffic Management	TMC Signal Control Traffic Maintenance	Tacoma TOC Thurston County Regional Cities
Freeway Control (ATMS04)	Roadway	Roadway Freeway Control	WSDOT
	Traffic Management	TMC Based Freeway Management Traffic Maintenance	Tacoma TOC Thurston County Regional Cities
Traffic Information Dissemination (ATMS06)	Roadway	Roadway Traffic Information Dissemination	WSDOT
	Traffic Management	TMC Traffic Information Dissemination	WSDOT

[1] Except as noted, use of the term "WSDOT" is intended to refer specifically to WSDOT Olympic Region inclusive of Thurston County (also Pierce, Kitsap, Mason, Grays Harbor, Jefferson and Clallam counties) and the construction, operations and maintenance interests in the region. The use of the term "Tacoma TOC" refers to the specific WSDOT Olympic Region operational activities conducted by and coordinated through that center located in Tacoma. This would include (in general) traffic and incident management functions on the interstate and state highways in the Thurston Region.

[2] Use of the phrase "Regional Cities" is intended to represent all cities in the Thurston Region who are (or will be) participants in the ITS programs. This initial list would include, but is not limited to: Olympia, Lacey, Tumwater, Yelm, Tenino, Bucoda, Rainier, Rochester, etc.

Thurston Region Market Packages	Subsystems	Equipment Packages	Implementing Centers
Regional Traffic Control (ATMS07)	Traffic Management	TMC Regional Traffic Control	Tacoma TOC Thurston County & Regional Cities
Incident Management (ATMS08)	Emergency Management	Emergency Response Management	Washington State Patrol Thurston County 911 Call Center Thurston County EOC (exceptional situations) Local Police and Fire
	Roadway	Roadway Incident Detection	WSDOT
	Traffic Management	TMC Incident Detection TMC Incident Dispatch, Coordination/Communication	WSDOT Washington State Patrol Thurston County 911 Call Center Local Police and Fire
Traffic Forecast and Demand Management (ATMS09)	Traffic Management	TMC Traffic Network/Performance Evaluation	WSDOT
Emissions Monitoring and Management (ATMS10)	Emissions Management	Emissions Data Management	Thurston Regional Planning Council (TRPC) WSDOT, Regional Cities and Counties
	Roadway	Roadway Emissions	WSDOT, Regional Cities and Counties
Virtual TMC and Smart Probe Data (ATMS12)	Roadway	Roadway Probe Beacons	Thurston County
	Vehicle	Smart Probe	Thurston County Maintenance Crew Vehicles
Standard Railroad Crossing (ATMS13)	Traffic Management	HRI Traffic Management	Tacoma TOC
	Roadway	Standard Rail Crossing	
Advanced Railroad Crossing (ATMS14)	Traffic Management	HRI Traffic Management	Tacoma TOC
	Roadway	Advanced Rail Crossing	
Railroad Operations Coordination (ATMS15)	Traffic Management	Rail Operations Coordination	Tacoma TOC
Road Weather Information Systems (ATMS18)	Roadway	Roadway Environmental Monitoring	WSDOT Thurston County
	Traffic Management	TMC Road Weather Monitoring	WSDOT Thurston County

Thurston Region Market Packages	Subsystems	Equipment Packages	Implementing Centers
PUBLIC TRANSPORTATION MANAGEMENT ADVANCED PUBLIC TRANSPORTATION SYSTEMS (APTS) MARKET PACKAGES			
Transit Vehicle Tracking (APTS01)	Transit Management	Transit Center Tracking and Dispatch	Intercity Transit
	Transit Vehicle	On-Board Transit Trip Monitoring	Intercity Transit Vehicles
Transit Fixed Route Operations (APTS02)	Transit Management	Transit Center Fixed Route Operations Transit Garage Operations	Intercity Transit
	Transit Vehicle	On-board Fixed Route Schedule Management	Intercity Transit Vehicle
Demand Responsive Transit Operations (APTS03)	Transit Management	Transit Center Para-transit Operations Transit Garage Operations	Intercity Transit
	Transit Vehicle	On-board Para-transit Operations	Intercity Transit
Transit Passenger and Fare Management (APTS04)	Transit Management	Transit Center Fare and Load Management	Intercity Transit
	Transit Vehicle	On-board Transit Fare and Load Management	Intercity Transit
	Remote Traveler Support	Remote Transit Fare Management	Intercity Transit
Transit Security (APTS05)	Transit Management	Transit Center Security	Intercity Transit
	Transit Vehicle	On-board Transit Security	Intercity Transit
	Remote Traveler Support	Remote Mayday I/F Secure Area Monitoring	Intercity Transit
Transit Maintenance (APTS06)	Transit Management	Transit Garage Maintenance	Intercity Transit
	Transit Vehicle	On-board Maintenance	Intercity Transit Vehicles
Multi-Modal Coordination (APTS07)	Roadway	Roadside Signal Priority	Intercity Transit Vehicles
	Traffic Management	TMC Multi-modal Coordination	Tacoma TOC Thurston County Regional Cities
	Transit Management	Transit Center Multi-modal Coordination	Intercity Transit Pierce Transit Special Needs Transportation (ACCT, etc)
	Transit Vehicle	On-board Transit Signal Priority	Intercity Transit Vehicles

Thurston Region Market Packages	Subsystems	Equipment Packages	Implementing Centers
Transit Traveler Information (APTS08)	Transit Management	Transit Center Information Services	Intercity Transit Special Needs Transportation (ACCT, etc)
	Transit Vehicle	On-board Transit Information Services	Intercity Transit
	Remote Traveler Support	Remote Transit Information Services	Intercity Transit
ELECTRONIC PAYMENT SERVICES			
Electronic Fee/Payment Collection (ATMS10)	Vehicle	Vehicle Toll/Parking Interface	Intercity Transit Special Needs Transportation
TRAVELER SERVICES ADVANCED TRAVELER INFORMATION SYSTEMS (ATIS) MARKET PACKAGES			
Broadcast Traveler Information (ATIS1)	Information Service Provider	Basic Information Broadcast	Local Commercial Radio and TV
	Personal Information Access	Personal Basic Information Reception	WSDOT (Puget Sound; e.g., NW and Olympic Regions)
	Remote Traveler Support	Remote Basic Information Broadcast	
Interactive Traveler Information (ATIS2)	Information Service Provider	Interactive Infrastructure Information	
	Personal Information Access	Personal Interactive Information Reception	WSDOT (Puget Sound; e.g., NW and Olympic Regions)
	Remote Traveler Support	Remote Interactive Information Reception	
FREIGHT MOBILITY COMMERCIAL VEHICLE OPERATIONS (CVO) MARKET PACKAGES			
Fleet Administration (CVO1)	Fleet and Freight Management	Fleet Administration Fleet Maintenance Management	Washington State Patrol WSDOT Commercial Vehicle Division
	Commercial Vehicle	On-board Trip Monitoring	
	Vehicle	Vehicle Location Determination	
Electronic Clearance (CVO3)	Commercial Vehicle Administration	CV Information Exchange	WSDOT Commercial Vehicle Division
	Commercial Vehicle	On-board CV Electronic Data	
	Commercial Vehicle Check	Roadside Electronic Screening	Washington State Patrol WSDOT Commercial Vehicle Division

Thurston Region Market Packages	Subsystems	Equipment Packages	Implementing Centers
CV Administrative Processes (CVO4)	Commercial Vehicle Administration	Credentials and Taxes Administration CV Information Exchange	WSDOT Commercial Vehicle Division Washington State Patrol
	Fleet and Freight Management	Fleet Credentials and Taxes Management and Reporting	WSDOT Commercial Vehicle Division
CVO Fleet Maintenance (CVO9)	Fleet and Freight Management	Fleet Maintenance Management	WSDOT Commercial Vehicle Division
	Commercial Vehicle	On-board Trip Monitoring	
EMERGENCY SERVICES AND MANAGEMENT EMERGENCY MANAGEMENT (EM) MARKET PACKAGES			
Emergency Response (EM1)	Emergency Management	Emergency Call Taking Emergency Response Management	Thurston County 911 Call Center Washington State Patrol Local Police and Fire
	Emergency Vehicle	On-board EV Incident Management Communicator	Thurston County Emergency Vehicles Washington State Patrol Local Police and Fire
Emergency Routing (EM2)	Emergency Management	Emergency Dispatch	Thurston County 911 Call Center Washington State Patrol Local Police and Fire
	Emergency Vehicle	On-board EV en-route Support	Thurston County Emergency Vehicles Washington State Patrol Local Police and Fire
	Roadway	Roadside Signal Priority	WSDOT Thurston County Regional Cities
Mayday Support (EM3)	Emergency Management	Mayday Support	Washington State Patrol Thurston County 911 Call Center Local Police and Fire

Thurston Region Market Packages	Subsystems	Equipment Packages	Implementing Centers
INFORMATION STORAGE AND MANAGEMENT ARCHIVED DATA MANAGEMENT (AD) MARKET PACKAGES			
ITS Data Mart (AD1)	Commercial Vehicle Administration	CV Data Collection	WSDOT Commercial Vehicle Division Washington State Patrol
	Emergency Management	Emergency Data Collection	Thurston County Regional Cities Washington State Patrol
	Archived Data Management Subsystems	Government Reporting Systems Support ITS Data Repository Traffic and Roadside Data Archival	Thurston County Regional Cities WSDOT TRPC
	Information Service Provider	ISP Data Collection	WSDOT
	Roadway	Roadside Data Collection	Thurston County Regional Cities WSDOT
	Traffic Management	Traffic Data Collection	Thurston County Regional Cities WSDOT
	Transit Management	Transit Data Collection	Intercity Transit

Thurston Region Market Packages	Subsystems	Equipment Packages	Implementing Centers
ITS Data Warehouse (AD2)	Commercial Vehicle Administration	CV Data Collection	WSDOT Commercial Vehicle Division Washington State Patrol
	Emergency Management	Emergency Data Collection	Thurston County Regional Cities Washington State Patrol
	Archived Data Management Subsystems	ITS Data Repository On-line Analysis and Data Mining	Thurston County Regional Cities WSDOT TRPC
	Information Service Provider	ISP Data Collection	WSDOT
	Roadway	Roadside Data Collection	Thurston County Regional Cities WSDOT
	Traffic Management	Traffic Data Collection	Thurston County Regional Cities WSDOT
	Transit Management	Transit Data Collection	Intercity Transit
ITS Virtual Data Warehouse (AD3)	Archived Data Management Subsystem	Virtual Data Warehouse Services	Thurston County Regional Cities WSDOT TRPC

5.0 Standards

5.1 Overview

Standards can be thought of as the glue that pulls the various pieces of the architecture together. Defined standards are fundamental to the establishment of nationally compatible and interoperable ITS deployments. Standards will enable deployment of consistent, non-interfering, reliable systems on local, regional and national levels. Open standards will further benefit the consumer by enhancing competition for the range of products necessary to implement the ITS user services. Larger markets for specific products will reduce production costs through economy of scale. Producers benefit from standards because they assure a wide market over which the product can be sold. Many of the benefits the public receives from the National ITS Architecture are a direct result of the development and implementation of standards. Primarily, standards provide benefits in the following areas:[3]

?? National Compatibility – National compatibility is represented by the ability to use the same equipment and services, regardless of the geographical location. The architecture identifies roughly 45 specific interfaces requiring nationwide compatibility. Examples include the delivery of real-time traveler information to in-vehicle devices and the dedicated short range interface between the vehicle and the roadside. Nationwide standards for these types of interfaces will allow travelers and commercial vehicles to use their compliant equipment anywhere within the United States.

?? Multiple Suppliers – The architecture can encourage competition in the delivery of ITS services through the implementation of standards in areas where a standard is not necessarily required to provide a traveler with seamless operation of his ITS service. These interfaces will benefit from standards in allowing multiple suppliers of equipment and software that will directly connect to other ITS systems.

?? Ranges of Functionality – The standard packages contain data flows that support several levels of service. For example, the *trip plan* data flow contains a large number of optional data fields. The standards developer is encouraged to maintain the flexibility in the data flow specifications to allow for multiple implementations.

?? Synergy – As discussed above, the architecture began with a logical architecture that satisfied the identified user services. As a result, there are functions and data flows common to several of the services. These "processes" appear in several higher level data flows and, because they come from a single source, support synergy and consistency.

?? Risk Reduction – The architecture reduces risk to public providers, private providers and consumers. For public providers, existence of standards means that equipment purchased one year will be likely to operate with new equipment purchased several years from now. This also means that agencies will not be locked into specific vendors (proprietary systems) since all vendors will be able to build to the same standard (open architecture). For private

[3] ITS Standards Development Plan, FHWA, June, 1996.

providers, existence of standards means that they can gather information from multiple sources using well defined message sets and thereby increases the level of service to their customers (economies of scale). For consumers, products built to a particular standard will allow a user to select their service provider from a number of companies (competition), not just the company that their equipment happens to be compatible with.

5.2 Identification of Relevant ITS Standards for the Thurston Region

Approximately eighty (80) different ITS standards have been identified as relevant in the implementation of the systems in the National ITS Architecture. The task of working with the public and private sector ITS community to develop, educate and outreach these standards has been tasked to seven different standards development organizations (SDOs). These SDOs are:

- American Association of State Highway and Transportation Officials (AASHTO)
- American National Standards Institute (ANSI)
- American Society for Testing and Materials (ASTM)
- Institute of Electrical and Electronics Engineers (IEEE)
- Institute of Transportation Engineers (ITE)
- National Electrical Manufacturers Association (NEMA)
- Society of Automotive Engineers (SAE)

Standards that apply specifically for traffic and transit management applications are jointly developed by ITE, NEMA and AASHTO under a joint committee known as the National Transportation Communications for ITS Protocol (NTCIP) Committee.

In the National ITS Architecture, the logical architecture presents a functional view of the ITS user services. It defines the functions or processes that are required to perform the selected ITS user services, and the information or data flows that need to be exchanged between these functions. The physical architecture partitions the functions defined by the logical architecture into systems and subsystems. In order to accomplish the functions outlined in the logical architecture, some communication must take place between the elements of the physical architecture. These communication links in the Physical Architecture are defined by the architecture flows between the subsystems. The architecture flows are the pieces that identify the standards and define how the communications take place between the various subsystems in the National ITS Architecture.

Recently the U.S. DOT's Joint Program Office (JPO) has placed a major emphasis on defining these standards based on application areas grouped by the National ITS Architecture interfaces (e.g., center to center, center to roadside), which are deployment oriented and define specific ITS services or systems. The current standards web site (http://www.its-standards.net) identifies these application areas, their definitions and the relevant standards for each of them.

5.3 National ITS Architecture Interfaces, Application Areas and Relevant Standards for the Thurston Region

As described in the section above, the USDOT has enabled a deployment perspective to grouping the available 80 ITS Standards into relevant application areas. By reviewing the definitions of the National ITS Architecture Interfaces, appropriate application areas, and relating it to the system architecture defined in sections 2, 3, and 4, the ITS Standards relevant to the Thurston Region are identified in Table 5-1. The table lists the following:

- ?? National ITS Architecture Interfaces;
- ?? their respective application areas,
- ?? the subsystems involved,
- ?? the ITS Standard Document Number,
- ?? the associated standard developing organization for each standard, and
- ?? the standard name.

The following describes the National ITS Architecture Interfaces (interfaces between subsystems) and the application areas that fall under them. The interfaces and application areas described below are based on the Thurston region system architecture as defined in Sections 2, 3 and 4.

5.3.1 National ITS Architecture Interface: Center to Roadside

This category of application areas includes those standards that provide communication links between a transportation or traffic management center and roadside equipment that regulates the flow of traffic.

Application Areas:

1. **Data Collection and Monitoring:** This application area covers the interface between a traffic management center (Tacoma TOC) or a data archive (WSDOT) and a specific type of roadway equipment that monitors and collects traffic information data over a period of time—the data collection and monitoring (DCM) device. The DCM device processes sensor signals to generate information about the traffic passing the sensor that is collected or archived for later analysis. This function may be deployed using portable devices for short-term data collection or permanently installed devices for continuous monitoring of a site. The data collected can be used to revise traffic control strategies, such as changing traffic signal timing or ramp meter control, thereby improving the overall efficiency of transportation management. The DCM device can also collect speed, travel times, and other data measured and communicated by passing vehicles equipped with a transponder or other short-range communications device (vehicle probe).

2. **Dynamic Message Signs:** This application area covers the interface between a traffic management subsystem and a specific type of roadway equipment that provides

information to a vehicle operator -- the dynamic message sign (DMS). This sign may be deployed using various technologies, such as "flip panels," multiple lights, or light emitting diodes and is capable of displaying a limited number of messages or a fully customized message using various fonts and colors. The primary purpose of these signs is to convey traffic conditions, weather conditions, and other traveler-advisory information to the vehicle operator.

3. **Environmental Monitoring:** This application area covers the interface between a traffic management center and a specific type of roadway equipment that monitors weather, roadway surface, and air/water quality conditions—the environmental sensor stations. The environmental sensor station is commonly deployed as the roadside component of a road/weather information system (RWIS). WSDOT currently operates and maintains several RWIS stations in the state and a few in Thurston County. It is comprised of a remote processor unit connected to one or more sensors that collect environmental or meteorological data. The environmental sensor station collects weather data such as air temperature, amount and type of precipitation, visibility, dew point, relative humidity, wind speed, and wind direction. It also collects surface conditions, including pavement temperature, subsurface temperature, surface conditions (dry, wet, or frozen), amount of deicing material, and freezing point on the road surface. The primary users of the information from these devices are roadway maintenance and traffic operations.

4. **Ramp Metering:** This application area covers the interface between a traffic management center and a specific type of roadway equipment that provides freeway control—a ramp meter control (RMC) unit. This control unit has the ability to meter freeway entry lanes in order to restrict the flow of traffic onto the freeways operated by WSDOT. The RMC has a metering plan that is either locally stored or can be loaded from the traffic management center. The metering plan can be adjusted manually or automatically based upon surveillance information gathered from the mainline lanes or from queue information gathered from the metered lanes.

5. **Traffic Signals:** This application area covers the interface between a traffic management center and a specific type of roadway equipment that provides roadway control—a local traffic signal controller. It is also possible to have an on-street master controller, a "field master," that manages a group of local signal controllers, behaving like a mini-traffic management center on the roadside. Based upon an analysis of traffic characteristics for a given time and type of day, the traffic management center invokes the appropriate pre-configured traffic signal control system timing plan, including simple pre-timed (fixed) and complex actuated control schemes, which is sent to the field masters and/or traffic signal controllers at the roadside. In the Thurston region the county, regional cities, and WSDOT operate and maintain the traffic signals on the local streets and major arterials. The purpose of traffic signal systems, in order of importance, is to (1) distribute right-of-way safely, (2) maintain the traffic signal system and (3) coordinate traffic signals to allow for efficient flow of traffic.

6. **Vehicle Sensors:** This application area covers the interface between a traffic management center (TMC) and a specific type of roadway equipment that senses various traffic parameters and communicates back to that central traffic management center. This interface supports the capability for the TMC to monitor traffic and road conditions, identify and verify incidents, detect faults in indicator operations, and collect data for traffic strategy development and long range planning. The sensors could be as simple as a single loop detector that communicates traffic data, or more elaborate systems including smart inductive loop sensors, microwave sensors, machine vision sensors, and visual image processing systems that sense and communicate a wide variety of traffic parameters. WSDOT currently operates and maintains several traffic detectors that collect traffic data and communicate it back to several TMCs including the Tacoma TOC.

7. **Video Surveillance:** This application area covers the interface between a traffic management center and video surveillance equipment on the side of the road. The video surveillance equipment, consisting of switches, CCTV cameras, and communications infrastructure, provides incident information and roadway images to a traffic operator in a traffic management center. WSDOT currently operates and maintains CCTV on major freeways in the state and images from CCTV cameras located along I-5 can be viewed by the Tacoma TOC to detect incidents and roadway conditions.

5.3.2 National ITS Architecture Interface: Center-to-Center

This category of application areas includes those standards that facilitate communication between transportation management centers. This category also includes communications necessary for transit use.

Application Areas:

1. **Data Archival:** This application area covers the interface between a transportation data archive (WSDOT) and the sources of the archived data. It also covers the interface between the data archive and users of the archived data. A data archive collects data to be used for non-operational purposes, such as planning, analysis, and research. The data placed into the archive can come from a variety of transportation systems including traffic management centers (WSDOT TMCs, Thurston county, regional cities), transit management centers (Intercity Transit, Pierce Transit), emergency management centers (Thurston County, Washington State Patrol) commercial vehicle administration systems, construction and maintenance systems, information service providers, providers of other modes of transportation (e.g. rail, ferry, or air), and intermodal freight carriers or terminals. The data archive may include data not directly from the transportation systems, e.g. weather information. The users of the archive data include various user systems as well as other data archives.

2. **Incident Management:** This application area covers the interfaces that support the coordination and exchange of incident-related information between allied agencies. The interfaces support coordination of incident management among agencies like the Washington State Patrol and the Thurston County E911 Call Center, disseminate situation awareness and response plans to all agencies, and allow resources to be requested, tracked, and managed. In this context, "incidents" include all types of transportation-related incidents such as traffic accidents, planned roadway closures, and special events. A broad array of centers can exchange this information, including those operated by public safety agencies, traffic management agencies, transit operators, fleet and freight operators, information service providers, and any other allied agency that is materially involved in incident response or dissemination of information about incidents. The extent to which information and coordination are shared between centers is determined through working arrangements among agencies or jurisdictions.

3. **Rail Coordination Application:** This application area covers the interface between a traffic management center (TMC) and a rail operations center. The interface supports the following capabilities:

   ?? Providing (from the rail operations center to the TMC) information about train movements and maintenance activities that could impact highway-rail intersections
   ?? Providing (from the TMC to the rail operations center) information about conditions at or near the highway-rail intersection (HRI), including obstructions or equipment failure, that might interfere with passing trains.

4. **Traffic Management:** This application area covers the interface between a traffic management subsystem and other centers. The application area supports a number of capabilities including:

   ?? Exchanging near real-time traffic data and control information by the Tacoma TOC to support a regional traffic management strategy.
   ?? Exchanging information with maintenance and construction operations in Thurston County for the efficient management of maintenance activities.
   ?? Providing near real time traffic information for use by information service providers (Puget Sound Regional Traveler Information) and the media (TV and Radio). Similarly, information service providers and the media share information that they receive from other sources with traffic management.
   ?? Exchanging information with transit and emergency operations to support traffic signal priority and preemption for transit and emergency vehicles, respectively.
   ?? Developing a more complete view of the status of the transportation network by acquiring transportation (e.g. public transportation) and event information from other centers.
   ?? Providing near real-time traffic information for use by other operations centers, such as emergency management and transit management.

?? These other centers could include another traffic management, transit management, and emergency management centers, as well as information service providers and other transportation service providers. The extent to which information and control are shared between centers is determined through working arrangements among agencies or jurisdictions.

5. **Transit Management:** This application area covers the interface between a transit management center and other centers and supports the following capabilities:

?? Providing multi-modal coordination between transit agencies (Intercity Transit, Pierce Transit) and other types of public transportation (i.e. ferries, rail, airlines) at transfer points, including coordinating information between local/regional transit organizations including schedules, on-time information, and ridership;
?? Coordinating with traffic management centers to obtain near real-time traffic conditions on transit routes and to request signal priority on the selected route(s);
?? Providing transit incident information, schedules, and fare and pricing information to an information service provider;
?? Providing transit information suitable for media use;
?? Coordinating with financial institutions on the approval and status of electronic fare payments;

The extent to which information and coordination are shared between centers is determined through working arrangements among agencies or jurisdictions.

6. **Traveler Information:** This application area covers the interfaces between an organization that creates traveler information, like the Puget Sound Regional Traveler Information System and other centers that provide transportation data to the Information Service Provider (ISP) or use the traveler information created by the ISP. ISPs typically collect transportation data from a variety of sources, integrate the data, and disseminate the data through many types of distribution channels (i.e., Internet, personal data assistants, radio, and television).

The application area supports a number of capabilities including:

?? Collect transportation data, including static data (e.g., transit, and event schedules) and near real-time data (e.g., traffic information, particularly sensor data, incidents, events, and video images, and transit vehicle status/location). The data could include information on other modes of transportation (e.g., ferry, rail, or airline).
?? Collect non-transportation data, including air quality information, tourism data (such as information about local events or other tourist activities), or yellow pages data (such as nearby restaurant locations, automobile service stations, or available lodging).
?? Integrate the data into traveler information, including coordination with other traveler information systems. The traveler information created could support

broadcast capability, the creation of personalized travel data, or the creation of route-guidance data.

?? Disseminate traveler information to the media
?? Provide route guidance to organizations (e.g., fleets of commercial vehicles)
?? Coordinate monetary transactions with financial institutions particularly for subscription-based information services
?? Deliver integrated near real-time traffic information for use by other operations centers, such as traffic management.

5.3.3 National ITS Architecture Interface: Center-to-Vehicle/Traveler

This category of application areas includes those standards that facilitate communication between transportation management centers and the driver of a vehicle or a traveler planning a trip. This category also includes communications necessary for coordination between transit management centers and their vehicles.

Application Area:

1. **Mayday:** This application area covers two types of interfaces:

   ?? between a driver or traveler and an emergency management center
   ?? between a traveler at a transit stop or transit facility and a transit management center

The application area covers the capability for a driver or traveler to request emergency assistance through an electronic Mayday message, which could be manually initiated by the driver or traveler, or automatically initiated from within a vehicle (e.g., following an accident). The traveler may be using a personal handheld device (e.g., personal data assistant), a traveler information display (e.g., a kiosk at a transit stop) or a "panic button" at a transit stop or facility. The application area includes the capability for the emergency management center (Thurston County, local police) or transit management center (Intercity Transit) to respond electronically to the emergency assistance request. Additionally, this application area includes the capability for site surveillance at a transit stop or transit facility using technologies such as closed circuit television (CCTV).

2. **Transit Vehicle Communication:** This application area covers the interface between a transit management center and transit or para-transit vehicles. This interface supports the following capabilities

   ?? collection of automated vehicle location information
   ?? collection of operational data (e.g., automated passenger counts and electronic fare payment information) and maintenance data (e.g., vehicle status and operating parameters)
   ?? providing the transit vehicle driver with electronic dispatch and routing instructions

?? support for emergency or "Mayday" alerts from the transit vehicle
?? providing traveler information to the vehicle, which in turn can provide it to the transit users.

3. **Traveler Information (As defined in the Interface: Center-Center)**

5.3.4 National ITS Architecture Interface: Roadside-to-Vehicle

This category of application areas includes those standards that facilitate wireless communication between roadside equipment and vehicles on the road.

Application Area:

1. **Signal Priority:** This application area covers the interface between a traffic signal controller and a Thurston County emergency vehicle desiring signal "preemption" or an Intercity transit vehicle desiring signal "priority." The granting of preemption or priority to the vehicle may be based upon passive detection of the vehicle type, or upon a request from an active device on the vehicle. Signal preemption typically implies that the controller switches the light to green in the direction of the preemption request, overriding the current timing. (However, there are other possible scenarios, such as setting all directions to flashing red.) Signal priority typically implies that the controller delays the phase transition so that a transit vehicle can get through the intersection. With signal priority the request for priority may or may not be granted, based on the overall traffic situation at the intersection.

5.3.5 National ITS Architecture Interface: Roadside-to-Roadside

This application area category includes standards that facilitate communications between railroad wayside equipment and highway roadside equipment.

Application Area:

1. **Highway Rail Intersection:** This roadside-to-roadside application area covers the interface between (rail) wayside equipment and roadside equipment at a highway rail intersection (HRI), providing the means to support coordinated operation of that equipment. This application area includes the interface to wayside equipment that support all types of rail, including light-rail transit, rapid-rail transit, and commuter rail, freight, and inter-city passenger trains, although similar information exchanges could apply to other types of multi-modal crossings (e.g., draw bridges).

Table 5-1: Relevant ITS Standards for the Thurston Region Categorized by National ITS Architecture Interface and Application Area

Application Area	Subsystems Involved	Doc Number	Associated SDO	Standard Name
NATIONAL ITS ARCHITECTURE INTERFACE: CENTER TO ROADSIDE				
Data Collection and Monitoring	Traffic Management Roadside	1101	NTCIP Joint Committee (ITE, NEMA, and AASHTO)	NTCIP – Simple Transportation Management Framework (STMF)
		1102		NTCIP – Octet Encoding Rules (OER)
		1103		NTCIP – Simple Transportation Management Protocol (STMP)
		1201		NTCIP – Global Object Definitions
		1204		NTCIP – Object Definitions for Environmental Sensor Stations (ESS)
		1205		NTCIP – Object Definitions for Closed Circuit Television (CCTV) Camera Control
		1206		NTCIP – Data Collection and Monitoring Devices
		1208		NTCIP – Object Definitions for Video Switches
		1209		NTCIP – Object Definitions for Transportation System Sensor Objects
		2001		NTCIP – Class B Profile
		2101		NTCIP – Subnet Profile for PMPP Over RS-232
		2102		NTCIP – Subnet Profile for PMPP Over FSK Modems
		2103		NTCIP – Subnet Profile for PPP over RS232 (Dial-up)
		2104		NTCIP – Subnet Profile for Ethernet
		2201		NTCIP – TP-Transportation Transport Profile
		2202		NTCIP – Internet Transport Profile (TCP/IP and UDP/IP)
		2301		NTCIP – Application for Simple Transportation Management Framework (STMF)
		2302		NTCIP – Application Profile for Trivial File Transfer Protocol
		2303		NTCIP – Application Profile for File Transfer Protocol (FTP)
Dynamic Message Signs	Traffic Management Roadway	2303, 1102, 2104, 2103, 2201, 1103, 2102, 1101, 2001, 1201, 2101, 2301, 2202	NTCIP Joint Committee (ITE, NEMA, and AASHTO)	All the standards listed are defined above.
		1203		NTCIP – Object Definitions for Dynamic Message Signs

Application Area	Subsystems Involved	Doc Number	Associated SDO	Standard Name
Environmental Monitoring	Traffic Management Roadway	2303, 2302, 1102, 2104, 2103, 2201, 1103, 2102, 1204, 1101, 2001, 1201, 2101, 1209, 1206, 2301, 2202	NTCIP Joint Committee (ITE, NEMA, and AASHTO)	All the standards listed are defined above.
Ramp Metering	Traffic Management Roadway	1102, 2104, 2103, 2201, 1103, 2102, 1101, 2001, 1201, 2101, 2301, 2202	NTCIP Joint Committee (ITE, NEMA, and AASHTO)	All the standards listed are defined above.
		1207		NTCIP – Object Definitions for Ramp Meters
Traffic Signals	Traffic Management Roadside	1102, 2104, 2103, 2201, 1103, 2102, 1101, 2001, 1201, 2101, 2301, 2202	NTCIP Joint Committee (ITE, NEMA, and AASHTO)	All the standards listed are defined above.
		1210		NTCIP – Objects for Field Management Stations
		1202		NTCIP – Object Definitions for Actuated Traffic Signal Controllers
Vehicle Sensors	Traffic Management Roadway	2303, 2302, 1102, 2104, 2103, 2201, 1208, 1103, 2102, 1205, 1101, 2001, 1201, 2101, 1209, 1206, 2301, 2202	NTCIP Joint Committee (ITE, NEMA, and AASHTO)	All the standards listed are defined above.
Video Surveillance	Traffic Management Roadway	2303, 2302, 1102, 2104, 2103, 2201, 1208, 1103, 2102, 1205, 1101, 2001, 1201, 2101, 2301, 2202	NTCIP Joint Committee (ITE, NEMA, and AASHTO)	All the standards listed are defined above.

Application Area	Subsystems Involved	Doc Number	Associated SDO	Standard Name
NATIONAL ITS ARCHITECTURE INTERFACE: CENTER TO CENTER				
Data Archival	Archived Data Mgt. Traffic Management Emergency Management Transit Management Archived Data User Systems	2303, 1102, 2104, 2202,	NTCIP Joint Committee (ITE, NEMA, and AASHTO)	All the standards listed are defined above.
		2304		NTCIP – Application Profile for DATEX-ASN
		2305		NTCIP – Application Profile for Common Object Request Broker Architecture (CORBA)
		2501		NTCIP – Information Profile for DATEX
		2502		NTCIP – Information Profile for CORBA
		ASTM AG	American Society for Testing and Materials (ASTM)	ADMS Standard Guidelines
		ASTM DD		ADMS Data Dictionary
		TS285	American National Standards Institute (ANSI)	ANSI – Commercial Vehicle Safety and Credentials Information Exchange
		TS286		ANSI - Commercial Vehicle Credentials
		P1512	Institute of Electrical and Electronics Engineers (IEEE)	IEEE – Standard for Common Incident Management Message Sets (IMMS) for use by EMCs
		TM2.01	Institute of Transportation Engineers (ITE)	ITE – Message Sets for External TMC Communication
		TM1.03		ITE - Standard for Functional Level Traffic Management Data Dictionary (TMDD)
		P1512.a	Institute of Electrical and Electronics Engineers (IEEE)	IEEE – Standard for Emergency Management Data Dictionary
		J2529	Society of Automotive Engineers (SAE)	SAE – Rules for Standardizing Street Names and Route IDs
		J2540		SAE – Messages for Handling Strings and Look-up Tables in ATIS Standards
		J2353		SAE – Data Dictionary for Advanced Traveler Information Systems (ATIS)
		J2354		SAE – Message Set for Advanced Traveler Information Systems
		1401	NTCIP Joint Committee (ITE, NEMA, and AASHTO)	NTCIP – TCIP Common Public Transportation Objects
		1403		NTCIP – TCIP Passenger Information (PI) Business Area Standard
		1406		NTCIP – TCIP Onboard Objects
		1407		NTCIP – TCIP Control Center Objects
		1408		NTCIP – TCIP Fare Collection Objects

Application Area	Subsystems Involved	Doc Number	Associated SDO	Standard Name
Incident Management	Emergency Management Traffic Management Transit Management Fleet and Freight Mgt	2303, 2304, 1102, 2104, 2502, 2501, 2305, P1512-, TM 2.01, TM 1.03, P1512.a, 2202, 1401, 1402, 1405	NTCIP Joint Committee, IEEE, and ITE	All the standards listed are defined above.
		P1512.1	Institute of Electrical and Electronics Engineers (IEEE)	IEEE – Standard for Traffic Incident Management Message Sets for Use by EMCs
		P1512.2		IEEE – Standard for Public Safety IMMS for sue by EMCs
		P1512.3		IEEE – Standard for Hazardous Material IMMS for use by EMCs
		1301	NTCIP Joint Committee (ITE, NEMA, and AASHTO)	NTCIP – Message Set for Weather Reports
Rail Coordination	Traffic Management Rail Operations Center	2303, 2304, 1102, 2104, 2502, 2501, 2305, 2202	NTCIP Joint Committee (ITE, NEMA, and AASHTO)	All the standards listed are defined above.
Traffic Management	Traffic Management Transit Management Emergency Management Construction & Maintenance Information Service Provider	2303, 2304, 1102, 2104, 1210, 2502, 1301, 2501, 2305, TM 2.01, P1512.1, P1512.a, 2202, J2529, J2540, J2353, J2354	NTCIP Joint Committee, ITE, IEEE, and SAE	All the standards listed are defined above.
Transit Management	Transit Management Traffic Management Information Service Provider	2303, 2304, 1102, 2104, 2502, 1301, 2501, 2305, TM 2.01, TM 1.03, 2202, J2529, J2540, J2353, J2354, 1407, 1401, 1408, 1403	NTCIP Joint Committee, ITE, IEEE, and SAE	All the standards listed are defined above.
		1402	NTCIP Joint Committee (ITE, NEMA, and AASHTO)	NTCIP - TCIP – Incident Management (IM) Business Area Standard
		1404		NTCIP – TCIP – Scheduling/Runcutting (SCH) Business Area Standard
		1405		NTCIP – TCIP – Spatial Representation (SP) Business Area Standard

Application Area	Subsystems Involved	Doc Number	Associated SDO	Standard Name
		TS 3.TM	Institute of Transportation Engineers (ITE)	ITE – Traffic Management Business Area Standard
Traveler Information	Information Service Provider Traffic Management Fleet and Freight Mgt.	1208, 1205, 1201, J2529, J2540, J2353, J2354, 1401, 1408, 1402, 1406, 1403, 1405	NTCIP Joint Committee, and SAE	All the standards listed are defined above.
		CEA/EIA-794	Electronics Industry Alliance (EIA)	Data Radio Channel (DARC) System
		CEA/EIA –795		Sub-carrier Traffic Information Channel (STIC) System
		J1746	Society of Automotive Engineers (SAE)	SAE – ISP Vehicle Location Referencing Standard
		J2369		SAE – Standard for ATIS Message Sets Delivered Over Bandwidth Restricted Media
NATIONAL ITS ARCHITECTURE INTERFACE: CENTER TO VEHICLE/TRAVELER				
Mayday	Emergency Management Vehicle Transit Management Personal Information Access Remote Traveler Support	J2313	Society of Automotive Engineers (SAE)	On-board Land Vehicle Mayday Reporting Interface
Transit Vehicle Communications	Transit Management Transit Vehicle	J2529, J2540, J2353, J2354, 1407, 1401, 1408, 1402, 1406, 1403, 1404, 1408	SAE and NTCIP Joint Committee	All the standards listed are defined above.
Traveler Information				Same as the standards listed in center-center – Traveler Information
NATIONAL ITS ARCHITECTURE INTERFACE: ROADSIDE TO VEHICLE				
Signal Priority	Roadway Emergency Vehicle Transit Vehicle	ASTM N/A	American Society for Testing and Materials (ASTM)	Standard Specification for 5.9 GHz Physical Layer
		ASTM N/A		Standard Specification for 5.9 GHz Data Link Layer
		PS 111-98		ASTM – Specification for Dedicated Short Range Communication (DSRC) Physical Layer Using Microwave 902-928 MHz

Application Area	Subsystems Involved	Doc Number	Associated SDO	Standard Name
		PS 105-99		ASTM - Specification for Dedicated Short Range Communication (DSRC) Data Link Layer: Medium Access Logical Link Control
		P1556	Institute of Electrical and Electronics Engineers (IEEE)	IEEE – Security/Privacy of Vehicle/RS Communications including Smart Card Communications
		1211	NTCIP Joint Committee (ITE, NEMA, and AASHTO)	NTCIP – Objects for Signal Control Priority
Toll/Fee Collection	Transit Vehicle	1455	Institute of Electrical and Electronics Engineers (IEEE)	IEEE-Standard for Message Sets for Vehicle
		ASTM, PS 111-98, PS-105-99, P1556	American Society for Testing and Materials (ASTM) and Institute of Electrical and Electronics Engineers (IEEE)	All the standards listed are defined above.
NATIONAL ITS ARCHITECTURE INTERFACE: ROADSIDE TO ROADSIDE				
Highway Rail Intersection	Roadway Wayside Equipment	P1570	Institute of Electrical and Electronics Engineers (IEEE)	IEEE – Standard for Interface Between the Rail Subsystem and the Highway Subsystem at a Highway Rail Intersection

APPENDIX A

USER SERVICE REQUIREMENTS AND ASSOCIATED PROCESS SPECIFICATIONS (P-SPECS)

User Services and User Service Requirements	Associated P-Specs
1.1 Pre-trip Travel Information	
Thurston Regional ITS shall provide a Pre-Trip Travel Information (PTTI) capability to assist regional travelers, public agencies and commercial operators in making mode choices, travel time estimates, and/or route decisions prior to trip departure. Thurston Regional PTTI will consist of three major functions, which are: (1) Current Situation Information, (3) Trip Planning Service, and (4) User Access. Information will be integrated from various transportation modes and presented to the user for their information and decision-making.	1.1.4.6, 4.4.1.8, 6.1.1, 6.1.2, 6.5.1, 6.8.3.1, 6.8.3.2, 6.8.3.3
1.2 En-route Driver Information	
Thurston Regional ITS shall include an En-Route Driver Information function. Driver Information provides vehicle drivers with traffic and roadway status information, while en-route, which will allow alternative routes to be chosen for their destination. Driver Information consists of two major functions, which are (1) Driver Advisory and (2) In-vehicle Signing.	1.1.1.3, 1.1.3, 6.2.1.1, 6.2.1.2, 6.2.1.3, 6.2.1.4, 6.2.2, 6.2.3, 6.2.5
1.3 Route Guidance	
Thurston Regional ITS shall include a Route Guidance function. Route Guidance will provide travelers with directions to selected destinations. Four Route Guidance functions are potentially provided, these are: (1) Provide Directions, (2) Static Mode, (3) Real-Time Mode, and (4) User Interface.	1.6.1.1, 6.2.5, 6.6.1, 6.6.2.2, 6.6.2.3, 6.6.2.4, 6.6.2.6, 6.6.3, 6.6.4, 6.6.5
1.4 Ride Matching and Reservation	
Thurston Regional ITS shall include a Ride Matching function. Ride Matching will provide travel users with information on rideshare providers. Three major functions are provided which are (1) Rider Request, (2) Transportation Provider Services, and (3) Information Processing.	1.2.4.1, 1.2.4.2, 1.2.7.1, 1.2.7.5, 6.1.1, 6.1.2, 6.4.1, 6.4.2, 6.6.1, 6.6.4, 6.8.3.1, 6.8.3.2, 6.8.3.3, 7.4.2
1.5 Traveler Services Information	
Thurston Regional ITS shall include a Traveler Services Information function. Traveler Services Information provides travelers with service and facility data for the purpose of assisting prior to embarking on a trip or after the traveler is underway. The two functions included in this capability are: (1) Information Receipt and (2) Information Access.	1.2.4.1, 1.2.4.2, 1.2.7.1, 1.2.7.5, 6.1.1, 6.1.2, 6.2.1.2, 6.2.1.4, 6.2.3, 6.5.1, 6.5.2, 6.8.1.5, 6.8.3.1, 6.8.3.2

User Services and User Service Requirements	Associated P-Specs
1.6 Traffic Control	
Thurston Regional ITS shall provide a seamless city, county and state Traffic Control capability. Traffic Control provides the capability to efficiently manage the movement of traffic on streets and highways. This will also include control of network signal systems with eventual integration of freeway and arterial control. Four functions are provided which are: (1) Traffic Flow Optimization, (2) Traffic Surveillance, (3) Control Function, and (4) Provide Information.	1.1.1.1, 1.1.2.1, 1.1.2.2, 1.1.2.3, 1.1.3, 1.1.4.1, 1.1.4.2, 1.1.4.4, 1.1.4.6, 1.1.5, 1.2.1, 1.2.2.1, 1.2.2.2, 1.2.4.1, 1.2.4.2, 1.2.4.3, 1.2.5.1, 1.2.6.1, 1.2.6.2, 1.2.7.1, 1.2.7.5, 5.3.2, 5.3.7, 6.1.1, 6.1.4
1.7 Incident Management	
Thurston Regional ITS shall include an Incident Management function. Incident Management will identify incidents, formulate response actions, and support initiation and ongoing coordination of those response actions. Six major functions are provided which are: (1) Scheduled/Planned Incidents, (2) Identify Incidents, (3) Formulate Response Actions, (4) Support Coordinated Implementation of Response Actions, (5) Support Initialization of Response to Actions, and (6) Predict Hazardous Conditions.	1.1.1.1, 1.1.1.3, 1.1.2.2, 1.1.4.3, 1.2.7.2, 1.2.7.4, 1.2.8.1, 1.2.8.2, 1.2.8.3, 1.2.8.4, 1.3.1.1, 1.3.2.1, 1.3.2.2, 1.3.2.3, 1.3.2.4, 1.3.2.5, 1.3.3, 1.3.4.1, 1.3.4.2, 1.3.4.3, 1.3.4.4, 1.3.4.5, 1.3.5, 1.3.6, 1.3.7, 4.4.1.8, 6.6.1, 6.5.1, 6.6.2.3
1.8 Travel Demand Management	
Thurston Regional ITS Travel Demand Management will generate and communicate management and control strategies that will support and facilitate the implementation of TDM programs, policies and regulations. It consists of two major functions which are: (1) Increase Efficiency of Transportation System and (2) Provide Wide Variety of Mobility Options.	1.1.1.1, 1.1.1.2, 1.1.2.2, 1.2.5.1, 1.2.6.1, 1.2.7.3, 1.4.1, 1.4.2, 1.4.4, 1.4.5, 4.2.3.7, 6.1.1, 6.1.2, 6.2.1.6, 6.2.5, 6.4.2, 7.3.1.3
1.9 Emissions Testing and Mitigation	
Thurston Regional ITS shall include an Emissions Testing and Mitigation Function. This function will provide state and local governments with the capability to enhance their air quality control strategies. It will provide both area wide and roadside emissions monitoring.	1.5.1, 1.5.2, 1.5.3, 1.5.4, 1.5.5, 1.5.6, 1.5.7, 1.5.8
1.10 Highway-Rail Intersection	
Thurston Regional ITS shall include a Highway-Rail Intersection function to control highway and rail traffic in at-grade crossings. Two sub-services are supported: (1) Standard Speed Rail which is applicable to light rail transit, commuter rail and heavy rail trains with operational speeds up to 79 miles per hour (MPH); and (2) High Speed Rail which is applicable to all passenger and freight trains with operational speeds from 80 to 125 MPH.	1.1.2.2, 1.2.4.3, 1.2.7.1, 1.6.1.1, 1.6.2.1, 1.6.1.4.1, 1.6.1.6.1, 1.6.1.7.2, 1.6.2.2, 1.6.2.3, 1.6.3.1, 1.6.3.2, 1.6.3.3, 1.6.4.1, 1.6.4.2, 1.6.5.1, 1.6.5.3

User Services and User Service Requirements	Associated P-Specs
2.1 Public Transportation Management	
Thurston Regional ITS shall include a Public Transportation Management function.	4.1.1, 4.1.2.1, 4.1.2.2, 4.1.2.3, 4.1.2.4, 4.1.2.5, 4.1.3, 4.1.4, 4.1.5, 4.1.6, 4.1.7, 4.1.8, 4.1.9, 4.2.2, 4.2.3.1, 4.2.3.2, 4.2.3.4, 4.2.3.5, 4.2.3.9, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 4.3.5, 4.3.6, 4.3.7, 4.4.1.2, 4.4.1.3, 4.4.1.4, 4.4.1.5, 4.4.1.6, 4.4.1.7, 4.4.1.8, 4.5.1, 4.5.2, 4.5.3, 4.5.4, 4.5.5, 4.5.6, 4.5.7, 4.5.8
2.2 En-Route Transit Information	
Thurston Regional ITS shall include an En-Route Transit Information function. En-Route Transit Information provides travelers with real-time transit and high-occupancy vehicle information allowing travel alternatives to be chosen once the traveler is en-route. This capability integrates information from different transit modes and presents it to travelers for decision-making. It consists of three major functions which are: (1) Information Distribution, (2) Information Receipt, and (3) Information Processing.	1.3.1.3, 4.1.7, 4.2.2, 4.2.3.5, 4.7.1.1, 4.7.1.2, 5.1.5, 6.1.3, 6.2.1.1, 6.2.1.2, 6.2.1.3, 6.2.1.4, 6.2.2
2.3 Personalized Public Transit	
Thurston Regional ITS shall include a Personalized Public Transit function.	4.2.1.1, 4.2.1.2, 4.2.1.3, 4.2.1.4, 4.2.1.5, 4.2.1.6, 4.2.3.3, 4.2.3.5, 4.2.3.6, 4.6.4, 4.6.5, 6.1.1, 6.4.4, 6.8.3.2, 6.8.3.3, 7.3.1.3
2.4 Public Travel Security	
Thurston Regional ITS shall include a Public Travel Security function to create an environment of safety in public transportation.	4.4.1.1, 4.4.1.2, 4.4.1.3, 4.4.1.6, 4.4.1.7, 4.4.2, 4.4.3, 4.4.1.8, 6.1.1

User Services and User Service Requirements	Associated P-Specs
3.0 Electronic Payment	
Thurston Regional ITS shall include an Electronic Payment capability. Electronic Payment Services allows travelers to pay for transportation services by electronic means. Functions included are (1) Electronic Fare Collection, and (2) Electronic Payment Services Integration.	1.4.2, 1.4.4, 1.4.5, 4.6.1, 4.6.2, 4.6.3, 4.6.4, 4.6.5, 4.6.6, 4.6.7, 4.6.8, 4.7.2.1, 4.7.2.2, 4.7.2.3, 4.7.2.4, 4.7.2.5, 4.7.2.6, 4.7.2.7, 5.4.5, 5.4.7, 6.2.1.6, 7.3.1.3, 7.3.1.4, 7.3.4, 7.3.5, 7.4.1.6, 7.4.1.7, 7.4.1.8, 7.4.3, 7.5.1, 7.5.2, 7.5.3, 7.5.4, 7.5.5
4.1 Commercial Vehicle Electronic Clearance	
Thurston Regional ITS shall include a Commercial Vehicle Electronic Clearance capability.	2.3.1, 2.3.4, 2.3.5, 2.3.7, 2.4.4
4.3 On-Board Safety Monitoring	
Thurston Regional ITS shall include an On-Board Safety Monitoring function, that provides monitoring and warnings of safety problems. Of primary importance is to inform the driver, as soon as possible, of any problem that has been detected. Of secondary importance is notifying the carrier of detected safety problems. Last in importance is the notification of appropriate enforcement agencies.	2.3.1, 2.3.3.1, 2.3.4, 2.3.7, 2.4.1
4.4 Commercial Vehicle Administrative Processes	
Thurston Regional ITS shall include a Commercial Vehicle Administrative Process function. This will consist of two services to include: (1) Electronic Purchase of Credentials, and (2) Automated Mileage and Fuel Reporting and Auditing.	2.1.1, 2.1.2, 2.2.1, 2.2.2, 2.2.3, 2.4.4
4.6 Commercial Fleet Management	
Thurston Regional ITS shall include a Commercial Fleet Management function.	2.1.1, 2.1.3, 2.1.4, 2.1.5, 2.2.1, 2.2.3, 2.2.4, 2.4.4, 2.5.2
5.1 Emergency Notification and Personal Security	
Thurston Regional ITS shall include an Emergency Notification And Personal Security function that provides for the faster detection and reporting of accidents, and receipt of notification by travelers involved in an incident.	3.3.2, 3.3.3, 6.7.1.1, 6.7.1.2, 6.8.2.1, 6.8.2.2

User Services and User Service Requirements	Associated P-Specs
5.2 Emergency Vehicle Management	
Thurston Regional ITS shall include an Emergency Vehicle Management Service.	5.1.4, 5.3.1, 5.3.2, 5.3.3, 5.3.4, 5.3.6, 5.3.7, 6.6.1
7.1 Archived Data Function	
Thurston Regional ITS shall provide an Archived Data Function to control the archiving and distribution of ITS data. The Archived Data User Service helps achieve the ITS information goal of unambiguous interchange and reuse of data and information throughout all functional areas. The Archived Data User Service provides the Historical Data Archive Repositories and controls the archiving functionality for all ITS data with five major functions: (1) the Operational Data Control function to manage operations data integrity, (2) the Data Import and Verification function to acquire historical data from the Operational Data Control function, (3) the Automatic Data Historical Archive function for permanently archiving the data, (4) the Data Warehouse Distribution function which integrates the planning, safety, operations, and research communities into ITS and processes data products for these communities; and (5) the ITS Community Interface which provides the ITS common interface to all ITS users for data products specification and retrieval.	1.1.1.4, 1.1.4.4, 1.1.4.6, 1.1.4.7, 1.1.5, 1.2.2.2, 1.2.6.1, 1.2.6.2, 4.1.8, 4.2.4, 6.1.1, 6.1.2, 6.1.5, 6.1.6, 6.2.1.2, 6.4.1, 6.5.2, 6.6.1, 6.6.2.2, 6.6.2.6, 6.6.5, 8.1, 8.2, 8.4, 8.5

APPENDIX B

PROCESS SPECIFICATIONS (P-SPECS) DESCRIPTIONS

P-Spec Nbr	Description
1.1.1.1	This process shall be responsible for collecting surveillance obtained from the roadside, vehicles, pedestrians (travelers using other modes of transport), railroad grade and multimodal crossings. Where any of the data is provided in analog form, the process shall be responsible for converting it into digital form and calibrating. The converted data shall be sent to other processes for distribution, further analysis and storage.
1.1.1.2	This process shall be responsible for collecting sensor status, identifying faults, and logging faults that have been detected by processes in other parts of the Manage Traffic function. It shall be possible for the faults to have been detected locally at the sensors, or centrally through communications links with the sensors. The process shall pass on new fault data to another processes for communication to the Construction and Maintenance terminator and shall receive fault clearances from the same terminator. It shall also maintain a store of the current fault state of all sensors. The process shall provide facilities that enable traffic operations personnel to review and update the current fault status of all sensors. Details of faulty and fixed equipment shall be passed by the process to the traffic control strategy selection process so that it can adjust its strategy to take account of the fault(s).
1.1.1.3	This process shall be responsible for collecting data obtained from environmental sensors. Where any of the data is provided in analog form, the process shall be responsible for converting it into digital form and calibrating. The converted data shall be sent to other processes for distribution, further analysis and storage.
1.1.1.4	This process shall collect and monitor sensor data from the roadside. The process shall collect the sensor data including sensor status and sensor faults from roadside equipment and distribute it to the Manage Archive Data function. The process shall run when a request for data is received from an external source.
1.1.2.1	This process shall receive data from other processes and store the data into the long term and current data stores. The data shall comprise sensor data, both smoothed and unsmoothed: processed sensor surveillance data, data sent to control indicators (output devices e.g. intersection controllers, pedestrian controllers, dynamic message signs, ramp metering equipment), parking lot management data and other street equipment, the status data received from the indicators, plus current traffic conditions, planned events, current incidents, parking lot states, freeway ramp states, link travel times, roadway conditions provided by vehicle probes, and selected traffic control strategy. The data stored by the process in the current data store shall be the values collected over a relatively short period of time. The data stored in the long term data store shall be retained for a longer period. The data retained in the long term data store may be aggregated so as to reduce the storage requirements for long historical records, the amount of aggregation to be an implementation decision.
1.1.2.2	This process shall receive and process data from sensors (both traffic and environmental) at the roadway. The process distributes data to Provide Device Control processes that are responsible for freeway, highway rail intersections, parking lot, surface street and freeway management. It also sends the data to another Provide Traffic Surveillance process for loading into the stores of current and long term data. Information about the various sensors to aid in this processing and distribution of data is accessed from the data store.
1.1.2.3	This process shall be responsible for the maintenance of the store of static data used in the processing of sensor data. This sensor data shall be used to provide traffic surveillance information for use by other processes within the Manage Traffic function. The store shall contain data showing the relationship between sensors and the surface street and freeway network, i.e. where they are located, to which part(s) of the network their data applies, the type of data, etc. It shall also hold information about the ownership of each link (that is, the agency or entity responsible for collecting and storing surveillance of the link) in the network which shall be used by processes involved in exchanging surveillance information (and optionally control) with other Traffic Management Subsystems (TMS's). The contents of the store shall be provided by the Plan System Deployment function.

P-Spec Nbr	Description
1.1.3	This process shall be responsible for continually producing and updating a predictive model of the traffic flow conditions in the road or freeway network served by the Manage Traffic function that an instance of this process is allocated to. The prediction shall be based on current surveillance, historic traffic data and surveillance, current incidents, planned events, current traffic control strategy, data received fromother Traffic Management Subsystems (TMS's) serving other geographic and/or jurisdictional areas, and current and predicted weather conditions. The predictive model of traffic flow produced by this process shall be used by processes in the Manage Traffic function and other ITS functions.
1.1.4.1	This process shall on request retrieve traffic data from the data stores managed by other processes in the Provide Traffic Surveillance facility of the Manage Traffic function. It shall be possible for requests to originate from traffic operations personnel, the media operator, the Manage Demand facility within the Manage Traffic function, the Plan System Deployment function and the Provide Driver and Traveler Services function. With the exception of those from the Manage Demand facility and the Plan System Deployment function, all requests shall be provided by interface processes. The process shall also generate traffic data for output by other processes to in-vehicle signage functions.
1.1.4.2	This process shall provide the interface through which traffic operations personnel can obtain access to the data stored by other processes in the Provide Traffic Surveillance facility of the Manage Traffic function, and set up the parameters that govern the data that is available to non-traffic operations people via a separate process to the media operator. This stored data shall comprise current and long term (historic) data on traffic conditions, weather conditions and roadside equipment activity, plus prediction estimates of traffic conditions. The data shall apply to some or all of the surface street and freeway network served by the specific instance of the Manage Traffic function. Where appropriate and/or requested by the traffic operations personnel, the process shall provide the data output in the form of an overlay onto a map of the relevant part(s) of the surface street and freeway network served by the instance of the function. The process shall obtain the map from a local data store, which it shall enable the traffic operations personnel to update as and when required.
1.1.4.3	This process shall be responsible for providing the interface between the media and the process responsible for obtaining data from the stores of traffic data maintained by other processes within the Provide Traffic Surveillance facility of the Manage Traffic function. The process shall enable the media to request and be provided with current, long term (historic) and predicted traffic data. The data may be provided in one or more formats: as a data stream, as processed and displayed to Traffic Operations Personnel (e.g. graphical summaries of link speeds),or as a display (with data included on a map of relevant part(s) of the road and freeway served by the Manage Traffic function. The media shall only be able to request and see displayed that data that the traffic operations personnel have made available, through the use of the definition in the traffic data media parameters.
1.1.4.4	This process shall provide updates to a store of digitized map data when a request is received from traffic operations personnel via their interface process. The map data shall be for use as the background for displays of traffic data requested by traffic operations personnel and media operators through their respective interface processes. This process shall obtain the new map data from either a specialized data supplier or some other appropriate data source.
1.1.4.6	This process shall provide customized sets of traffic data for broadcast, advisories, and personalized data to travelers, traveler information data archive, and the media. This process shall use the parameters in the data store 'traffic_data_retreival_parameters' to define exactly what data shall be retrieved as a result of each request. The process shall select the appropriate subset of traffic data which will be sent to each ITS function which is requesting data. The process shall accept traveler profiles for use in determining what personalized data to send to the traveler. The process shall send kiosk and personal traffic requests to the archival process.
1.1.4.7	This process shall collect traffic data and ahs operational data to distribute to the Manage Archive Data function. The process shall run when a request for data is received from an external source, or when fresh data is received.

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1.1.5	This process shall exchange data with similar processes in other Traffic Management Subsystems (TMS's). The other TMS can be adjacent geographically, under control of a different jurisdiction, or part of a more complex hierarchy. The exchange of data shall be triggered by either a request from a remote TMS for data from the TMS to which the Manage Traffic function belongs, or because data needs to be sent from the local TMS to a remote TMS. This data shall include traffic control preemption for vehicle routes which pass through the local network but have a destination in an area served by a remote TMS, or include data about an incident that has an impact on the traffic conditions in the network served by a remote TMS. The data received from remote TMS's shall be used either to vary the current traffic control strategy to give signal preemption to emergency vehicles or enable the passage of commercial vehicles with unusual loads, or as input to the local traffic predictive model estimation process.
1.2.1	This process shall select the appropriate traffic control strategy to be implemented over a road and/or freeway section served by the specific instance of the Manage Traffic function. The strategy shall be selected by the process from a number that are available, e.g. adaptive control, fixed time control, local operations. The selected strategy shall be passed by the process to the actual control processes for implementation according to the part of the network to which it is to be applied, i.e. surface roads, freeways (i.e. limited access roads), ramps and/or parking lots. The definition of strategy can be extended to include a strategy for the operations of sensors such as video cameras used to provide traffic surveillance data. The process shall make it possible for the current strategy selection to be modified to accommodate the effects of such things as incidents, emergency vehicle preemption, the passage of commercial vehicles with unusual loads, equipment faults and overrides from the traffic operations personnel. The strategy for control of freeways and parking lots is through use of DMS signs and lane indicators. The strategy for control of ramps is through the timing plans for ramp meters. The selected strategy shall be sent to the process within the Provide Traffic Surveillance facility responsible for maintaining the store of long term data.
1.2.2.1	This process shall implement selected traffic control strategies and transit vehicle overall priority on some or all of the indicators covering the freeway network served by the Manage Traffic function. It shall implement the strategies only using the indicators (e.g. dynamic message signs (DMS)) specified in the implementation request and shall coordinate its actions with those of the process that controls the road network. The process shall also be capable of monitoring the extra inputs that will arise where tunnels are involved, including the detection of fire and the consequent requirement to re-route traffic.
1.2.2.2	This process shall implement selected traffic control strategies and transit priority on some or all of the indicators covering the road (surface street) network served by the Manage Traffic function. It shall implement the strategies only using the indicators (intersection and pedestrian controllers, variable message signs (dms), etc.) that are specified in the implementation request and shall coordinate its actions with those of the processes that control the freeway network and the ramps that give access to the freeway network.
1.2.4.1	This process shall transfer data to processes responsible for controlling equipment located at the roadside within the road (surface street) network served by the Manage Traffic function. This data shall contain outputs for use by roadside indicators, such as intersection and pedestrian controllers, dynamic message signs (DMS), highway advisory radio (HAR), etc. Data for use by in-vehicle signage equipment shall be sent to another process for output to roadside processes. All data shall be sent to this process by processes within the Manage Traffic function. This process shall also be responsible for the monitoring of input data showing the way in which the indicators are responding to the data that they are being sent, and the reporting of any errors in their responses as faults to the Collect and Process Indicator Fault Data facility within the Manage Traffic function. All output and input data shall be sent by the process to another process in the Manage Traffic function to be loaded into the store of long term data.

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1.2.4.2	This process shall transfer data to processes responsible for controlling equipment located at the roadside within the freeway network served by the Manage Traffic function. This data shall contain outputs for use by roadside indicators, such as dynamic message signs (DMS), etc. Data for use by in-vehicle signage equipment shall be sent to another process for output to roadside processes. All data shall have been sent to this process by processes within the Manage Traffic function. This process shall also be responsible for the monitoring of input data showing the way in which the indicators are responding to the data that they are being sent, and the reporting of any errors in their responses as faults to the Collect and Process Indicator Fault Data facility within the Manage Traffic function. All output and input data shall be sent by the process to another process in the Manage Traffic function to be loaded into the store of long term data.
1.2.4.3	This process shall format and output data for use by roadside processes in creating in-vehicle signage. This process supports a full range of functionality for in-vehicle signage (from display of signage to location specific advisory data). The process shall be capable of outputting some or all of the following advisory data: link state data, current incidents, planned events, and highway rail intersection status. The process shall be capable of outputting some or all of the following signage data: dynamic message sign contents or fixed signage. The data shall be structured by this process so that it can be output by each roadside process to vehicles for use by in-vehicle signage equipment.
1.2.6.1	This process shall maintain the store of static and link data used by other processes within the Manage Traffic function. Link data shall also be sent to the Provide Driver and Traveler Services function to enable it to obtain data about links that are not in the geographic area which it serves.
1.2.6.2	This process shall provide updates of static data to other processes in the Provide Traffic Control facility of the Manage Traffic function. An update of the data shall only be provided when this process has been notified by another process that the contents of the store of static data has been changed. This process shall provide updates to the map update provider about changes to the static data of a particular region.
1.2.7.1	This process shall implement the indicator output data generated by other processes within the Manage Traffic function for use on the roads (surface streets) served by the function. It shall perform the functions needed to provide control at intersections or pedestrian crossings, generate the output for dynamic message signs (dms) and highway advisory radios (HAR), or provide the interface for data to be sent to the units (or systems) that manage multimodal crossings. The dms may be either those that display variable text messages, or those that have fixed format display(s) (e.g. vehicle restrictions, or lane open/close).
1.2.7.2	This process shall monitor the operation of the processes that output in-vehicle signage, highway advisory radio, as well as indicator data in the road (surface street) and freeway network. It shall report any instances where the indicator response does not match that expected from the contents of the indicator control data it is receiving, the in-vehicle signage process reports a fault, or the HAR processes report a fault.
1.2.7.3	This process shall receive indicator (e.g. signal) preemption and priority requests from other functions within ITS. These requests shall enable the process to give selected vehicles (e.g. those that belong to Transit Authorities or Emergency Services) signal preemption or priority at intersections, pedestrian crossings and multimodal crossings in the surface street and freeway network served by the instance of the Manage Traffic function. Sending of the priority request output shall also generate an output to the monitoring process to suspend its activities while the priority request is being served. This process shall only generate its data flow outputs when input data is received.

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1.2.7.4	This process shall output data for use by in-vehicle signage equipment on vehicles traveling along the road (surface street) and freeway network served by the Manage Traffic function. This data shall be able to provide information from any of the types of indicators that are supported by the function, e.g. intersection controller, pedestrian controller, dynamic message sign (dms), plus data about incidents and link information such as speed, travel times or roadway conditions. The process shall be responsible for its own fault monitoring, which shall check that output data is being sent and that it is an accurate representation of the input data. When a fault is detected this process shall report it to the process responsible for the monitoring of roadside equipment faults.
1.2.7.5	This process shall implement the indicator output data generated by other processes within the Manage Traffic function for use on freeways served by the function. It shall perform the functions needed to output control data to ramp metering controllers and multimodal crossings, generate the output for dynamic message signs (dms), or generate the output for highway advisory radios(HAR). The dms may be either those that display variable text messages, or those that have fixed format display(s), for such things as vehicle restrictions, or lane open/close.
1.2.8.1	This process shall collect data about faults in the operation of indicators (e.g. signals, dms, har) that have been detected by processes in other parts of the Manage Traffic function. It shall be possible for the faults to be detected locally at the indicators, or centrally through communications links with the indicators.
1.2.8.2	This process shall collect data about indicator faults that have been detected by processes in other parts of the Manage Traffic function. It shall be possible for the faults to have been detected locally at the indicators, or centrally through communications links with the indicators. The process shall pass on new fault data to another process for communication to the Construction and Maintenance terminator and shall receive fault clearances from the same process communicating with that terminator. It shall also maintain a store of the current fault state of all indicators. The process shall provide facilities that enable traffic operations personnel to review and update the current fault status of all indicators. Details of faulty and fixed equipment shall be passed by the process to the traffic control strategy selection process so that it can adjust its strategy to take account of the current fault(s).
1.2.8.3	This process shall provide an interface for the exchange of data with the Construction and Maintenance terminator. The interface shall be used to both send data containing details of new indicator equipment faults, and to receive clearances when the faults are cleared. The details of new equipment faults and the clearances shall be received from and sent to another process.
1.2.8.4	This process shall provide the interface through which traffic operations personnel access data about faults on indicator equipment controlled by the Manage Traffic function. The process shall enable the personnel to monitor all indicator equipment faults that have been detected, and if necessary, amend that data. It shall also enable the traffic operations personnel to manually input faults in cases where they cannot otherwise be detected.
1.3.1.1	This process shall analyze traffic sensor data, vehicle probe data, or video images for anomalies that could indicate occurrence of an incident. The data may be collected from roads (surface street) and/or highways served by the Manage Traffic function. The process shall pass on any anomalies that it detects to another process in the Manage Incidents facility as possible detected incidents.
1.3.1.3	This process shall process raw traffic image data received from sensors located on the road (surface street) and freeway network served by the Manage Traffic function. The process shall transform the raw data into images that can be sent to another process within the Manage Incidents facility. It shall also act as the control interface through which the images of traffic conditions which are analyzed for incidents can be changed by the traffic operations personnel, who shall also be supplied with images for viewing.

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1.3.2.1	This process shall receive data on possible incidents from other processes within the Manage Incidents facility and other ITS functions. The process shall load all data that it receives into the store of possible incidents. As part of the loading activity, the process shall enter the data into the relevant parts of the standard format for incident data, and shall assign a level of confidence (e.g. related to the source of the data or time of its detection) to that data.
1.3.2.2	This process shall review input data about possible incidents and provide verification of the incident. The process shall have the capability of using algorithms to automatically identify and verify an incident. The process shall have the capability to classify an incident as current incident or a planned event and shall be load the data into the store of possible incidents as either current incidents or planned events. The process shall report any incidents that it is unable to verify or classify to the traffic operations personnel for manual verification and classification. The process shall allow the traffic operations personnel to request all possible incidents and carry out the verification and classification process manually.
1.3.2.3	This process shall receive updates of planned events and review the complete list of them to determine when an incident should be reclassified from planned event to current incident. It shall carry out the re-classification process automatically either upon receiving notice that the store of planned events has been updated, or at some periodic rate. The criteria for reclassifying an incident could be that the planned start time of the event has passed. The process shall request details of planned events from the process that manages their data store and shall send details of any new (re-classified) current incidents to the process that manages their data store. It shall also provide updates of planned events and current incidents to other ITS functions, and details of any new planned events to the process responsible for the output of data to vehicle signage functions.
1.3.2.4	This process shall provide the interface to, and manage the use of the store containing details of planned events. The process shall enter details of all new planned events into the store, retrieve details on request, and delete details of an incident when it has been re-classified as a current incident. The process shall be able to receive details of planned events from within the local Manage Incidents facility, and from similar facilities in other Traffic Management Subsystems (TMS's). When requested, the process shall also be able to provide details of its planned events to the Manage Incidents facilities in other TMS's.
1.3.2.5	This process shall provide the interface to, and manage the use of the store of current incident details. The process shall enter the details of all new current incidents into the store, retrieve details on request, and delete details of incidents when they cease to be current. The process shall be able to receive details of current incidents from within the local Manage Incidents facility, and from similar facilities in other Traffic Management Subsystems (TMS's). When requested, the process shall also be able to provide details of its current incidents to the Manage Incidents facilities in other TMS's.
1.3.3	This process shall provide responses to incidents that become current, i.e. active. Three general strategies for response to incidents can be supported by the process: 1) Operator enters response (there is no set of predetermined responses), 2) the operator selects response from a set of predetermined responses (possibly modifying the response), and 3) the process automatically accesses and implements a response from a set of predetermined responses (while informing the operator of the actions taken). Where predetermined responses are utilized, the operator shall have the capability to view, modify, or override the predetermined response. The predetermined response to each type of incident shall be defined for the process in the store defined_responses_data. If the process cannot find a predetermined response for a particular incident, it shall send the details of the incident to the traffic operations personnel so that they can provide an update to the store of predetermined responses. The process shall output the predetermined responses to an incident when it receives notification from another process in the Manage Incidents facility that a new current incident has occurred. At the same time it shall also output the incident data to the process responsible for providing broadcast data to roadside processes. The other process in the Manage Incidents facility shall also provide details of incidents that have ceased to be current (terminated) so that this process can send out data to clear the actions requested and roadside broadcast information output in response to its occurrence.

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1.3.4.1	This process shall retrieve incident data from the stores of planned events and current incidents that are managed by other processes in the Manage Incidents facility of the Manage Traffic function. The process shall retrieve data as the result of a request which may come from the traffic operations personnel or the media operator. The output shall be returned to the source of the request, except where the media operator has specified that the data should be output to the media system.
1.3.4.2	This process shall provide the interface between the traffic operations personnel and the Manage Incidents facility of the Manage Traffic function. It shall enable the personnel to request and amend details of predicted and current incidents and predetermined incident responses, obtain and control incident video image data and manually re-classify incidents as possible or current or a planned event. It shall also output to the traffic operations personnel incident details to which no predetermined response currently exists. The process shall support inputs from and outputs to the traffic operations personnel. Where appropriate and/or requested by the traffic operations personnel, the process shall provide the output 'display' in a form incorporating a map of the relevant part(s) of the surface street and freeway network served by the function. The process shall obtain the map from a local data store, which it shall request to be updated by another process as and when required.
1.3.4.3	This process shall provide the interface between the Media and the Manage Incidents facility. It shall enable the media to request details of incidents and shall allow transmission of incident information to the media. The media shall also provide raw input data on possible incidents. The process shall enable the output to incorporate a map of the area to which the incidents relate.
1.3.4.4	This process shall provide updates to the store of digitized map data used with displays of incident data produced by processes in the Manage Incidents facility of the Manage Traffic function. The process shall obtain the new data from a map provider or other appropriate data source, on receiving an update request from the traffic operations personnel interface process within the Manage Incidents facility.
1.3.4.5	This process shall provide the capability for the Manage Traffic function to generate and receive requests for resources in responding to incidents. The process shall provide the capability for traffic operations personnel to request resources from the Construction and Maintenance to provide equipment and support for incident response and clean up. The process shall be able to receive resource requests from the Manage Emergency function and respond with the status of the response by Construction and Maintenance or the traffic operations personnel.
1.3.5	This process shall manage the data store containing possible predetermined responses to incidents used within the Manage Incidents facility. These responses shall be those that another process within the facility has found to be worth including in the store of predetermined responses from an analysis of the incident response log. This process shall enable retrieval of the data from the store for presentation to traffic operations personnel and its possible transfer to the process that manages the store of predetermined incident responses that are actually used by other processes in the Manage Incidents facility.
1.3.6	This process shall manage data held in the store of predetermined incident responses that are used by processes within the Manage Incidents facility of the Manage Traffic function. The process shall provide details of the current predetermined responses in response to requests from traffic operations personnel, and shall also update the store with new responses received from the process that manages the store of possible predetermined responses.
1.3.7	This process shall analyze the data in the log of incident responses within the Manage Incidents facility of the Manage Traffic functions. The process shall analyze the log so that possible standard predetermined incident responses can be identified from the data in the incident_response_log data store. Any such possible standard predetermined responses that are identified shall be passed by this process to the process that manages the store of possible predetermined responses.

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1.4.1	This process shall provide the interface between the traffic operations personnel and the processes and data stores used within the Manage Demand facility of the Manage Traffic function. It shall enable the traffic operations personnel to access the data used as input by the demand forecasting process and the results of that process, to request that the input data be updated, set the policies used as input to the Calculate Forecast Demand process, to request that the demand forecasting process runs, and to run the process that implements the results. Where appropriate and/or requested by the traffic operations personnel, the process shall provide the output in a form that includes a map of the relevant part(s) of the road and freeway network served by the Manage Travel Demand function. The process shall obtain the map from a local data store, which it shall request to be updated by another process when required.
1.4.2	This process shall collect data from other ITS functions for use as input to the demand forecasting process within the Manage Demand facility of the Manage Traffic function. The process shall support data retrieval from other functions on request from the traffic operations personnel and through the receipt of unsolicited data from ITS functions. It shall load all the data that it receives in a consistent format into the input store used by the demand forecasting process.
1.4.4	This process shall implement the traffic and travel demand forecast data produced by the demand forecasting process in the Manage Travel Demand facility of the Manage Traffic function. The new demand forecast data shall be implemented in such a way that it can influence the demand from travelers for various types of services provided by ITS functions. The process shall when required, request changes to transit services, and/or the charges for tolls, and/or the use of parking lot spaces (as per the locally determined demand policy). It shall communicate the results of its policy implementation to the process that provides the interface to the traffic operations personnel.
1.4.5	This process shall provide a forecast of traffic and travel demand in the geographic area served by the Manage Traffic function to which this instance of the Manage Travel Demand facility belongs. The process shall base its forecast on the current and predicted traffic levels traveler demand patterns obtained from an analysis of data obtained from elsewhere within the Manage Traffic function and from other ITS functions as well as locally determined demand policy. The process shall produce a demand forecast that changes the way that services are provided by ITS functions according to locally determined demand policy.
1.5.1	This process shall provide the interface between the traffic operations personnel and the processes and data stores used within the Manage Emissions facility of the Manage Traffic function. The process shall enable the personnel to access and update the pollution reference data used by other processes within the facility, and to access the pollution state data provided by those processes. The process shall support inputs from the traffic operations personnel. Where appropriate and/or requested by the traffic operations personnel, the process shall incorporate map data of the relevant part(s) of the surface street and freeway network served by the Manage Traffic function. The process shall obtain the map from a local data store, which it shall request to be updated by another process as and when required.
1.5.2	This process shall process the pollution data being collected from sensors in the geographic area being served by the Manage Traffic function. The process shall integrate data from distributed roadside sensors (provided by another process) with that obtained directly from sensors looking at the general (wide area) environment. The data shall be checked by the process against the pollution levels that have been set up as reference points. If the process finds that the detected levels of pollution exceed the reference levels it shall generate pollution warnings. The process shall send these warnings to other processes in the Manage Traffic function for output to drivers and travelers.
1.5.3	This process shall provide updates to the map data used in displays of pollution data produced by processes in the Manage Emissions facility of the Manage Traffic function. The process shall obtain the map data from a specialist map data supplier or some other appropriate data source, on receiving an update request from the traffic operations personnel interface process within the Manage Emissions facility.

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1.5.4	This process shall manage the store of pollution state data in the Manage Emissions facility of the Manage Traffic function. The data in the store shall be that which has been received by the process from other processes within the facility. The process shall manage the data in the store to enable its contents to be available to other processes within the Manage Traffic function, and to traffic operations personnel, via an interface process within the Manage Emissions facility.
1.5.5	This process shall obtain pollution data about individual vehicles and analyze it against reference data obtained from another process within the Manage Emissions facility of the Manage Traffic function. The process shall use this reference data to determine whether or not a vehicle is possibly violating the acceptable levels of pollution output. When the process determines that a possible violation has occurred, it shall send the detected pollution levels and the vehicle identity to the process responsible for law enforcement in the Manage Emergency Services function for action.
1.5.6	This process shall process the local area pollution data analyzed by sensors looking at the levels of pollution at the roadside within the geographic area served by the Manage Traffic function. The process shall pass the data on to another process within the Manage Emissions facility for integration with wide area pollution data and comparison with thresholds for pollution incidents.
1.5.7	This process shall manage the log of pollution data within the Manage Emissions facility of the Manage Traffic function. The process shall receive data for entry into the log from other processes within the facility. It shall also send the contents of the log to the Manage Archive Data function for use in planning future modifications to the ITS network.
1.5.8	This process shall manage the store of pollution reference data within the Manage Emissions facility of the Manage Traffic function. It shall make the contents of the store available to other processes within the facility that are responsible for emissions management, and on request to the traffic operations personnel interface process. The process shall accept updates to the stored data from the traffic operations personnel interface process.
1.6.1.1	This process is responsible for monitoring local sensor data obtained from traffic surveillance and then determining and reporting the current state of all traffic in the HRI vicinity. The process provides triggers for other processes within Manage HRI Traffic Volume. It also monitors the device controls as they are initiated by the Activate HRI Device Controls process.
1.6.1.4.1	This process is responsible for generating the messages to advise and protect motorists, travelers and train crews approaching and crossing railroad grade crossings. Based on the severity of the hazard condition sent by the Detect HRI Hazards process this process will either send an hri_advisory command for non-time critical data or an hri_alert command for time critical data to the Report Alerts and Advisories. These users that will receive these messages include drivers, bicyclists, and pedestrians.
1.6.1.6.1	This process is responsible for protecting highway vehicles approaching and crossing railroad grade crossings by initiating the closure up to 3 minutes before train arrival. This process receives the near term status of the crossing including any approaching trains or trapped vehicles. With this information along with the local control plan data the predicted hri state is computed and sent to the Detect Imminent Vehicle/Train Collision process. If an hri_predicted_collision message is returned then this process sends out an hri_hazard message to the Detect HRI Hazard which will in turn result in a change to the device control strategy. This process also receives rail operations advisories for processing along with the state and control plan data. As needed this process will output any rail_operations_message data to the Interact with Rail Operations process.
1.6.1.7.2	This process is responsible for controlling vehicular traffic at an active HRI by controlling the operation of traffic control devices in accordance with a predetermined local control plan. The local_control_plan is communicated to the Close_HRI_on_Detection process. This local control plan can be preempted by a strategy_preemption message from the Detect_HRI_Hazards process or by such inputs as an event_notice from the Detect_Roadway_Events process or hri_traffic_surveillance data. The outputs of this process include the command messages to close the HRI, requests for information from the Manage Traffic function, and information about the current hri_traffic_data.

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1.6.2.1	This process is responsible for exchanging routine data with rail operations. Such data being sent to the rail operators includes event schedules, requests for information from the Rail Operators, incident notification based on rail operations messages received from Close_HRI_on_Detection process and hri_priority_message data received from the Manage Alerts and Advisories process. This process receives maintenance schedules, train schedules, and incident notifications from the rail operators. This information is used to develop the rail operations update data that is passed onto the Manage Rail Traffic Control Data process and the rail operations priority data that is sent to the Manage Alerts and Advisories process.
1.6.2.2	This process is responsible for acquiring HRI advisory or alert data from rail operations and for providing HRI status to rail operations. The data managed by this process may be time critical, as in the case of alerts or priority messages, or not time critical, as in the case of advisories.
1.6.2.3	This process is responsible for providing and maintaining a current store of rail operations data. The data is assembled from the rail_operations_update information sent by the Exchange Data with Rail Operations process. Queries for this information are received from the Manage Alerts and Advisories process and the Interact with Vehicle Traffic Management processes.
1.6.3.1	This process is responsible for interfacing to railroad owned and maintained wayside equipment, such as Wayside Interface Units, Crossing Gate Controllers, etc. All these devices are expected to provide real-time information to the HRI about approaching trains and their own health. In addition, advanced implementations will make use of a communications path back to approaching trains provided by the railroad's equipment.
1.6.3.2	This process is responsible for generating advisories/ alerts that are routed to the wayside equipment for transmission to the train crews. If the intersection is blocked, or there is an incident at the intersection this information will be passed to the Interact with Wayside Systems process for routing to the wayside equipment. The wayside equipment can then route the information directly to the train crews, or to rail operations.
1.6.3.3	This process is responsible for automatically protecting commuter, intercity, transit and freight trains as they approach and cross grade crossings. It also reports HRI rail traffic advisories to traffic management and rail operations. It is responsible for verifying and reporting overall HRI status to approaching trains so that crews can act within safe service braking distances. It provides for notification of Automatic Train Stop systems (ATS, PTS, etc) with sufficient advance warning to allow emergency brake application time to stop a train before it encounters an HRI hazard. Finally, it provides automatic status indications about the HRI to the crews of approaching trains.
1.6.4.1	This process is responsible for coordination and managing of HRI closures at the Traffic management Center. It interfaces with Manage Incidents process to provide incident information and to receive strategy overrides as required by the larger incident management function.
1.6.4.2	This process is responsible for interacting with traffic management processes. It collects data from processes that are within the HRI elements located at the roadside and forwards the data as needed to other processes within traffic management. It also acts as the interface between rail operations and traffic management processes through its interface with the Interact with Rail Operations process.
1.6.5.1	This process is responsible for initiating reports of the health status of the HRI to both Traffic Management and Rail Operations. In addition the process initiates reporting of the health status of the HRI to the wayside interface equipment (and ultimately to the train when the advanced HRI functionality is in place).
1.6.5.3	This process is responsible for managing a log of the HRI operation for use in strategy planning, demand management and traffic management.

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2.1.1	This process shall be responsible for providing the commercial vehicle manager with the ability to manage the activities of commercial vehicles. The process shall provide the capability for the manager to obtain commercial vehicle routes. When a route has been confirmed, the process shall enable the manager to enroll commercial vehicles for electronic clearance at roadside check station facilities, to process and pay for electronic credential and tax filing, to send tag data to the Provide Commercial Vehicle On-board Data facility, and to provide vehicle route instructions for use by the commercial vehicle driver. Periodically it shall also send reports about taxes that have been paid to the Administer Commercial Vehicles facility. The process shall also enable the manager to obtain commercial vehicle activity reports from the logs provided by roadside checkstation facilities. It shall be possible to obtain these reports either on request or at periodic intervals.;
2.1.2	This process shall be responsible for providing a static commercial vehicle route using data provided by the commercial vehicle manager. A static route is one which is based on geographic data and therefore takes no account of current or predicted traffic conditions, incidents, etc. The process shall provide the route using its own route generation algorithms and data from its own store of digitized map information.
2.1.3	This process shall be responsible for providing an interface for the commercial vehicle manager. The process shall enable this interface to provide the manager with facilities for the input of data used to set up commercial vehicle routes, to pay the necessary taxes and duties so that a commercial vehicle can be enrolled for a particular route, to exchange general information messages with a driver in a vehicle, and to set up instructions for a driver to take a vehicle on a particular route. It shall be possible for the driver's route instructions input by the manager to include details of the cargo to be picked up and/or dropped off at each point along the route. The enrollment activity supported by the process shall enable a commercial vehicle to pass through the roadside checkstations along its route without stopping, unless safety checks are required. The process shall support inputs from the commercial vehicle manager in both manual and audio form, and shall provide its outputs in audible and visual forms. It shall enable the visual output to be in hardcopy, or as a display.
2.1.4	This process shall be responsible for providing the communications interface and data storage facility for data that is exchanged between the commercial vehicle manager and commercial vehicle drivers in their vehicles. The process shall support the receipt of data from the vehicle consisting of that processed from input received by sensors on board the vehicle and text data used to exchange general information with the driver. Only the output to the vehicle of the data that contains the general text message shall be supported by the process. The process shall enable access to the store of received data by the manager through the manager's interface process.
2.1.5	This process shall be responsible for providing the communications interface through which a commercial vehicle driver can obtain details of the vehicle route that has been provided by the commercial vehicle manager. The process shall enable the output of the route instructions in audio and/or visual form. It shall be possible for the visual form to be either hardcopy output, or in the form of a display. The process shall retain the data for a particular route internally, so that successive requests for details of the same route do not require use of the communications network.
2.2.1	This process shall be responsible for providing the commercial vehicle driver with the ability to manage the activities of a commercial vehicle. In this instance the driver is assumed to be acting in the role of a commercial vehicle manager, and is therefore probably the owner/driver of the vehicle. The process shall provide the capability for the driver to obtain commercial vehicle routes, to enroll commercial vehicles for electronic clearance at roadside check station facilities, and to process and pay for electronic credential and tax filing.
2.2.2	This process shall be responsible for providing a static commercial vehicle route using data provided by the commercial vehicle driver. A static route is one which is based on geographic data and therefore takes no account of current or predicted traffic conditions, incidents, etc. The process shall provide the route using its own route generation algorithms and data from its own store of digitized map information. In this instance the driver is assumed to be acting in the role of a commercial vehicle manager, and is therefore likely to be the owner/driver of the vehicle.

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2.2.3	This process shall be responsible for providing an interface for the commercial vehicle fleet manager. In this instance the driver is assumed to be acting in the role of a commercial vehicle manager, and is therefore likely to be the owner/driver of the vehicle. The process shall enable this interface to provide the driver with facilities for the input of data used to set up commercial vehicle routes, to pay all the necessary taxes and duties so that a commercial vehicle can be enrolled for a particular route, and to obtain a copy of the data collected by processes on-board the vehicle. The enrollment activity supported by the process shall enable a commercial vehicle to pass through the roadside checkstations along its route without stopping, unless safety checks are required. The process shall support inputs from the commercial vehicle driver in both manual and audio form, and shall provide its outputs in audible and visual forms. It shall enable the visual output to be in hardcopy, or as a display.
2.2.4	This process shall be responsible for providing communications between the commercial vehicle driver and the commercial vehicle. In this instance the driver is acting in the role of vehicle manager, and is therefore likely to be the owner/driver of the vehicle. The process shall support the receipt of data from the vehicle consisting of that processed from input received by sensors on board the vehicle The process shall enable access to the store of received data by the driver through the driver's interface process.
2.3.1	This process shall be responsible for the output of pull-in or pass messages to commercial vehicle drivers as they approach the commercial vehicle roadside checkstation or border crossing facilities. The process shall support the use of roadside equipment such as dynamic message signs (DMS), or simple red-green lights, flashing orange lights, etc. to provide the output. These output messages shall be received by the process from other processes responsible for roadside facilities within the Manage Commercial Vehicles function. The process shall support pull-in messages that are the result of checks on a commercial vehicle's electronic credentials, safety and border crossing data, the result of the vehicle's tag not being properly read, or the result of a general pull-in decision for all vehicles being issued by inspectors at the roadside facility. The process shall also generate a message to be sent to the vehicle so that an indication can be output directly to the driver at the same time as it appears on the roadside equipment.
2.3.3.1	This process shall be responsible for providing an interface through which a commercial vehicles roadside checkstation facility can communicate with a passing commercial vehicle. When a request for on-board data is received from another process within the facility, the process shall issue a data request to the identified commercial vehicle. The data received by the process from the vehicle shall be stored in the store of collected data for use by the roadside inspection process.
2.3.4	This process shall be responsible for detecting the presence of commercial vehicles through the use of sensors that can differentiate between the different types of vehicle. The process shall use the sensors to determine the number of axles, gross vehicle weight and weight per axle data for use by inspectors at the roadside checkstation facilities. When a commercial vehicle is detected, the process shall transmit a request for its on-board tag data, which when received shall be passed to other processes within the roadside facility. If no tag data is received, or the data cannot be interpreted correctly, the process shall send a request for the vehicle to pull-in to be output by another process in the roadside checkstation facility.
2.3.7	This process shall be responsible for the output of the pull-in or pass messages to commercial vehicle drivers directly in their vehicles as they approach a commercial vehicle roadside checkstation facility. These messages shall be generated by other processes within the facility that are responsible for checking the commercial vehicle's credentials (including those for border crossing) and safety, or may be the result of the vehicle's tag not being properly read, or may be the result of a general pull-in decision for all vehicles being issued by inspectors at the roadside checkstation facility.
2.4.1	This process shall be responsible for providing the commercial vehicle end of the communications link between itself and a commercial vehicle roadside checkstation facility. The process shall enable an inspector at the facility or elsewhere to have access to the data accumulated on-board the vehicle for use in a vehicle inspection. It shall also enable the inspector to send back data about the result of the inspection for storage on-board the vehicle.

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2.4.4	This process shall be responsible for providing the interface between the commercial vehicle driver and processes on-board the commercial vehicle. The process shall provide interfaces to the processes responsible for collecting, analyzing and storing data about the vehicle, its cargo, the driver, etc., and for the exchange of data with the commercial vehicle manager. The process shall support inputs fro m the driver in both manual and audio form, and shall provide its outputs in audible and visual forms. It shall enable the visual output to be in hardcopy, or as a display.
2.5.2	This process shall be responsible for making payment for electronic credential and tax filing. The data on which the payment is based shall be that for a commercial vehicle's route as provided by the commercial vehicle manager or the commercial vehicle driver who is also the owner of the vehicle. The actual payment activity will be carried out by another process in the Provide Electronic Payment Services function.
3.3.2	This process shall be responsible for sending messages it receives from other processes in this facility to the Manage Emergency Services function. It shall also be responsible for passing on the resulting response to the driver via processes in the Provide Driver and Traveler Services function. This process is also capable of receiving requests for additional data from the Manage Emergency Services function and transmitting follow-up details. This process can also receive commands related to the vehicle's security system from the Manage Emergency Services function and forward the commands to the vehicle's security system.
3.3.3	This process shall be responsib le for preparing and submitting data for transmission to the Manage Emergency Services function. The data shall be sent by this process when an emergency situation is detected by analyzing inputs from the vehicle. This process shall produce its outputs regardless of any action by the driver and shall be designed to be as the result of a crash which may have prevented the driver from initiating the emergency request personally.
4.1.1	This process shall collect and process data available to sensors on-board transit vehicles. This data shall be sent by this process to other processes on-board the transit vehicle and elsewhere in the Manage Traffic function for use in determining vehicle schedule deviations and for storage as operations data.
4.1.2.1	This process shall determine the schedule deviation and estimated times of arrival (ETA) at transit stops of a transit vehicle. The data shall be sent by this process to other processes in the Manage Transit function for use in calculating corrective instructions for output to the transit vehicle drivers, for use in calculation of a much wider return to schedule strategy where more than one vehicle and/or service is involved, and for storage as transit vehicle operational data. This process shall also send the data to the transit driver interface process, so that the driver is aware of the actual schedule deviation. This output shall be set to zero (no deviation) when that condition occurs, even when it has followed a period of deviation from schedule.
4.1.2.2	This process shall generate outputs that enable a transit vehicle schedule deviation to be corrected. The process shall derive its outputs from data received from another process in the Manage Traffic function. The outputs produced by the process shall consist of corrective instructions for output to the transit vehicle driver by a process on-board the vehicle, and preemption requests for traffic signal controllers at road and freeway intersections. The process shall only produce this output when another process has determined that deviation is small, or the transit vehicle is operating in an urban area. In all other conditions, the process shall provide an output that shows that there are no corrective instructions.
4.1.2.3	This process shall provide a schedule correction interface for the transit driver in the transit vehicle. The interface shall provide data to the driver about how far the vehicle is from its schedule and what corrective action the driver must take. The data shall be received by the process from other processes in the Manage Traffic function. The output delivered by the process shall be available in audio or visual form in such way that while alerting the driver to the information it contains, it shall in no way impair the driver's ability to operate the vehicle in a manner that is both safe to its passengers and to other vehicles on the roads and freeways. The process shall maintain the output until new data is received from the other processes.

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4.1.2.4	This process shall provide the interface through which multimodal transportation service providers are informed of a transit vehicle schedule deviation. The output delivered by the process results from input received from another process in the Manage Transit function, and shall relate to the deviation of an individual transit vehicle. The process shall provide the output in a form that enables adjustments to be made to any connecting services being provided by the multimodal supplier so that transit users are not unconvenienced by the deviation of a transit vehicle on one service. A zero (or null) output shall be provided when no deviations are present.
4.1.2.5	This process shall provide the interface through which requests for preemption can be output from a transit vehicle. The output shall be received by the process as a result of data sent from another process in the Manage Transit function. The process shall provide the output in a form that can be used by the controllers at intersections, pedestrian crossings and multimodal crossings on the roads (surface streets) and freeway network served by the Manage Traffic function to provide priority of the transit vehicle. If no data is received from the other process, or it shows that no preemption is needed, the process shall produce no output.
4.1.3	This process shall provide the transit vehicle's current location with a high degree of accuracy. The location shall be computed by this process from data sent by other processes that provides basic vehicle location and on-board vehicle conditions, such as proximity to transit stop, vehicle doors opened or closed, etc. The data shall be output continuously by the process and sent to other processes for their use and for storage.
4.1.4	This process shall manage large deviations of individual transit vehicles, deviations in rural areas, and deviations of large numbers of vehicles. The process shall generate the necessary corrective actions which may involve more than the vehicles concerned and more far reaching action, such as, the introduction of extra vehicles, wide area signal preemption by the Manage Traffic function, the premature termination of some services, etc. All corrective actions generated by this process shall be subject to the approval of the transit fleet manager before being implemented. Confirmation that the requested overall priority has been given by the Manage Traffic function shall be received by the process.
4.1.5	This process shall provide transit vehicle operational data to processes within the Manage Transit function, and on request to the transit fleet manager and the Manage Travel Demand facility in the Manage Traffic function. This process shall also provide transit probe and AVL information to the Manage Traffic function. Transit probe information can be provided by fixed route, flexibly routed, and paratransit services. The data shall be obtained by this process from another process that manages a store of transit vehicle operating data.
4.1.6	This process shall manage the store of transit vehicle operating data. When any new data is received from another process, this process shall load it into the data store. This process shall also retrieve selected data on request from other processes in the Manage Transit function.
4.1.7	This process shall provide the interface through which multimodal transportation service providers are informed of transit vehicle schedule deviations. The output delivered by the process shall result from input received from another process in the Manage Transit function, and shall relate to the deviation of a number of transit vehicles such that the disruption will affect several services, possibly on different routes. The process shall provide the output in a form that enables adjustments to be made to any connecting services being provided by the multimodal supplier so that transit users are not inconvenienced by the deviations. A zero (or null) output shall be provided when no deviations are present.
4.1.8	This process shall provide customized sets of transit vehicle schedule deviations to travelers, the traveler information data archive, and to the media. The process shall only provide data to the media and data archive when prompted by the arrival of new deviation data in the transit_vehicle_operational_data store, which is maintained by another process in the Manage Transit function. The outputs shall be made available following a direct request from the other ITS function, or as part of a subscription process relating to a traveler's transit profile. The process shall obtain the required data from the process that manages the store of transit vehicle operating data. The process shall send kiosk and personal transit deviation requests to the archival process.

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4.1.9	This process shall collect and process vehicle maintenance data available to sensors on-board transit vehicles. When processed, the data shall be sent by this process on request to another process in the Manage Transit function for storage as transit vehicle operating data so that it can subsequently be used for work on future vehicle maintenance.
4.2.1.1	This process shall provide the interface through which processes in the Provide Driver and Traveler Service function can gain access to the Provide Demand Responsive Transit Service facility. The process shall enable the interface to support the receipt of trip requests, their transfer to another process for the actual demand responsive schedule generation, the output of the proposed schedule and their (possible) subsequent confirmation. The process shall store the input and schedule data relating to each request until such time as the request is confirmed or the data in the request is no longer valid, e.g. the time(s) used in the proposed schedule has(ve) passed. The confirmation of a particular schedule shall be sent by the process to another process that will enable the schedule to be implemented.
4.2.1.2	This process shall provide the facility for the calculation of the location and availability of transit vehicles for use in demand responsive transit operations. The process shall base its calculation on the vehicle's current location and on the output from a process that determines vehicle availability from data input to sensors. The output shall be loaded by the process into a store for use by another process.
4.2.1.3	This process shall provide dynamic routing and scheduling of transit vehicles so that a demand responsive transit service can be provided. The generation of the specific route and schedule by the process shall be initiated by a request from the management process. The choice of route and schedule produced by the process shall depend on what other demand responsive transit schedules have been planned, the availability and location of vehicles, and the relevance of any regular transit routes and schedules. The process shall send its output to another process for output to the requesting process, and shall also load it into a data store for use if the schedule is later confirmed.
4.2.1.4	This process shall provide output when a demand responsive transit schedule is confirmed. The outputs shall contain details of the schedule and shall be sent to the transit fleet manager and to processes that provide interfaces to the transit driver, a store of data used by the regular transit routes and schedule generation processes, and the transit driver schedule generation processes. The process shall obtain the data for the outputs from the store of data provided by the schedule generation process.
4.2.1.5	This process shall manage data input to sensor(s) on board a transit vehicle. Data including the vehicle's availability for use in demand responsive transit services shall be provided by this process to other processes within the Manage Transit function.
4.2.1.6	This process shall provide the interface through which a transit driver will be sent instructions about the demand responsive transit schedule that has been confirmed. The process shall send the data in a format that will enable the driver to implement the schedule. The output provided by the process shall be available in audio or visual form in such a way that while alerting the driver to the information it contains, it shall in no way impair the driver's ability to operate the vehicle in a manner that is both safe to its passengers, and to other vehicles on the roads and freeways. The input and output forms shall also include those that are suitable for travelers with physical disabilities.
4.2.2	This process shall provide the interface to the store of current regular transit plans, i.e., routes and schedules and demand responsive transit schedules. The process shall enable the store to be used by the Demand Responsive Transit facility as a source of data about regular transit services when it is generating its schedules. The demand responsive transit schedule data shall be accessible as input to the regular transit route and schedule generation processes.

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4.2.3.1	This process shall generate new transit routes. The process shall use parameters set up by the transit fleet manager, operational data for the current routes and schedules, plus the current routes and digitized map data, as sources of input from which the new routes are generated. The process shall also use the requested input data containing the demand responsive transit routes and schedules. The generation of new routes by the process shall be initiated as a result of data received from the transit fleet manager interface process, with the output being sent to other processes for storage. The output data produced by the process shall include sufficient data for a specialist map data provider to generate maps showing transit routes and stops, either as separate data or as part of the general digitized map data provided to other ITS functions.
4.2.3.2	This process shall generate new transit schedules for use by the regular transit operation. The process shall use parameters set up by the transit fleet manager, operational data for the current routes and schedules, plus the current routes and schedules themselves, as sources of input from which the new schedules are generated. The process shall also use the data containing the demand responsive transit routes and schedules to generate the new schedules. The generation of new schedules by the process shall be initiated as a result of data received from the transit fleet manager interface process or a request for services to a parking lot. The process shall send its output to another process for storage.
4.2.3.3	This process shall obtain transit routes and services data and distribute it to ITS functions that are outside the transit center. The process shall run when a request for data is received from an external source, or when fresh data is received. In the latter case, the data shall only be sent by the process to the multimodal transportation service provider. For data requests that include an origin and a destination, the process shall only provide details of the transit service(s) that link the two points. The details shall only cover those portion(s) of the service(s) that are needed to complete the requested trip and not full details of the services.
4.2.3.4	This process shall provide the interface through which the transit fleet manager controls the generation of new routes and schedules (transit services). The transit fleet manager shall be able to review and update the parameters used by the routes and schedules generation processes and to initiate these processes. This process shall also act as the interface through which the Manage Demand facility in the Manage Traffic function can request changes to the current routes and schedules in its efforts to adjust the modal split of travelers' trips in order to make the most efficient use of the road and highway network served by the local ITS functions. The input and output forms shall include those that are suitable for travelers with physical disabilities.
4.2.3.5	This process shall collect transit operational data and load it into a data store for use by the routes and schedules generation processes. The data shall be provided to this process by other processes in the Manage Transit function and shall enable an accurate picture of how routes and schedules are currently operating in terms of the numbers of vehicles that are available, the numbers of passengers that they are carrying, and the numbers of passengers passing through each roadside facility (transit stop).
4.2.3.6	This process shall obtain transit routes and services data and distribute it internally to other processes in the Manage Transit function. The process shall only provide its outputs when fresh data is received from another process. If this does not happen for a long period of time (days), then the process shall initiate its own request for fresh data.
4.2.3.7	This process shall provide the interface through which transit routes and schedules can be exchanged with other transit centers (Other TRM). This data shall be output when data is received from another (local) process and shall enable coordination between services provided by adjacent transit operations, particularly where they serve the same geographic areas. The process shall also provide routes and schedules to the local process when the data is received from other transit centers.

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4.2.3.9	This process shall provide updates to the store of digitized map data used by the transit route generation process and as the background for displays of transit services requested by the transit fleet manager. The process shall obtain the new data from a specialist data supplier or some other appropriate data source, after receiving an update request from the transit fleet manager interface process within the function. The processes requiring data for use in transit route generation and as the background to displays will read the data from the store loaded by this process.
4.2.4	This process shall obtain transit passenger and deployment data, transit user payment transaction data, transit emergency data, transit security data, maintenance and personnel data, and distribute it to the Manage Archive Data function. The process shall run when a request for data is received from an external source, or when fresh data is received. All inputs to this process are unsolicited, and all outputs are solicited, except that the 'transit_archive_status' is a solicited input.
4.3.1	This process shall monitor the condition of a transit vehicle. It shall use the transit vehicle maintenance specification to analyze brake, drive train, sensors, fuel, steering, tire, processor, communications equipment, and transit vehicle mileage to identify mileage based maintenance, out-of-specification or imminent failure conditions. The data resulting from this analysis shall be loaded by the process into the store of transit vehicle operations data, through the output flow transit vehicle maintenance. This data is then sent to the process that generates transit vehicle maintenance schedules.
4.3.2	This process shall generate transit vehicle maintenance schedules and includes what and when maintenance or repair is to be performed. Transit vehicle availability listings (current and forecast) shall also be generated by the process to support transit vehicle assignment planning. The maintenance and/or repair that is to be performed on the transit vehicle shall be scheduled by the process for a specific month, week, day(s), and hour(s). The availability of the transit vehicle that is also output by the process shall be based upon the transit vehicle maintenance schedule. The process shall load each transit vehicle maintenance schedule that it produces into the store of transit vehicle operations data, through the process that maintains this data store.
4.3.3	This process shall assign transit maintenance personnel to a transit vehicle maintenance schedule. The maintenance schedule shall be received from another process and shall define what and when maintenance repair is to be performed to a specific transit vehicle. The process shall base the personnel assignment upon details about the personnel obtained from the transit fleet manager and held in a local data store. These details shall comprise personnel eligibility, work assignments, preferences and seniority. The process shall also provide these details to the transit fleet manager on request. When a work assignment has been generated, the process shall send it to the transit maintenance personnel and also to the process that monitors and verifies maintenance work activity. The input and output forms shall include those that are suitable for travelers with physical disabilities.
4.3.4	This process shall verify that the transit vehicle maintenance activities were performed correctly and that a time stamped maintenance log for record keeping was generated. The correctness of the maintenance activities shall be judged by the process against the transit vehicle's status, the maintenance personnel's work assignment, and the transit maintenance schedules produced by other processes. The process shall save a time stamped record of all the maintenance activities performed on the vehicle into the transit vehicle maintenance log.
4.3.5	This process shall provide the transit fleet managers with the capability of requesting and receiving transit vehicle maintenance information. The process shall obtain the data for each request from the store of transit vehicle operations data, through the process that manages the data store, and shall produce the output to the transit fleet manager in an easily understood form. The input and output forms shall include those that are suitable for travelers with physical disabilities.

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4.3.6	This process shall provide the transit maintenance personnel with the capability to update transit vehicle maintenance information. The process shall send the data received from the transit maintenance personnel to the transit vehicle operations data store management process for use by other processes.
4.3.7	This process shall manage the store of transit vehicle operations data. It shall be able to load data it receives about vehicle maintenance into the store and provide that data on request to other processes.
4.4.1.1	This process shall manage the security in the transit system by monitoring for potential incidents. Data shall be obtained by the process from a variety of sources and assessed for any security problems. Problems shall be passed by the process to the transit system operator for review and the required action. Information about incidents shall also be sent by this process to another process for output to the media, using interface parameters set up by the transit system operator.
4.4.1.2	This process shall support the management of emergencies that occur in the transit system by processing information received from transit vehicles. The process shall accept inputs from either the transit vehicle driver or a transit user, the latter through such interfaces as panic buttons, alarm switches, etc. The reported emergencies shall be sent to another process for action by the transit system operator and subsequently for output to the media. The process shall also send acknowledgment data to the process providing the interface to the transit driver.
4.4.1.3	This process shall provide an interface for the transit system operator to identify and act upon potential information security problems and emergencies. This information shall be provided by other processes through input data flows. This process shall also provide the capability for the transit system operator to update parameters that control the output of data about the potential security problems to the media. The input and output forms shall include those that are suitable for travelers with physical disabilities.
4.4.1.4	This process shall provide the interface through which information about security problems and emergencies detected within the transit system are distributed directly to the media and other information systems. This process shall construct its output from the data supplied by other processes. This data shall contain parameters that define the way (format, content, etc.) in which the information is output by the process. The input and output forms shall include those that are suitable for travelers with physical disabilities.
4.4.1.5	This process shall provide an interface to the transit vehicle through which the driver can both report an emergency situation and receive an acknowledgment. The process shall provide this interface in such a way that its operation for both inputs and outputs shall be transparent to transit users on board the vehicle and to anyone outside the vehicle, and shall not compromise the safe operation of the vehicle by the driver.
4.4.1.6	This process shall collect data about emergencies that occur on-board transit vehicles for output to the media and the Manage Emergency Services function. These emergencies may be reported by either the transit driver or a transit user, the latter through such interfaces as panic buttons, alarm switches, etc. For output to the media interface process, the data shall be combined with the data in the media interface parameters data store.
4.4.1.7	This process shall monitor the secure area environment. Data shall be obtained by the process from a variety of sources and assessed for any security problems. Problems shall be passed by the process to other processes for review and the required action. Information about incidents shall also be sent by this process to another process for output to the media, using interface parameters set up by the transit system operator. The process shall also provide facilities for the control of video cameras and audio output in the secure area environment.
4.4.1.8	This process shall provide an interface in the Provide Driver and Traveler Services function through which travelers can declare emergencies. The traveler may be at a kiosk or other device, transit stop, transit depot, etc. The input and output forms shall include those that are suitable for travelers with physical disabilities.

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4.4.2	This process shall provide transit fleet managers with an interface through which they can control the coordination data sent to the Manage Emergency Services function following the detection of a security problem or emergency within the transit operations network by other processes. The process shall use data from the store of predefined responses to security problems and emergencies in the outputs that it sends to the Manage Emergency Services function. If no match can be found then the process shall send all the available data to the transit fleet manager for action. The input and output forms shall include those that are suitable for travelers with physical disabilities.
4.4.3	This process shall provide the interface through which the transit fleet manager can enter and review predefined responses to security problems and emergencies that have been detected by other processes within the Manage Transit function. This data shall be stored in a form which can be used by another process to provide coordination data to the Manage Emergency Services function. The input and output forms shall include those that are suitable for travelers with physical disabilities.
4.5.1	This process shall assess the transit driver's performance at previous work assignments. The process shall carry out this activity by 1) utilizing standardized performance evaluation criteria set forth by governmental regulations and transit operating company policies, 2) assessing the transit driver's driving history, and 3) assessing comments from the transit driver's supervisor(s). It shall also use the details of any moving violations or accidents, supervisor comments, government regulations, and company policies. The data shall be sent to this process by the process that provides the interface to a local data store, each time that the store is updated with driver performance data.
4.5.2	This process shall assess the transit driver's availability based on previous work assignments plus health and vacation commitments. The process shall carry out this activity by 1) utilizing standardized transit driver work criteria set forth by governmental regulations and company policies, 2) monitoring the transit driver's health status and vacation status, and 3) monitoring the transit driver's accumulated work hours. The data shall be sent to this process by the process that provides the interface to a local data store, each time that the store is updated with driver availability data.
4.5.3	This process shall assess the transit driver's cost effectiveness when carrying out previous work assignments. The process shall perform this activity by 1) utilizing standard transit driver cost criteria set forth by governmental regulations and company policies, and 2) monitoring the transit driver's hourly wage and accumulated work hours. The data shall be sent to this process by the process that provides the interface to a local data store, each time that the store is updated with driver cost effectiveness data.
4.5.4	This process shall assess the transit driver's eligibility for future work assignments. The process shall carry out this activity by 1) monitoring the transit driver's performance, availability and cost effectiveness, 2) utilizing standardized transit driver eligibility criteria set forth by governmental regulations and company policies, and 3) ensuring that the transit driver has the required experience, education and certifications. The data shall be sent to this process in one of two ways: 1) by the process that provides the interface to a local data store, each time that the store is updated with driver eligibility data, or 2) the data is produced as the result of analysis work carried out by other processes within the Manage Traffic function.
4.5.5	This process shall assign transit drivers to transit schedules. The transit driver's eligibility, route preferences, seniority, and transit vehicle availability shall be used by the process to determine the transit driver's route assignment. The output produced by the process shall be sent to the transit driver in the form of the next work assignment. The input and output forms shall include those that are suitable for travelers with physical disabilities.
4.5.6	This process shall provide the interface through which the transit driver can input data to the store of transit driver information. The interface provided by this process shall enable the transit driver to update personal availability and route assignment information. The input and output forms shall include those that are suitable for travelers with physical disabilities.

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4.5.7	This process shall provide the interface between the transit fleet manager and the store of driver information. The interface provided by the process shall enable the fleet manager to review and update transit driver information. The input and output forms shall include those that are suitable for travelers with physical disabilities.
4.5.8	This process shall provide the read and write interface to the store of transit driver information. The interface enables the contents of the store to be updated with inputs received from the transit driver and transit fleet manager via other processes, as well as, inputs resulting from analysis of driver availability, cost effectiveness, eligibility, and performance carried out by other processes. The process shall also supply data to these processes when the store is updated with information from the transit driver and fleet manager. It shall also supply data to the process that generates driver route assignments when any of the analysis inputs is received.
4.6.1	This process shall detect embarking transit users on-board a transit vehicle and read data from the payment instrument that they are carrying. The process shall provide an image of all transit users which shall be used for violation processing of those who do not have a payment instrument or whose transit fare transaction fails. It shall obtain an image of the required accuracy under all lighting conditions and over the range of speeds with which transit users will pass through the fare collection point on a transit vehicle.
4.6.2	This process shall determine the transit user's travel routing based on the transit vehicle's current location and the user's destination. The process shall support the transit user's routing, enabling it to include travel on the vehicle for all or part of its route and (possibly) transfer to another vehicle on another route. In order to achieve this capability, the process shall have access to the complete range of transit services (routes and schedules) that are available to the transit user. The transit vehicle's location shall be provided by other processes within the Manage Transit function. Details of all transactions with the transit user's payment details removed, shall be sent by this process to the interface process for loading into a data store.
4.6.3	This process shall calculate the transit user's fare based on the origin and destination provided by the user. The process shall calculate the fare using the transit routing, transit fare category, and transit user history components of the ride data, in addition to information provided by the interface process for the transit fares data store. The accumulated data shall be sent by this process to another process for the actual implementation of the fare payment transaction.
4.6.4	This process shall manage the transit user fare payments on-board a transit vehicle. The process shall receive information about the fare that is to be paid and the method of payment adopted by the transit user. It shall always support two modes of operation to complete the back end financial processing: infrastructure interactive, or semi-autonomous batch processing. The interactive method shall be used for individual transactions, such as those in paratransit type operations where value/volume ratios are high. It shall send transit user fare payment data to processes in the Provide Electronic Payment Services function for financial authorization and transaction processing, plus the return of the result for display to the transit user. A failed transaction shall result in the transmission of an image of the transit user to another process. Batch processing shall be used by the process for routes where value/volume ratios are low. It shall be performed using all the same data flows and processes as in the interactive method, except that transaction records are queued in a transaction buffer store which shall be maintained by this process. The accumulated data for the fare transactions shall be sent to the Provide Electronic Payment Services function on command from the transit vehicle driver, or when the transit vehicle has reached a convenient point on its route. The transit vehicle driver shall be notified when batch processing has completed successfully. In either mode of operation, a record of the status of all transit fare processing shall be sent to an interface process for the fare collection storage database.
4.6.5	This process shall provide the fare payment interface for the transit user on-board a transit vehicle. The process shall prompt the transit user for information necessary that has not been provided for the transaction. The result of the transit service ride fare payment plus other services request and payment, shall be reported back to the transit user by the process. The input and output forms shall include those that are suitable for travelers with physical disabilities.

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4.6.6	This process shall provide a database on-board the transit vehicle for use in fare processing. The database shall contain transit fare information from which the fares for all possible trips within the transit operational network can be determined.
4.6.7	This process shall provide passenger loading and fare statistics data to other ITS functions. The process shall send the data automatically at regular periodic intervals using data collected in the store of fare transaction data. This store receives data from the process that interfaces to the user on-board a transit vehicle.
4.6.8	This process shall act as the interface for advanced payment of tolls and parking lot charges from the transit user. Requests for these advanced payments shall be passed to other processes in the Provide Electronic Payment Services function for transaction processing. The process shall ensure that the response to these requests from transit users is returned to the transit vehicle from which it was made.
4.7.1.1	This process shall communicate with the Transit Management Center (TRMC) by providing public transit information at roadside locations. These locations may consist of transit vehicle stops or other locations that provide general public transit information. The process shall enable the roadside unit to obtain information about the transit services on request from the local transit user interface process and to receive data about late running services from other processes within the Manage Transit function. The received data shall be loaded into a local data store for future use. The input and output forms shall include those that are suitable for travelers with physical disabilities.
4.7.1.2	This process shall provide the roadside (transit stop) interface through which transit users receive information about an approaching transit vehicle or one that has already arrived. The process shall output the data to the transit user as soon as it is received and shall load the data into the local store for future use. Output of the data shall be maintained until the vehicle leaves the stop, when the process shall cease output of the data and delete it from the local store. The input and output forms shall include those that are suitable for travelers with physical disabilities.
4.7.2.1	This process shall detect transit users embarking at a roadside transit stop and read data from the payment instrument that they are carrying. The process shall provide an image of all transit users which shall be used for violation processing of those who do not have a payment instrument or whose transit fare transaction fails. It shall obtain an image of the required accuracy under all lighting conditions and over the range of speeds with which transit users will pass through the fare collection point at the roadside, i.e., a transit stop.
4.7.2.2	This process shall determine the transit user's travel routing based on the user's destination and the location of the roadside transit stop from which the route request is being made. The process shall support the transit user's routing enabling it to include travel on all or part of the route(s) operating from the stop and (possibly) transfer to another route. In order for this to be achieved, the process requires access to the complete range of transit services (routes and schedules) that are available to the transit user. Details of all transactions with the transit user's payment details removed, shall be sent by this process to the interface process for loading into the transit roadside fare collection data store.
4.7.2.3	This process shall calculate the transit user's fare based on the origin and destination provided by the user. The process shall calculate the fare using the transit routing, transit fare category, and transit user history components of the ride data together with data provided by the interface process to the database of transit fares. The accumulated data shall be sent by the process to another process for the actual implementation of the fare payment transaction.

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4.7.2.4	This process shall generate the data necessary to enable the financial transaction between the transit user and the transit provider to be completed at the roadside, i.e., at a transit stop. The process shall accept and process current transit passenger fare collection information. The process shall perform the front end transaction between the transit user and the transit system, and use the infrastructure interactive mode of operation to complete the back end processing. This means that the process shall send data about each transaction to processes in the Provide Electronic Payment Services function for the back end financial authorization and transaction processing. The process shall then await the return of the result for display to the transit user before accepting the next transaction. A failed transaction shall result in the transmission of an image of the transit user to another process. A record of the status of all transit fare processing shall be sent to another process for storage in a fare collection database.
4.7.2.5	This process shall provide the interface for the transit user at the roadside, i.e., at a transit stop. The interface shall enable the transit user to specify the required destination of a transit service ride and request other (yellow pages) services. The process shall prompt the transit user for information necessary for the transaction that has not been provided. The result of the transit service ride fare payment plus other services request and payment, shall be reported back to the transit user by the process. The input and output forms shall include those that are suitable for travelers with physical disabilities.
4.7.2.6	This process shall provide a database at the roadside, i.e., a transit stop, for use in fare processing. The database shall contain transit fare information from which the fares for all possible trips within the transit operational network can be determined.
4.7.2.7	This process shall create passenger loading and fare statistics data based upon data collected at the roadside and send this data to the store of transit operations data. The process may send the data at regular periodic intervals, on-demand, or through some other trigger mechanism. The process shall create its outputs using information collected in the store of fare transaction data. This data is received from other processes at the roadside, i.e., at a transit stop.
5.1.4	This process shall enable existing emergency centers to receive emergency calls, determine response requirements to the extent necessary to route the information, and route distress calls and emergency information to predesignated responding agencies and vehicles. All identified emergency information shall be provided by the process in a standard format as required. The process shall also communicate with commercial fleet managers to obtain details of cargo and other vehicle data where this will affect the response of the emergency services, e.g., in the case of a vehicle carrying a HAZMAT load. The current status of all emergency service responses shall be stored by the process in an action log, for access by the communications process.
5.1.5	This process shall manage the store of data that defines the way in which the emergency service resources shall be deployed in response to emergencies. Deployment shall vary by certain criteria, such as, type of emergency, source of information, time of day, location, etc. Parameters to define this allocation shall be loaded into the data store following receipt from the process that provides the emergency services operator interface.
5.3.1	This process shall select the appropriate emergency services and their vehicle(s) to respond to incidents. The process shall determine the type and number of vehicles to be dispatched, and provide the vehicle(s) with information on the type and location of the incident. It shall request data about the vehicles that are available from the interface process to the data store of emergency vehicle status. Once the vehicle determination has been made, the status data shall be changed by the process, and incident data sent to the process responsible for the actual dispatch of the vehicle(s).
5.3.2	This process shall direct selected emergency vehicles and drivers to respond to an incident, receive acknowledgment that they will in fact respond, and provide them with the location and details of the incident that was pre-calculated and sent to this process. If called for, the process shall send details to the Manage Traffic function to request a traffic control preemption be provided for the vehicle(s) if that mode of priority is available and chosen. The data for the emergency vehicle driver shall be sent to the driver interface process.

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5.3.3	This process shall manage information about the location of all emergency vehicles available for dispatch and that have been dispatched, and the ETA for vehicles en route. The process shall send this data to the store of emergency vehicle status data. If the vehicle is on its way to an emergency, as indicated by the received vehicle status, the process shall also send data to processes in the Manage Traffic function that will enable the vehicle to have whatever level and mode of priority is available and granted at traffic signals.
5.3.4	This process shall assess the status of emergency vehicles that are responding to an incident. In making its assessment, the process shall use data from the process managing a store of vehicle status, plus data from the emergency vehicle driver interface process. The process shall send the results of the assessment to the process responsible for managing emergency and emergency response information and update the store of vehicle status.
5.3.6	This process shall maintain a data store of the current status of all emergency vehicles available for dispatch and that have been dispatched. It shall provide data from the store on request from other processes and shall update the contents of the store with new data received from other processes. The process shall output the status of a vehicle to the process responsible for vehicle tracking for as long as it is on its way to an incident, to update ETA estimates and enable local vehicle priority to be given at intersections, if that mode of priority is chosen and granted.
5.3.7	This process shall calculate and assign emergency vehicle routes for incident assistance upon request.
5.4.5	This process shall manage the details of fare collection violations reported by the Manage Transit function that have taken place on-board a transit vehicle. The process shall use the parameters in the store of vehicle fare collection violation (enforcement) data to process and send the information to the correct law enforcement agency. This process shall also maintain the vehicle fare collection enforcement data store, entering all information received from other processes.
5.4.7	This process shall manage the details of fare collection violations reported by the Manage Transit function that have taken place at the roadside, i.e., at a transit stop. The process shall use the parameters in the store of roadside fare collection violation (enforcement) data to process and send the information to the correct law enforcement agency. This process shall also maintain the roadside fare collection enforcement data store, entering all information received from other processes.
6.1.1	This process shall obtain all the information needed to fulfill the traveler's request for a trip. The process shall support the request for trips that require the use of one or more modes of transport, and shall use the preferences and constraints specified by the traveler in the trip request, plus data from the store of trip planning parameters, to select the most appropriate modes. It shall send details of the trip requirements to the specialized processes that provide route information for the different modes of transport. When route data is received back from these processes, this process shall ensure that the whole trip is covered by one coherent route for which all the data such as costs, arrival times, and modal change points are known. The information provided to the traveler by the process shall be sufficient to enable the traveler to understand the routing, modes and cost of the trip. The trip information shall be stored for possible use in subsequent trip confirmation. The process also includes parking lot data. This data is used in transactions requiring electronic payment of parking lot services, as well as for a traveler making a parking lot reservation. This process shall exchange all input and output data from and to the traveler with the appropriate traveler interface process. The traveler shall send parking lot data, traveler trip requests, and traveler current condition requests to the archival process.
6.1.2	This process shall confirm a trip previously requested by a traveler and any financial transactions that this may require. The process shall base the trip confirmation upon information created by the process responsible for trip planning and stored locally. Confirmation details shall be sent to specialized processes (such as those responsible for demand responsive transit, ridesharing, etc.) to make reservations for their services. The response to these reservation requests and any necessary payment transactions shall be sent to the traveler. This process shall exchange all input and output data to and from the traveler via the appropriate traveler interface process. The trip confirmation shall be sent to the archival process.

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6.1.3	This process shall collect data about services that are available to travelers from multimodal service providers. These suppliers shall be those that provide travel services that are not part of regular transit or demand responsive transit operations, e.g. heavy rail, and may not involve surface transportation, e.g. ferry and airline operations. The process shall provide data formatted for use as part of a traveler's multimodal trip, and shall support subsequent confirmation of any portion provided by the Multimodal Service Provider.
6.1.4	This process shall manage the data store containing parameters used by the trip planning processes. These parameters shall govern the way in which multimodal trips are planned by other processes within Provide Trip Planning Services. This process shall accept inputs from the ISP Operator to define or update trip planning parameters. This process shall output these trip planning parameters to the ISP Operator.
6.1.5	This process shall receive all traveler requests, such as requests for traffic and transit information, requests for current conditions such as weather, trip requests, guidance route requests, advisory requests, yellow page information requests, and service confirmations. These requests shall be stored in the service_req_and_confirm_data data store and output to the traveler information data archive. The process shall run when a new request or confirmation is received from an external source.
6.1.6	This process shall accept traveler information service requests and confirmations, parking management information, payment transaction data, rideshare requests, commercial and non-commercial probe data, route guidance data, and origin/destination data, and store it in its local traveler info data archive data store, together with a catalog to describe the data. When requested by the Manage Archive Data function, this information will be sent to that function. The process shall also provide a control interface to the ISP operator, responding with the status received from the requester of the archive. The process shall run when a request for data or a catalog is received from an external source, when a command is received from the ISP Operator, or when fresh data is received.
6.2.1.1	This process shall collect and fuse traffic data that will be used to create broadcast or advisory messages to travelers. The input data for this process shall consist of historical, current, and predicted traffic and planned event data. The process shall extract from the data those elements appropriate for advisory or broadcast messages and load it into the store of traveler_traffic_information_data store. The data can be provided to the process either via direct request from the process or as a result of periodic (unrequested) updates.
6.2.1.2	This process shall provide advisory data to users in vehicles (drivers or transit users) as a result of a request from the driver or transit user. (e.g. This process supports a request/response type of exchange with the user.) The advisory information is extracted from the data stores of traveler traffic and transit information. The process shall have the capability to filter the advisory data, read from the data stores, store so that the output only contains data that is relevant to the current location of the vehicle from which the request was made. When the user requests location specific data, the vehicle's location shall be provided to the process in the request message. Advisory data requests shall be sent to the data archival process.
6.2.1.3	This process shall collect and fuse transit advisory data that will be used to create broadcast or advisory messages to travelers. The process shall extract from the data those elements appropriate for advisory or broadcast messages and load it into the traveler_transit_information_data store. The data can be provided to the process either via direct request from the process or as a result of periodic (unrequested) updates. The process shall fuse all the received data into a coherent set, which is loaded into a traveler_transit_information_data store for access by other processes.
6.2.1.4	This process shall extract advisory data from stores of traveler traffic and transit information at locally determined intervals and send it out to drivers or transit users in vehicles as wide area broadcast messages. The content and rate of these messages shall be based upon parameters from the broadcast_parameters_data store, which is managed by the ISP operator.

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6.2.1.6	This process shall gather transit advisory data and provide it via another process to the transit user on-board a transit vehicle. The interface shall receive requests from the transit user specifying the required destination of a transit service ride and other (yellow pages) type services. The transit user may also request and receive information about the state of traffic on the roadway, as well as transit route and stop data (i.e., traffic and transit advisory data). This process extracts data from the store of traveler transit information upon request for advisory data from the driver or transit user in a vehicle. The process shall filter the data read from the store so that output only contains that which is relevant to the current location of the vehicle from which the request was made. The vehicle's location shall be provided to the process in the request data. The input and output forms shall include those that are suitable for travelers with physical disabilities.
6.2.2	This process shall provide in-vehicle advisory and broadcast data for output to drivers and transit users. The process shall format requests from users for advisory data and output the requests to other processes. The request for advisory data shall allow the user to request only information relevant to the location of the vehicle. The request may be repeated, periodically, or when the vehicle changes location by a distance determined by the implementation. Data broadcast to the driver shall include traffic related data (incidents, link data and in-vehicle signage), as well as data from the vehicle itself. This vehicle data includes vehicle conditions, smart probe data, safety and position warnings, and enhanced vision images. Safety and warning messages shall be prioritized by the process to supersede advisory and broadcast messages. The process shall also support the transfer of reservation requests from the users in vehicles for other services such as yellow pages.
6.2.3	This process shall provide a data input and output interface for a transit user on-board a transit vehicle. The process shall enable traffic and travel advisory information, plus yellow pages information to be requested and output to the transit user. When constructing the outputs the process shall use the data in the store of vehicle display definitions data. In addition to the traveler's request/response for information, broadcast advisories about the imminent arrival of the transit vehicle at the next stop are also displayed for the transit user. The process shall handle all inputs and outputs in such a way that they do not impair the vehicle driver's ability to control the transit vehicle in a manner that is safe to both its occupants, to other road and freeway users, and to pedestrians. The input and output forms shall also include those that are suitable for travelers with physical disabilities.
6.2.5	This process shall provide a user interface for a driver through which traffic and travel advisory information can be obtained. The process shall enable traffic and travel advisory information to be requested and output to the driver, and shall also support the automatic output of wide area broadcast information (including in vehicle signage) to the driver. The process shall support output of safety and vision enhancement information to the user. When constructing all outputs the process shall use the vehicle_display_definitions_data store parameters. One purpose of the vehicle_display_definitions_data store is to provide a translation table for road sign and message templates used for in-vehicle display. Part of the input interface provided by the process shall enable the driver to invoke and cancel automatic control of the vehicle including the use of automated highway system (ahs) lanes. The process shall support inputs from the driver in manual or audio form, and shall provide its outputs in audible or visual forms. Visual output may be either in hardcopy, or as a display. Both types of output shall not impair the driver's ability to control the vehicle in a safe manner.
6.4.1	This process shall accept and screen traveler requests for ride-sharing. These requests shall be sent to the process as a result of trip plan requests received from travelers by other processes. This process shall use eligibility data from a local rideshare_data store, to screen travelers before they are matched with other travelers and to enable ridesharing for all or part of their proposed trips. Traveler rideshare requests and rideshare data from the rideshare_data data store shall be sent to the data archival process.

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6.4.2	This process shall match travelers for ridesharing trips. The process shall attempt to achieve a match by considering some or all of the following: the origin and destination of the traveler's proposed trip, any routing constraints, preferences specified by the traveler, compatibility of this rideshare with rideshares confirmed by other travelers, the requesting traveler's eligibility data, and traffic data obtained on request from the Manage Traffic function. The process shall consider the possible disbenefits to other travelers who will be part of the same rideshare when finding the rideshare best suited to the travelerÆs requirements. The process shall store data about selected rideshares in the rideshare_data store, and shall update the data when confirmation of the rideshare acceptance is received from another process.
6.4.4	This process shall confirm the traveler's rideshare match and initiate a payment transaction where appropriate. The process shall send the payment transaction data for action by a process in the Provide Electronic Payment Services function. The results of this transaction shall be sent by this process to the process providing the overall trip confirmation. Once a rideshare match is confirmed, this data is sent to the rideshare match process where it can be factored in to subsequent matches.
6.5.1	This process shall collect and update data about incidents, road construction, weather, events and yellow pages data. This data shall be obtained by the process from other ITS functions and from outside sources such as the weather service, yellow pages service providers and the media. The process shall load the data into a local store for use by the process that provides yellow pages information and reservations.
6.5.2	This process shall provide information and reservation services obtained from yellow pages service providers. The process shall provide the information and reservation data so that it can easily form part of a traveler's information request or trip planning activities. The process shall be able to request additional yellow pages information if the process cannot find the required data in the tourist_information data store. The process shall send requests for payment to a process in the Provide Electronic Payment Services function for action, and shall send the response back to the process from which the payment request was received. The traveler's yellow pages requests shall be sent to the data archival process.
6.6.1	This process shall manage the creation of multimodal routes (those with one or more modes in them) in response to travelerÆs trip or route requests. It shall support on-line route guidance for travelers using personal devices, route guidance for vehicles, selection of specialized vehicle based routes for other ITS functions, (such as Manage Emergency Services and Manage Commercial Vehicles), and selection of multimodal routes in response to trip planning requests from travelers. The multimodal routes provided by the process shall take account of the traveler's preferences and constraints. Constraints can include the access needs of those with disabilities. Preferences can include minimizing waiting time at modal interchange points, level of traveler security, or minimum cost. Trip requests, traveler route requests, and traveler route acceptances shall be sent to the data archival process.
6.6.2.2	This process shall update the data stores containing information which is used by the another process to calculate vehicle routes. This process shall also provide data about links (speed or travel times), and queues to be broadcast to vehicles (to support autonomous guidance with dynamic link updates). The process shall fuse link and queue data received from Manage Traffic sources with probe data received from vehicles under infrastructure based route guidance, or with probe data obtained from other sources (such as from an electronic toll collection system). The process shall obtain route segment data as requested data or as data received at periodic intervals from other ITS functions. The process shall have the capability to request data about route segments outside its own area by sending a data request to the process that provides the interface with other ISP's. Link addresses, mapped to other ISPs, will be maintained by this process and stored in the link_data_store. Usage of current road networks shall be sent to the data archival process.

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6.6.2.3	This process shall obtain from another ISP current or predicted data for road links that are outside the area served by the local supplier. This area, which may be defined on a geographic or jurisdictional basis, is the portion of the transportation network on which the ISP maintains real time information. Identification of which ISP to contact is based upon a store that maps a link to the ISP which maintains real time information about this link. If there is no map to another ISP in the data store, then the process will return default or static data for the link(s). This process shall also respond to similar requests from other ISPs for real time data on links within the local database.
6.6.2.4	This process shall provide the interface to map update providers, or other appropriate data sources, through which updates of the digitized map data can be obtained. The process shall request new data from the provider on request from the ISP operator interface process. The data received from the supplier shall be loaded into a the map_data_for_route_selection data store by the process in such a way that it can be easily used by the route selection process in determining vehicle routes, trip planning, and on-line vehicle guidance.
6.6.2.6	This process shall calculate route segment travel times from vehicle probe data. The probe data shall be accepted by the process from a variety of sources including toll collection points and vehicles receiving on-line infrastructure based guidance. The process shall be responsible for combining the data obtained from these sources and producing one set of route segment travel times or route segment speeds. The process shall indicate route segments for which no data, or insufficient data, is available (this indication could be by setting the link time or speed to zero). Vehicle guidance probe data shall be sent to the data archival process.
6.6.3	This process shall provide the interface to a map update providers through which to obtain fresh updates of digitized map data used in identification of non-vehicle portions of routes. The process shall request new data from the provider on request from the ISP operator interface process. The data received from the supplier shall be loaded into the map_data_for_general_use data store by the process in such a way that it can be easily used by the route selection process in determining non-vehicle routes for use in on-line traveler guidance and trip planning.
6.6.4	This process shall determine routes that are based on regular transit services. Routes shall be provided by the process to travelers in response to trip planning and on-line personal guidance requests. The data provided by the process shall be different for the two types of requests since trip planning information will not need the detail that guidance data requires. The process shall base routes on the current state of the regular transit services using data obtained from processes in the Manage Transit function. It shall also respond to any preferences and constraints, such as those for travelers with special needs, that are specified in the route request. Data on the current use of transit routes in on-line guidance shall be provided by the process to the Manage Demand function to aid in demand management. This data on current use of the transit routes in on-line guidance is stored in the transit_mode_routes data store.
6.6.5	This process shall determine routes, or portions of routes, not based on use of vehicles or regular transit services. Routes shall be provided by the process for travelers in response to trip planning, on-line personal guidance requests, and for data archival. Data provided by the process will be different for the two types of requests since the data for trip planning will not need the level of detail that guidance data requires. The process shall calculate its routes using digitized map data obtained and updated by another process. It shall make use of the alternative modes, (such as ferries, walking, cycling, etc.) that have been specified in the route request, and shall also take account of any preferences and constraints, (such as those for travelers with special needs). Data on current use of routes in on-line guidance shall be provided by the process to the Manage Demand function.
6.7.1.1	This process shall respond to the input of a request from a driver for action by the emergency services. Input of the request shall be received by the process from the driver via a panic button or some other functionally similar form of input device provided as part of the in-vehicle equipment. When the input is received, the process shall send a message to the communications process, containing the vehicle's current location, its identity and basic vehicle data relevant to its current condition, as well as any other data, such as personal medical history, vehicle orientation, etc., that may be developed in-vehicle by other systems.

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6.7.1.2	This process shall prepare and send an emergency message from a driver to the Manage Emergency Services function. The message shall only be sent by the process in response to data received from another process that monitors driver inputs. Once an emergency message has been sent, the process shall send a message to that effect to another process in the Provide Vehicle Monitoring and Control function for output to the driver. The process shall then await a response from the Manage Emergency Services function, and then send a detailed message to the other process for output to the driver. Output of the emergency message to the Manage Emergency Services function shall be repeated by the process at regular intervals until a response is received.
6.8.1.5	This process shall provide an emergency notification interface for a traveler using a personal portable device. The emergency notification interface shall enable the output of messages generated by a traveler's emergency request to another process.
6.8.2.1	This process shall respond to the input of a request from a traveler for action by the emergency services. Input of the request shall be received by the process from the traveler via a panic button or some other functionally similar form of input device provided as part of the traveler's personal portable device. When the input is received, the process shall send a message to the communications process, containing the traveler's current location and identity.
6.8.2.2	This process shall prepare and send an emergency message from a traveler's personal portable device to the Manage Emergency Services function. The message shall only be sent by the process in response to data received from another process that monitors traveler inputs. Once an emergency message has been sent, the process shall send a message to that effect to another process for output to the traveler. The process shall then await a response from the Manage Emergency Services function, and when received again send a message to the other process for output to the traveler. Output of the emergency message to the Manage Emergency Services function shall be repeated by the process at regular intervals until a response is received.
6.8.3.1	This process shall receive traveler requests from a personal device (portable, or non portable) then provide support for trip planning, traffic, transit and other (yellow pages) services information, trip confirmation, yellow pages services confirmation, and payment requests. The process shall send these requests to the appropriate processes within the Provide Driver and Traveler Services function for further processing to generate responses. The interface to the traveler shall be provided through a separate process, from which input to this process originates.
6.8.3.2	This process shall provide the traveler (using a personal device) with data about all requested trip, traffic, transit, other (yellow pages) services information, confirmation of any requested reservations, and payments made as part of confirmed trip plans. The data shall be sent by the process to an interface process which is responsible for its actual output to the traveler. This data shall include digitized map data to act as the background to the output when the data is shown in a suitable format. This process shall request data from other ITS functions or be sent it as a result of requests from another process.

P-Spec Nbr	Description
6.8.3.3	This process shall provide an interface in a personal device through which travelers can plan and confirm trips, as well as obtain current traffic and transit information. The process shall support trip planning and confirmation of other (yellow pages) services such as lodging, restaurants, theaters, and other tourist activities. The process shall be able to load in the traveler_personal_regular_data store frequently used information such as traveler identity (the owner of the personal device), home and work locations, etc. This will reduce the amount of input needed by the traveler for each trip request. The process shall also carry out input data verification and require input confirmation, with the traveler, before passing the data to other processes. The traveler's payment information and location (when traveler is using a portable device) shall be obtained by this process from other processes. The process shall support inputs from the traveler in both manual and audio form, and shall provide its outputs in audible and visual forms that are consistent with a personal device. This process shall include forms suitable for travelers with hearing and vision physical disabilities. The process shall display data for as long as required by the traveler and must enable viewing of previously output data. When used with a portable device, the process shall provide the traveler the option to filter the data (to be displayed) relevant to the travelers current location.
7.3.1.3	This process shall be responsible for maintaining a log of all the transactions carried out by other processes in the Process Electronic Transit Fare Payment facility. The identity of the payee shall have been removed from the data before it is stored. At periodic intervals the process shall output the accumulated records to the transit fleet manager, the transit system operator and to another process in the Provide Electronic Payment Services function. The process shall also be responsible for sending details of transactions to the financial institution to enable the users to be billed through their credit identities. The input and output forms shall include those that are suitable for travelers with physical disabilities.
7.3.1.4	This process shall be responsible for checking to see if the required transit fare payment has already been made. The process shall determine the existence of an advance payment for the transit fare by comparing the received payment information with that in the store containing the list of advanced payments. If the payment has already been made then the process shall remove the requirement for local billing and remove the record of the advanced payment from the store. Details of each payment transaction shall be sent by the process to another process with the payment information received from the transit user removed.
7.3.4	This process shall be responsible for providing the interface through which payment information can be read from a transit user tag. The process shall support reading this data from transit users at the roadside, e.g., a transit stop, for use in paying the current transit fare and (if required) advanced payments. The process shall support advanced payments for tolls, parking lot charges, and/or transit fares. The process shall collect either the credit identity or the stored credit value data from the tag, and update the stored credit value as a result of the fare and (possibly) advanced charges.
7.3.5	This process shall be responsible for providing the interface through which the payment information can be read from a transit user tag. The process shall support the reading of this data from transit users embarking on-board transit vehicles, for use in paying the current transit fare, and if required, advanced payments. The process shall support advanced payments for tolls, and/or parking lot charges, and/or transit fares. It shall be possible for the process to collect either the credit identity or the stored credit value data from the tag, and to update the stored credit value as a result of the fare and (possibly) advanced charges having been paid.
7.4.1.6	This process shall be responsible for transacting advanced payments required for the confirmation of a trip by a traveler. Payments supported by the process shall comprise those for any tolls, parking lot charges, transit fares, or other (yellow pages) services that need to be paid for the trip to be confirmed. The process shall receive the transaction data from a process in the Provide Driver and Traveler Services function and shall send the data to the financial institution. Tolls, fares and parking lot charges are sent to the Route Traveler Advanced Payment function for processing. The process shall send the response from the financial institution to the requesting process and shall send details of the transaction to another process for entry into the payment_transaction_records data store.

P-Spec Nbr	Description
7.4.1.7	This process shall be responsible for the collection and maintenance of a data store that contains transaction records for payments made for various services provided. The process shall load information into the payment_transaction_records data store for services comprising updates of map databases for drivers and travelers, registration of other (yellow pages) service providers (so that information about what they have to offer is available to travelers and transit users), advanced payment of tolls, parking lot charges, transit fares and other (yellow pages) services that form part of travelers' trips. The data shall be stored by the process with all references to the identity of the payment source, i.e., driver, traveler, commercial vehicle fleet manager, and any other payment information, removed.
7.4.1.8	This process shall be responsible for transacting payments for ridesharing that are required for the confirmation of a traveler's trip. The process shall start the transaction by receiving data from a process in the Provide Driver and Traveler Services function and shall send the data to the appropriate financial institution. The process shall send the response from the financial institution to the requesting process and shall send details of the transaction to another process for entry into a store of transaction records.
7.4.2	This process shall be responsible for collecting data about the prices being charged for tolls, parking lots and transit fares. This process shall accept data sent to it by the other processes when they have updated their data and automatically sent it, or this process shall request a transfer of data from the other processes. The process shall load the data into the price_data_for_services data store from which some or all of it can be read on request from processes in other ITS functions.
7.4.3	This process shall be responsible for receiving a traveler's request for advanced payment (for tolls, parking lot charges, and/or transit fares) and routing it to the appropriate part of the Provide Electronic Payment Services function. The process shall also receive responses to the advanced payment requests and shall return them to the originating process.
7.5.1	This process shall be responsible for providing the interface through which driver credit identities and stored credit may be entered into the ITS from on-board vehicle tags. The types of vehicles from which data is collected shall include private cars or vans, commercial vehicles, and transit vehicles, including those used for demand responsive transit services. This process shall also provide an interface through which the stored credit held by the tag can be debited for the payment of current or advanced tolls, plus advanced parking lot charges, and/or transit fares.
7.5.2	This process shall be responsible for providing the interface through which credit identities and stored credit values may be collected from tags being used by transit users. The process shall support the collection of this data at the roadside (which in this instance is a transit stop). Payments by the transit user for fares, other services, payment of advanced tolls, and/or parking lot charges shall be supported by the process. It shall also provide an interface through which stored credit held by the tag can be debited for the same types of payment.
7.5.3	This process shall be responsible for providing the interface through which credit identity or stored credit may be collected from the tag being used by a traveler with a personal device. The process shall support the collection of this data from any location in which the device (and hence the tag) is being used. It shall provide an interface through which the credit identity can be used for the payment of advanced tolls, parking lot charges, transit fares, display updates, and/or map updates. The process shall also enable the stored credit value on the tag to be used for the same purposes.
7.5.4	This process shall be responsible for providing the interface through which credit identity or stored credit values may be collected from the tags used by commercial fleet managers. The process shall support the use of the tag data to complete payment for the filing of electronic credentials and tax information that will enable a commercial vehicle to be cleared to travel within the geographic area served by a particular jurisdictional authority. This process shall also enable the stored credit value to be debited as an alternative method of payment.

P-Spec Nbr	Description
7.5.5	This process shall be responsible for providing the interface through which credit identities and stored credit values may be collected from payment instruments being used by travelers. The process shall support the collection of data at the roadside (which in this instance is a kiosk) and use this data for payments needed to confirm a traveler's trip. Payments supported by the process shall include those for advanced tolls, parking lot charges, transit fares, and/or other (yellow pages) services. It shall also provide an interface through which the stored credit held by the tag can be debited for the same types of payment.
8.1	This process shall collect data from each major function within ITS and external sources for archive purposes that may not exist within current ITS data sources. This process shall respond to requests from the Manage Archive Data Administrator Interface process to import data or data catalogs. This process shall send requests for data or a catalog of available data to the other functions and terminators, either a subscription for data or a one-time request. This process shall receive meta data along with the data to describe the conditions under which the data was collected or any other information about the operational data. When data is received this process shall perform quality checks such as range validation or reformat the data as necessary to meet the archive schema. This process shall execute methods on the incoming data such as cleansing, summarizations, aggregations, or transformations applied to the data before it is stored in the archive. Any changes made to the data shall be recorded in the meta-data stored in the archive to assist in the reconstruction of the original data if possible. This process shall receive inputs from the Manage Archive Data Administrator Interface that contain the parameters for managing the processing on the data. This process forwards the collected onto the Manage Archive function along with updated meta-data and a record of any methods applied to the incoming data. This process shall also support the notification of the operational source functions of any errors that may be present in the data that could be caused by equipment failures or a transmission error.
8.2	This process shall store the collected and formatted data in a permanent archive data store. This process shall receive the formatted data from the Get Archive Data function accompanied by any updates to the meta data that would describe the formatting operations performed on the data as it was imported. This process shall respond to requests from the administrator interface function to maintain the schema of the archive data, set update frequencies, backup schedules, user authentication schemes, cleansing algorithms. This process shall provide the administrator interface function with status of the data quality in the archive, frequency reports on use of the archive, updates to the measure of the volume of the data and other data archive metrics. This process shall receive inputs from the Coordinate Archives function to provide data and information about the archive schema to other archives. In turn the process shall receive data and schema of other archives to use to build a global schema. The process shall use the global schema to support requests from user systems for data that may be spread across multiple archives. The process shall maintain the access privileges information for the data held in the archive to maintain the security of the archive. The process shall employ such techniques as necessary to maintain the integrity of the data and ensure no data is lost from the archive. The process shall respond to requests for data to support user data products, user analysis, and inputs to government reporting systems. The process shall respond to such request by authenticating the originator of the request and providing the data that is available. The process shall also be capable of providing a sample or catalog of data contained within the archive to support the user requests.
8.4	This process shall coordinate the information exchange between different Manage Archived Data functions represented through the Other Archives terminator. This process shall allow other archives to share data collected by other archive functions to share the data in response to local requests from users systems. This process shall use data collected from different archives to build a set of global schema which the data archive definitions for the local archive plus any archives known to the local archive. This process shall provide the global schema to the local Manage Archive function. This process shall receive the schema of the local archive to share with other archive functions. This process shall provide data to those other archives when requested. This process shall support analysis, data fusion, and data mining of archived information across geographically dispersed archives.

P-Spec Nbr	Description
8.5	This process shall monitor the archive data user systems interface for requests for data from the archive. This process shall support requests from users involved in planning, research, safety, as well as operations of transportation functions. This process shall receive requests for data and catalogs of data that may be contained in the archive. This process shall translate the requests into a format that can be understood by the Manage Archive function to retrieve data from the archive. When data or a catalog of data is received from the archive, this process shall generate the requested data product for the users systems. For archive data requiring financial payment this archive process the financial requests and manages an interface to a Financial Institution.

APPENDIX C

DATA FLOW DESCRIPTIONS

Data Flow Name	Data Flow Description
archive_data	This data store within the Manage Archived Data function contains the collection of data imported into the archive function that has been formatted for the archive schema. This data store is comprised of the data, the meta data to describe the archived data in detail enough to improve the usefulness of the data over time, a catalog and schema of the data held within the archive, and a set of access permissions for the data held within the archive.
cf_on_board_vehicle_data	This data flow is used within the Manage Commercial Vehicle function and contains data collected on-board a commercial vehicle output of which has been requested by the commercial vehicle manager.
cf_request_on_board_vehicle_data	This data flow is used within the Manage Commercial Vehicles function. It contains a request from the commercial vehicle manager for the commercial vehicle to output the on-board data it has collected, plus any general message data from the driver.
confirm_vehicle_fare_ payment	This data flow is sent from the Provide Electronic Payment Services function to the Manage transit function to confirm that transaction processing of the payment of a single transit fare (interactive operation) or of a group of fares (batch mode) from on-board the vehicle has been completed. If the transaction processing was in batch mode, the transit user's tag identity will be set to zero (0), otherwise it will be set to the identity provided in the transaction request.
control_parameters	This data flow is used within the Manage Traffic function to pass data between the Provide Traffic Surveillance and Provide Device Control facilities.
cv_roadside_data_for_vehicle	This data flow is used within the Manage Commercial Vehicle function. It contains data that is being sent from a commercial vehicle roadside checkstation or border crossing facility to the commercial vehicle.
cv_vehicle_data_for_roadside	This data flow is used within the Manage Commercial Vehicle function. It contains data that is being sent from the commercial vehicle to the commercial vehicle roadside checkstation facility.
em_archive_status	This data flow is sent from the Manage Archived Data function to the Emergency Management function. It is the status returned when transit archive data is sent from the Emergency Management function to the Manage Archived Data function.
em_archive_request	This data flow from the Manage Archived Data function contains the request for data collected and stored by the Emergency Management function. The request can be a request for a catalog of the data held by the function or a request for the data itself.
emergency_data_archive	This data store is used to hold data that is to be archived by the Manage Archived Data function. This data includes information, such as, incident characteristics and emergency management response data.
emergency_request_driver_ acknowledge	This data flow is used by the Manage Emergency Services function to acknowledge that the request for emergency services previously sent by the driver has been received and is therefore sent to the Provide Driver and Traveler Services function for output.
emergency_request_driver_ details	This data flow is used by the Provide Driver and Traveler Services function to send data about an emergency declared by a driver to the Manage Emergency Services function.

Data Flow Name	Data Flow Description
emergency_traffic_control_ request	This data flow is sent from the Manage Emergency Services function to the Manage Traffic function. It contains a list of the route segments that have been provided for use by an emergency vehicle, together with the arrival time at each segment. The data will be used by the Manage Traffic function to generate changes to the current traffic management strategy to give the emergency vehicle priority.
emergency_traffic_control_ response	This data flow is sent from the Manage Traffic function to the Manage Emergency Services function. It contains a list of the route segments that have been provided for use by an emergency vehicle and indicates the traffic management strategy that is in effect for these route segments.
emergency_vehicle_ acknowledge	This data flow is used within the Manage Emergency Services function. It contains the acknowledgment of data received by the emergency vehicle.
emergency_vehicle_dispatch_data	This data flow is used within the Manage Emergency Services function. It contains data required to dispatch an emergency vehicle to the scene of an incident.
emergency_vehicle_dispatch_ request	This data flow is used within the Manage Emergency Services function and contains data for the request for an emergency vehicle dispatch. The data flow specifies the information needed to respond to a particular incident.
emergency_ vehicle_dispatch_ response	This data flow provides current enroute status and requests any additional current incident response status.
emergency_vehicle_incident_ details	This data flow is used within the Manage Emergency Services function and contains details of an incident to which a response is required.
emergency_vehicle_ preemptions	This data flow is sent by the Manage Emergency Services function to the Manage Traffic function. It contains the data necessary for an individual emergency services vehicle and the stream of traffic in which the vehicle is traveling to be given preemption (priority) at an indicator controller. This will be at the controller for a particular road junction, pedestrian crossing, or highway entrance ramp. The data is sent directly from the emergency vehicle to the next controller along its route and therefore is not subject to any centralized coordination. Local coordination may be provided if there are links between adjacent controllers.
emergency_vehicle_response_ request	This data flow is used within the Manage Emergency Services function and contains data for the request for an emergency vehicle to be processed by the Select Response Mode function. The data flow specifies the information needed to respond to a particular incident.
emissions_archive_data	This data flow is to the Manage Archive data function from the Manage Traffic function. It contains pollution data collected from sensors allocated at the roadside and from vehicles.
emissions_archive_request	This data flow from Manage Archive Data function contains the request for data collected and stored by Manage Traffic function. The request can be a request for catalog of the data held by the function or a request for the data itself.
Emissions_archive_status	This data flow is sent from the Manage Archived Data function to the Manage Traffic function. It is the status returned when emissions archive data is sent from the Manage Traffic function to the Manage Archived Data function.

Data Flow Name	Data Flow Description
Erms_incidents	This data flow is sent from the Manage Emergency Services function to the Manage Traffic function. It contains data about incidents and the priority requests needed by emergency vehicles.
From_C_and_M	This data flow is sent to the Manage Traffic function. It contains either information about road and highway repairs from the Construction and Maintenance organization or indicator fault clearance data.
From_Commercial_Vehicle	This data flow is sent from a commercial vehicle to the Manage Commercial Vehicles and Provide Vehicle Monitoring and Control functions. It contains data that has been collected on-board a commercial vehicle for processing by sensors before being used within the functions.
From_Commercial_Vehicle_ Driver	This data flow is sent from the commercial vehicle driver to the Manage Commercial Vehicles function and contains data that has been input by a driver acting either as a driver, or acting as a commercial vehicle manager.
From_Commercial_Vehicle_ Manager	This data flow is sent from the commercial vehicle manager to the Manage Commercial Vehicles function and contains data that has been input by a commercial vehicle fleet manager.
From_Event_Promoters	This data flow is sent from the Event Promoters terminator to the Provide Driver and Traveler Services and Manage Traffic functions.
From_Financial_Institution	This data flow is sent from the Financial Institution to the Provide Electronic Payment Services function and contains data about requests for payments that have been successfully made or otherwise.
From_Other_EM	This data flow is sent by the other emergency centers to the Manage Emergency Services function and contains information about incidents that are taking place outside the area of operation serviced by the local function.
From_Payment_Instrument	This data flow is sent from the payment instrument to the Provide Electronic Payment Services function.
From_Traffic	This data flow is sent to the Manage Traffic function. It contains analog data from traffic on roads and highways that can be read by sensors within ITS.
From_Traffic_Operations_Personnel	This data flow is input by traffic operations personnel to various processes in the Manage Traffic function. It is used to request the output of traffic, incident, traffic and travel demand, or pollution data, or to control closed circuit television (cctv) systems, or to provide new parameters for use by processes in the Traffic Incident, Demand and Emissions Management facilities. It also provides information about roadway characteristics (shoulder width, pavement type, speed limit, etc.).
From_Transit_Driver	This data flow is sent to the Manage Transit function. It contains input from a transit vehicle driver.
From_Transit_Fleet_ Manager	This data flow is sent from the transit fleet manager to the Manage Transit function and contains various inputs. Some are initiated by the manager, whilst others result from prompts to input data which is additional to that already received by processes within the function.
From_Emergency_Personnel	This data flow is sent from the emergency personnel to the Manage Emergency Services function.

Data Flow Name	Data Flow Description
From_Environment	This data flow is sent from the environment to the Manage Traffic function. It provides information about the environmental conditions both generally in the area served by ITS and at the roadside. It is mostly analog data that must be converted by sensors to provide data for use by other processes.
From_Media	This data flow is sent from the Media to the Manage Traffic and Provide Driver and Traveler Services function. It provides input of data regarding incidents identified by the Media and traveler information, as well as requests for incident or traffic information.
From_Rail_Operations	This data flow is sent from a railroad operated operations center (or centers) to the ITS Manage Traffic function. It contains information about scheduled and/or planned railroad activity that may be relevant to ITS traffic management (e.g. train schedules through busy corridors, maintenance schedules for railroad owned and maintained grade crossing equipment, etc.). This is typically informational data and is not required for timely operation of grade crossing protection and safety devices. It is however the source of data for use in route planning, alternate route determination, railroad incident notifications, etc.
From_vehicle_characteristics	This data flow is sent from the vehicle characteristics terminator. It represents the presence of a vehicle near a sensor, which allows the sensor to create an output that can be used to identify a particular vehicle and its characteristics, such as the number of wheels, size, pollution parameters, etc., for toll payment and parking lot charging purposes.
From_Wayside_Equipment	This data flow represents information received by HRI from railroad maintained and operated wayside interface equipment (track circuits, gate controllers, local connections to centralized sites via railroad communications networks, etc.). This is assumed to be a real-time, or near real-time interface capable of providing direct communications with (or otherwise detecting) approaching trains.
From_Roadway_ Environment	This data flow is sent from the roadway environment to the Provide Vehicle Monitoring and Control and Manage Traffic functions. It contains analog data about the environment actually around the roadway itself covering such things as emissions, fog, ice, snow, etc.
From_Weather_Service	This data flow consists of data that is provided by the Weather Service terminator and is sent to the Provide Driver and Traveler Services and Manage Traffic functions. The weather service may also provide data to the Manage Archived Data function. The current and predicted weather data items will be organized by geographic area to allow for local variations.
Global_schema	This data flow from the Coordinate Archives function contains the definition of the archives that are managed by similar Manage Archived Data functions that have made the data available to local user systems. The global schema defines the structure of various archive databases, including information such as the definition of objects within a database or how tables of data are related to each other as in a relational database. The global schema would also define the information necessary to locate information spread across geographical boundaries as in a distributed archive model. The global schema is used to support mining and fusion activities of data across multiple archives.
Guidance_data	This data flow is used within the Provide Driver and Traveler Services function to transfer data between the Manage Trip Planning and Ridesharing facility and the Provide Guidance and Trip Planning Services facility.

Data Flow Name	Data Flow Description
Hri_surveillance_data	This data flow provides surveillance information, acquired by HRI at grade crossings, that is relevant to the overall traffic surveillance functions of ITS (e.g. grade crossing vehicle traffic, detected incidents, etc.
incident_command_request	This data flow requests resources, provides commands for relay to other allied response agencies, and includes other requests that reflect local command of an evolving incident response
incident_data_input	This data flow is used within the Manage Traffic function to send processed traffic sensor data and data received from other traffic management centers (TMC's) from the Provide Traffic Surveillance facility to the Manage Incidents facility.
Incident_details	This data flow is sent from the Manage Emergency Services function to the Manage Traffic function and provides information about current incidents.
Incident_details_request	This data flow is used by the Manage Traffic function to request details of incidents from the Manage Emergency Services function.
Incident_response_clear	This data flow is sent from the Manage Traffic function to the Manage Emergency Services function and is an indication that the Manage Traffic function has data indicating that an incident has been cleared.
Incident_response_status	This data flow provides the current status of an incident response indicating site management strategies in effect, incident clearance status, the incident command structure that is in place, and points of contact.
Incident_status_data	This data flow is sent from the Manage Emergency Vehicle function to the Manage Emergency Response function. It provides detailed incident information gathered by emergency personnel at the incident site and contains detailed information which includes the number and extent of injuries, identification of vehicles and people involved, specification of hazardous material, and any other information required to completely and accurately determine the scope and severity of the incident and the required response.
Incident_information	This data flow is sent from the Manage Emergency Services function to the Provide Driver and Traveler Services function and contains information that has been requested about incidents.
Incident_video_for_ emergency_services	This data flow is used within the Manage Traffic function. It contains current video images of incidents requested by the Manage Emergency Services facility.
Local_schema	This data flow from the Manage Archive function contains the definition of the archive managed by the local process. The schema defines the structure of the archive database, including information such as the definition of objects within a database or how tables of data are related to each other as in a relational database.
Other_archive_data_input	This data flow from the Coordinate Archive function to the Manage Archive function contains the data and meta data from other archives. This data is sent based on requests from local user systems to retrieve data that is not located within the local archive. This request for data is to support the activities of mining or fusion of data across multiple archives.

Data Flow Name	Data Flow Description
Other_archive_data_request	This data flow from the Manage Archive function to the Coordinate Archive function contains the request for data that may be located in other archives. This data request is built based on requests from user systems to retrieve data that is not located within the local archive but is known to exist in other archives based on the global schema that is being maintained.
Other_archive_data_request_ input	This data flow from the Coordinate Archive function to the Manage Archive function contains the request from other archives for data that may be located in the local archive. This data request is built based on requests from user systems of other archives to retrieve data that is not located within their local archive. This request for data is to support the activities of mining or fusion of data across multiple archives.
Other_archive_data	This data flow from the Manage Archive function to the Coordinate Archives function contains data drawn from the archive data store that is to be sent to other archives as part of data mining or fusion activities across multiple archives. This data flow may also contain any meta data from the archive necessary to describe the data provided.
paratransit_personal_ schedule	This data flow is sent from the Manage Transit function to the Provide Driver and Traveler Services function.
paratransit_service_ confirmation	This data flow is sent by the Provide Driver and Traveler Services function to the Manage Transit function to confirm that the traveler wants to use the previously identified paratransit service.
paratransit_trip_request	This data flow is sent from the Provide Driver and Traveler Services function to the Manage Transit function to action a trip request using the paratransit operation.
pollution_state_data	This data flow is used within the Manage Traffic function as a means of transferring current pollution data from the Manage Emissions facility to the Manage Demand facility. It contains data about the current levels of pollution obtained from the store of pollution data.
Pollution_state_data_request	This data flow is used within the Manage Traffic function as a means of requesting current pollution data to be sent from the Manage Emissions facility to the Manage Demand facility. It contains request for data about current levels of pollution.
Remote_video_image_control	This data flow is used within the Manage Traffic function. It is a request from the Emergency Management function to control closed circuit televisions(cctv) images of incidents that occurred on roadways.
Request_erms	This data flow is sent from the Manage Traffic function to the Manage Emergency Services function.
Rideshare_information .	This data flow is used within the Provide Driver and Traveler Services function to transfer information about rideshare requests, rideshare routes and travelers, and requests for rideshare as part of a traveler's proposed trip request.
Rideshare_request_and_ confirmation	This data flow is used within the Provide Driver and Traveler Services function to transfer information about rideshare requests.

Data Flow Name	Data Flow Description
Roadside_archive_data	This data flow is sent from the Manage Traffic function to the Manage Archive Data function. It contains the roadside archive data stored in the Manage Traffic function along with the meta data describing the data as collected from field equipment. It consists of sensor data which includes the status of the sensors and detection of sensor faults.
Roadside_archive_control	This data flow from the Manage Archive Data function contains the request for data collected and stored by the Manage Traffic function. The request can be a request for a catalog of the data held by the function or a request for the data itself.
Retrieved_archive_data	This data flow from the Get Archive Data function contains the data from sources within ITS and outside ITS, i.e. terminators. This data includes the updated meta-data to indicate what formatting or other methods may have been applied to the data as it was imported.
Route_data	This data flow is used to transfer data between the Provide Driver and Traveler Services function and the Manage Traffic function. It contains a wide variety of data covering road network use by guided vehicles and requests for current traffic data which can be presented to travelers, as well as a traveler profile for subscription of data.
Sensor_parameters	This data flow is used within the Manage Traffic function to send data between the Provide Device Control and Provide Traffic Surveillance facilities.
To_C_and_M	This data flow is sent to the construction and maintenance terminator from the Manage Traffic function. It either confirms that the request for maintenance work sent in as a planned incident from the terminator has been accepted, or requests changes to the timing to minimize the impact on traffic flows, or contains reports about indicators that are faulty.
To_Commercial_Vehicle	This data flow is sent to a commercial vehicle from the Manage Commercial Vehicles function. It contains a request for data to be provided by the commercial vehicle for use within the function.
To_Commercial_Vehicle_ Driver	This data flow is sent to the commercial vehicle driver from the Manage Commercial Vehicle function and contains responses to requests for information or requests for further data to be input.
To_Commercial_Vehicle_ Manager	This data flow is sent to the commercial fleet manager from the Manage Commercial Vehicles function and contains data to be output to the manager.
To_Emergency_Personnel	This data flow is sent to the emergency personnel from the Manage Emergency Services function.
To_Event_Promoters	This data flow is sent from the Manage Traffic function to the event promoters terminator
To_Financial_Institution	This data flow is sent to the Financial Institution from the Provide Electronic Payment Services function and contains requests for payment to be made for services being requested by travelers or drivers, or details of those involved in bad transaction data.

Data Flow Name	Data Flow Description
To_Media	This data flow is sent by processes within the Manage Traffic, Manage Transit, and Manage Emergency functions to the Media System. It provides output of information on traffic flow conditions, traffic incidents, transit incidents and other emergencies, plus a request for traveler information. The output data can be based upon a specific request from the Media, or as part of a subscription service where information of a predefined type is automatically output to the Media.
To_Other_EM	This data flow is sent to the other emergency centers by the Manage Emergency Services function to advise then of incidents that are taking place in locations that are in the area served by the local function and hence outside their area of operations.
To_Payment_Instrument	This data flow is sent to the payment instrument by the Provide Electronic Payment Services function. It consists of two types of data, that which requests payment for a service fromthe credit stored by the instrument itself, and that which gives notice that payment for the service will be charged to the credit identity provided by the instrument.
To_Traffic_Operations_ Personnel	This data flow is used by various processes within the Manage Traffic function to send data on traffic conditions, weather conditions, incidents, incident responses, traffic and travel demand and pollution data to traffic operations personnel.
To_Transit_Driver	This data flow is sent by the Manage Transit function to the transit driver. It contains information for the transit driver. This information is particular to this type of driver and is not relevant to drivers of other types of vehicle(s).
To_Transit_Fleet_Manager	This data flow is sent from the Manage Transit function and contains output to a transit fleet manager.
To_Wayside_Equipment	This data flow represents information for trains or hi-rail vehicles approaching a specific highway grade crossing and their crews. It is provided by HRI traffic control elements to rail owned and operated wayside interface equipment (train signaling circuits, automatic control interfaces, local connections to centralized sites via railroad communications networks, etc.). This is a time critical flow and requires the most direct communications path available to a train approaching a grade crossing.
Traffic_data_flow	This data flow is sent from the Manage Traffic function to the Provide Driver and Traveler Services function. It contains traffic data either to be provided direct to travelers or for use by the route guidance and route selection processes, or for archival.
Traffic_data_demand_request	This data flow is used within the Manage Traffic function to provide the Manage Demand facility with current, historic and predictive traffic data.
Traffic_data_for_broadcast_ to_personal_devices	This data flow is used to provide broadcast data on the traffic flowing in the road network, plus that which is predicted to flow in the network for output to a traveler's personal device. This subset of the full data will depend on the route segment list included in the request.
Traffic_data_for_emergency_ services	This data flow is used within the Manage Traffic function and contains current traffic information and roadway environmental conditions for the emergency management system.

Data Flow Name	Data Flow Description
Traffic_data_for_personal_devices	This data flow is used to provide data on the traffic flowing in the road network, plus that which is predicted to flow in the network for output to a traveler's personal device. This subset of the full data will depend on the route segment list included in the request.
Traffic_data_for_transit	This data flow contains information about environmental conditions, current incidents on the road, traffic flow state, and air quality data.
Traffic_management_archive_data	This data flow is sent from the Manage Traffic function to the Manage Archive Data function. It is used to provide data on the traffic flowing in the road network, which includes current, predicted, and historical data. It also provides data on video images and operational data.
Traffic_management_archive_request	This data flow from the Manage Archived Data function contains the request for data collected and stored by the Manage Traffic function. The request can be a request for a catalog of the data held by the function or a request for the data itself.
Traffic_management_archive_status	This data flow is sent from the Manage Archived Data function to the Manage Traffic function. It is the status returned when traffic archive data is sent from the Manage Traffic function to the Manage Archived Data function.
Traffic_surveillance_data	This data flow represents highway traffic management surveillance information that is relevant to local ITS railroad grade crossing traffic management (e.g. stalled vehicles within crossings, crossing signal malfunctions, unusual traffic, detected incidents, etc.).
Transit_archive_data	This data flow from Manage Transit to Manage Archive Data contains the archive data stored in the Manage Transit function along with the meta data describing the data as collected from field equipment. This data can include a catalog of the data held by the function. This data flow is made up of transit passenger operational data, transit deployment data, transit user payment data, transit emergency data, transit security data, maintenance and personnel data.
Transit_archive_data_request	This data flow from the Manage Archive Data function to the Manage Transit function contains the request for the data held by the Manage Transit function. The request for data may include the description of the data required or a time frame over which the requested information may be available.
Transit_archive_status	This data flow is sent from the Manage Archived Data function to the Manage Transit function. It is the status returned when transit archive data is sent from the Manage Transit function to the Manage Archived Data function.
Transit_conditions_guidance_request	This data flow is sent from the Provide Driver and Traveler Services function to the Manage Transit function. It is used to request details of the current state of transit vehicle operations for use in the preparation of data for on-line driver and traveler guidance.
Transit_conditions_advisories_request	This data flow is sent from the Provide Driver and Traveler Services function to the Manage Transit function. It is used to request details of the current state of transit vehicle operations for use in the preparation of data for driver and traveler advisories.
Transit_deviations_for_personal_devices	This data flow contains current transit service deviations for a particular route. This data will be output to a traveler's personal device.

Data Flow Name	Data Flow Description
Transit_deviations_for_ broadcast_to_personal_ devices	This data flow contains current transit service deviations for a particular route. This data will be broadcast to a traveler's personal device.
Transit_fare_data	This data flow is used within the Provide Electronic Payment Services function and contains details of the fares being currently charged for transit services.
Transit_fare_data_request	This data flow is used within the Provide Electronic Payment Services function. It contains a request for the current transit fare price data to be provided from the store that is being used to calculate transit fares.
Transit_fare_details	This data flow is sent from the Provide Electronic Payment Services function to the Manage Traffic function and contains details of the fares being currently charged for transit services.
Transit_fare_request	This data flow is sent from the Manage Traffic function to the Provide Electronic Payment Services function and contains a request for the current prices being charged for transit fares.
Transit_fare_transactions	This data flow is used by processes in the Manage Transit function and contains records of transit fare payment transactions.
Transit_inputs	This data flow is sent from the Manage Transit function to the Manage Traffic function and contains information about the operation of transit vehicles, requests for preemption at signalized intersections and the response to requests for changes in transit services that have been made to help redistribute traveler demand.
Transit_probe_data	This data flow contains the location of the transit vehicle on each part of its route, i.e., each transit route segment. This data will be used along with other probe data to calculate the link speed or travel time. Transit probe information can be provided by fixed route, flexibly routed, and para-transit services.
Transit_roadway_priority_ given	This data flow is sent from the Manage Traffic function to the Manage Transit function. It contains confirmation that the overall priority requested for one or more transit vehicles throughout the road and freeway network served by the function has been given.
transit_incident_coordination_dat a	This data flow is sent from the Manage Emergency Services function to the Manage Transit function and contains information needed to deal with a transit related incident.
Transit_coordination_data	This data flow is sent from the Manage Transit function to the Manage Emergency Services function. It is used to provide data on the way in which the response to a transit incident should be coordinated.
Transit_incident_details	This data flow is sent from the Manage Transit function to the Manage Emergency Services function and contains details of an incident in the transit operations network.
Transit_emergency_data	This data flow is sent from the Manage Transit function to the Manage Emergency Services function and contains details of an emergency on-board a transit vehicle.

Data Flow Name	Data Flow Description
Transit_running_data_for_ advisories	This data flow is used within the Provide Driver and Traveler Services function. It contains data on the current state of transit operations for use in driver and transit user advisory output messages. The messages will only contain data that is relevant to the vehicle's current location.
Transit_running_data_for_ guidance	This data flow is sent from the Manage Transit function to the Provide Driver and Traveler Services function. It is used to provide data on the current state of transit operation for use in preparing driver and traveler on-line guidance data
transit_services_demand_ request	This data flow is sent from the Manage Traffic function to the Manage Transit function. It is a request for supply of details of the transit services and will be used in the preparation of demand forecasts by the Manage Demand facility.
Transit_services_for_demand	This data flow is sent from the Manage Transit function to the Manage Traffic function. It contains a complete set of all the transit routes and the services that run upon them, including timings, etc. that are provided by the transit fleet from which the data was requested, for use in the calculation of demand forecasts by the Manage Demand facility.
Transit_services_for_eta	This data flow is used within the Manage Transit function. It is sent to the Operate Transit Vehicles facility for use in the calculation of transit vehicle estimated times of arrival (eta) at transit stops. It only contains details of the schedule for the transit route that is currently being operated by the vehicle.
Transit_services_for_ corrections	This data flow is used within the Manage Transit function. It is sent to the Operate Transit Vehicles facility for use in the calculation of corrections to transit vehicle routes and schedules to restore a service to normal operation. It contains a complete set of all the transit routes and the services that run upon them, including timings, etc. that are provided by the transit fleet from which the data was requested.
Transit_services_travelers_ request	This data flow is used within the Manage Transit function to request the details of the current transit services for a transit user at the roadside. The transit user will have to provide the origin and destination so that the receiving process can work out for which transit route(s) data will be provided.
Transit_user_advanced_ payment_on_vehicle	This data flow is sent from the Manage Transit function to the Provide Electronic Payment Services function. It contains the cost of advanced payments that must be deducted from the credit currently stored on the payment instrument being used by a transit user on-board a transit vehicle. These advanced payments may cover tolls, and/or parking lot charges, and/or transit fares.
Transit_user_vehicle_credit_ identity	This data flow is sent from the Provide Electronic Payments Services function to the Manage Transit function and contains the credit identity of a transit user on-board a transit vehicle, or a stored credit value. Either data item is obtained by a process within the Provide Electronic Payment Services function as data input from the payment instrument terminator
transit_updates	This data flow is sent from the Manage Traffic function to the Manage Transit function and contains traffic data for use in transit operations, requests for information on transit services, or requests for changes to transit services to try and re-distribute traveler demand.
Transit_vehicle_arrival_time	This data flow is used within the Manage Transit function. It contains the estimated time of arrival of a transit vehicle at a stop plus the route and service number on which it is operating.

Data Flow Name	Data Flow Description
Transit_vehicle_availability	This data flow is used within the Manage Transit function and contains details of a transit vehicle's availability for work.
Transit_vehicle_eta_for_ advisory	This data flow is used as an interface between the Manage Transit and Provide Driver and Traveler Information functions. It contains the estimated time of arrival of a transit vehicle at the end of a transit route segment, which is usually a stop, plus the route and service number on which it is operating.
Transit_vehicle_location	This data flow is used within the Manage Transit function to provide the exact location of the transit vehicle.
Transit_vehicle_fare_data	This data flow is sent by the Provide Electronic Payment Services function to the Manage Transit function and contains details of the fares being currently charged for regular transit services. It is for use in calculating fares that are to be paid by transit users on-board a transit vehicle
transit_vehicle_passenger_ data	This data flow is used within the Manage Transit function and contains the number of passengers carried by a transit vehicle while in service. It is derived from on-board vehicle fare collection data and may be used for calculating future transit schedules.
Transit_vehicle_roadway_ preemptions	This data flow is sent from the Manage Transit function to the Manage Traffic function and contains data necessary for an individual transit vehicle to be given preemption (priority) at indicator controllers. This will be at the controller for a particular road junction, pedestrian crossing, or highway entrance ramp. The data is sent directly from the transit vehicle to the next controller along its route and therefore is not subject to any centralized coordination. Local coordination may be provided if there are links between adjacent controllers.
Transit_vehicle_user_data	This data flow is used within the Manage Transit function and contains data about a transit vehicle for automatic output to transit users at transit stops. The data is output at the transit stop as the vehicle approaches and contains information about the vehicle such as the route number.
Traveler_traffic_profile	This data flow contains a traveler's personal profile for obtaining traffic information. This profile is submitted one time and then used to generate future personalized trip information. This profile supports a subscription type of information dissemination to the traveler.
Trip_planning_data	This data flow is used within the Provide Driver and Traveler Services function to transfer data between the Provide Guidance and Trip Planning Services facility and the Manage Trip Planning and Ridesharing facility, as well as provide route information to the data archive.
Unusual_congestion	This data flow is used within the Manage Traffic function and identifies places in the road network at which unusual congestion has been detected.
Vehicle_location_for_ emergencies	This data flow is used within the Provide Driver and Traveler Services function. It contains the vehicle's location as computed from data input to sensors controlled by the processes that determines vehicle location. This is a high precision data flow that enables the location of the vehicle to be pin-pointed to a high degree of accuracy and is used to provide the destination for the emergency services when they respond to an emergency call-out message generated on-board a vehicle by its driver.

Data Flow Name	Data Flow Description
vehicle_location_for_transit	This data flow is sent from the Provide Driver and Traveler Services function to the Manage transit function. It contains the vehicle's location as computed from data input to sensors controlled by the processes that determine vehicle location. This is a low precision data flow that will be refined using data obtained from on-board the transit vehicle.
vehicle_pollution_alert	This data flow is used by the Manage Traffic function as a means of transferring current vehicle pollution data from the Manage Emissions facility to the Manage Emergency Services function to enable enforcement of air quality standards. It contains data about the current levels of pollution being output by a vehicle.
vehicle_status_details_for_ emissions	This data flow is sent from the Provide Vehicle Control and Monitoring function to the Manage Traffic function. It contains the operational status of the vehicle which is important because the levels of pollution vary according to how long the vehicle has been running, i.e. how warm is the engine, and what it is actually doing, e.g. is it stationary, or pulling away from a stop.
weather_service_information	This data flow consists of weather information that is provided by the Provide Driver and Traveler Services and Manage Traffic functions and is sent to the Provide Traffic Operations Personnel Traffic Data Interface.
weather_service_information_req uest	This data flow requests weather information from the Provide Driver and Traveler Services and Manage Traffic functions. The data requested will provide weather conditions for the Provide Traffic Operations Personnel Traffic Data Interface.
wide_area_pollution_data	This data flow is used within the Manage Traffic function as a means of transferring current pollution data from the Manage Emis sions facility to the Provide Traffic Surveillance facility. It contains data about the current levels of pollution obtained from the store of pollution data in the area covered by the Traffic Management Center

APPENDIX D

THURSTON REGION MARKET PACKAGE DESCRIPTIONS

Market Package	Description
Traffic and Transportation Management Market Packages	
Network Surveillance (ATMS01)	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 operated by WSDOT's Tacoma TOC. The derived data can be used locally such as when traffic detectors are connected directly to a signal control system or remotely (e.g., when a CCTV system sends data back to the Tacoma TOC). The data generated by this market package enables traffic managers to monitor traffic and road conditions, identify and verify incidents, detect faults in indicator operations, and collect census data for traffic strategy development and long range planning. The collected data can also be analyzed and made available to users and the Information Service Provider Subsystem.
Probe Surveillance (ATMS02)	This market package provides an alternative approach for surveillance of the roadway network. The implementation path supported by this market package includes the wide-area wireless communications between the vehicle (could be a personal vehicle or a county maintenance crew) and Information Service Provider (could be the Thurston County Roads and Maintenance, and the Tacoma TOC) used to communicate current vehicle location and status. The market package enables traffic managers to monitor road conditions, identify incidents, analyze and reduce the collected data, and make it available to users and private information providers. It requires one of the communications options identified above, roadside beacons and wire-line communications for the short range communications option, data reduction software, and utilizes wire-line links between the Traffic Management Subsystem and Information Service Provider Subsystem to share the collected information.
Surface Street Control (ATMS03)	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 in the Thurston region. A range of traffic signal control systems are represented by this market package ranging from static pre-timed control systems to fully traffic responsive systems that dynamically adjust control plans and strategies based on current traffic conditions and priority requests. Implementing centers in this market package include the local streets and signal systems that are operated by Thurston County and the regional cities of Olympia, Lacey and Tumwater along with some signals that are maintained and operated by WSDOT. This market package is generally an intra-jurisdictional package that does not rely on real-time communications between separate control systems to achieve area-wide traffic signal coordination. Systems that achieve coordination across jurisdictions by using a common time base or other strategies that do not require real time coordination would be represented by this package. This market package is consistent with typical urban traffic signal control systems.
Freeway Control (ATMS04)	This market package provides the communications and roadside equipment to support ramp control, lane controls, and interchange control for freeways mainly operated by WSDOT. Coordination and integration of ramp meters are included as part of this market package. This package is consistent with typical urban traffic freeway control systems. This package incorporates the instrumentation included in the Network Surveillance Market Package to support freeway monitoring and adaptive strategies as an option. This market package also includes the capability to utilize surveillance information for detection of incidents operated by the Tacoma TOC.

Market Package	Description
Traffic Information Dissemination (ATMS06)	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 operated by WSDOT. This package provides a tool that can be used to notify drivers of incidents by using portable DMS operated and maintained by Thurston County at selected roadway locations to provide information to travelers to take alternate routes and make better travel decisions. This package also covers the equipment and interfaces that provide traffic information from the Tacoma TOC to the media (for instance via a direct tie-in between a traffic management center and radio or television station computer systems), transit management center, emergency management center, and information service provider.
Regional Traffic Control (ATMS 07)	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 the WSDOT traffic management centers, Thurston county, adjoining counties of Pierce and Lewis, and all the regional cities to support a regional control strategy. The nature of optimization and extent of information and control sharing is determined through working arrangements between the stakeholders and jurisdictions in the Thurston region. This package relies principally on roadside instrumentation supported by the Surface Street Control and Freeway Control Market Packages and adds hardware, software, and wire line communications capabilities to implement traffic management strategies that 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.
Incident Management (ATMS 08)	This market package manages both predicted and unexpected incidents so that the impact to the transportation network and traveler safety is minimized. Requisite incident detection capabilities are included in the freeway control market package and through the regional coordination with other traffic management and emergency management centers, weather service entities, and event promoters supported by this market package. Information from these diverse sources are collected and correlated by this market package to detect and verify incidents and implement an appropriate response. In the Thurston Region, the day-to-day operations of incident management, including detection, response and clearance will be performed by the Thurston County E911 Call Center, Washington State Patrol and the Local Police and Fire. In the case of exceptional incident management, which includes situational conditions like earthquakes, the Thurston County EOC takes over emergency management operations of incident management. This market package provides Traffic Management Subsystem equipment that supports traffic operations personnel in developing an appropriate response in coordination with emergency management and other incident response personnel to confirmed incidents. The response may include traffic control strategy modifications and presentation of information to affected travelers using the Traffic Information Dissemination market package. The same equipment assists the operator by monitoring incident status as the response unfolds. The coordination with emergency management might be through a CAD system like the Thurston County E911 System or through other communication with emergency field personnel. The coordination can also extend to tow trucks and other field service personnel.

Market Package	Description
Traffic Forecast and Demand Management (ATMS 09)	This market package includes advanced algorithms, processing, and mass storage capabilities that support historical evaluation, real-time assessment, and forecast of the roadway network performance managed by WSDOT. This includes the prediction of travel demand patterns to support better link travel time forecasts. The source data would come from the WSDOT TMCs as well as other traffic management centers like the Thurston County Roads and regional city traffic departments. In addition to short-term forecasts, this market package provides longer range forecasts that can be used in transportation planning that can be useful to the Thurston Regional Planning Council (TRPC) and other MPOs in the region. This market package provides data that supports the implementation of TDM programs, and policies managing both traffic and the environment.
Emissions Monitoring and Management (ATMS11)	This market package monitors individual vehicle emissions and provides general air quality monitoring using distributed sensors to collect the data. The collected information is transmitted to the emissions management subsystem for processing. The Thurston Urban Region has been designated by the Environmental Protection Agency (EPA) as a PM10 non-containment area and TRPC is very involved in air-quality modeling and emissions projects to maintain the air quality standards in the county. Both individual detection and identification of vehicles that exceed emissions standards and general area-wide monitoring of air quality are supported by this market package. For area wide monitoring, this market package measures air quality, identifies sectors that are non-compliant with air quality standards, and collects, stores and reports supporting statistical data. For point emissions monitoring, this market package measures tail pipe emissions and identifies vehicles that exceed emissions standards. The gathered information can be used to implement environmentally sensitive TDM programs, policies, and regulations.
Virtual TMC and Smart Probe Data (ATMS 12)	This market package provides for special requirements of rural road systems. Instead of a central TMC, the traffic management is distributed over a very wide area (e.g., a whole state or collection of states). Each locality has the capability of accessing available information for assessment of road conditions. The package uses vehicles like the Thurston county snow and maintenance as smart probes that are capable of measuring road conditions and providing this information to the roadway for relay to the Traffic Management Subsystem, in this case the Thurston County.
Standard Railroad Grade Crossing (ATMS 13)	This market package manages roadway traffic at highway-rail intersections (HRIs) where operational requirements do not dictate more advanced features (e.g., where rail operational speeds are less than 80 miles per hour). Both passive (e.g., the crossbuck sign) and active warning systems (e.g., flashing lights and gates) are supported. (Note that passive systems exercise only the single interface between the roadway subsystem and the driver in the architecture definition.) These traditional HRI warning systems may also be augmented with other standard traffic management devices. The warning systems are activated on notification by interfaced wayside equipment of an approaching train. The equipment at the HRI may also be interconnected with adjacent state, county or city signalized intersections so that local control can be adapted to highway-rail intersection activities (e.g., temporary alteration of upstream signal timing patterns).

Market Package	Description
Advanced Railroad Grade Crossing (ATMS 14)	This market package manages roadway traffic at highway-rail intersections (HRIs) where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour—such as the operation of the ***Talgo*** passenger service on the High Speed Ground Transportation (HSGT) corridor paralleling I-5 in Washington and Oregon). This market package includes all capabilities from the Standard Railroad Grade Crossing Market Package and augments these with additional safety features to mitigate the operational risks associated with higher rail speeds. The active warning systems supported by this market package include positive barrier systems that preclude entrance into the highway-rail intersection when the barriers are activated. Like the Standard Package, the HRI equipment is activated on notification by wayside interface equipment which detects, or communicates with the approaching train. In this market package, additional information about the arriving train is also provided by the wayside interface equipment so that the train's direction of travel, its estimated time of arrival, and the estimated duration of closure may be derived. This enhanced information may be conveyed to the driver prior to, or in context with, warning system activation. This market package also includes additional detection capabilities which enable it to detect an entrapped or otherwise immobilized vehicle within the HRI and provide an immediate notification to highway and railroad officials.
Railroad Operations Coordination (ATMS 15)	This market package provides an additional level of strategic coordination between rail operations and traffic management centers. Rail operations coordination provides for the integration of train schedules, maintenance schedules, and any other forecasted events that will result in highway-rail intersection (HRI) closures. This information is used to develop forecast HRI closure times and durations which may be used in advanced traffic control strategies or to enhance the quality of traveler information.
Road Weather Information System (ATMS 18)	This market package monitors current and forecast road and weather conditions using a combination of weather service information and data collected from environmental sensors deployed on and about the roadway. WSDOT currently operates and maintains several Road Weather Information Systems (RWIS) in the state and in Thurston County. The collected road weather information is monitored and analyzed to detect and forecast environmental hazards such as icy road conditions, dense fog, and approaching severe weather fronts. This information can be used to effectively deploy road maintenance resources, issue general traveler advisories, and support traffic information dissemination to travelers through several broadcast media like message signs, highway advisory radio and through the ***rWeather*** website.
Public Transportation Management Market Packages	
Transit Vehicle Tracking (APTS1)	This market package provides for an Automated Vehicle Location System to track Intercity transit vehicle's real time schedule adherence and updates the transit system's schedule in real-time. Vehicle position may be determined either by the vehicle (e.g., through GPS) and relayed to the infrastructure or may be determined directly by the communications infrastructure. A two-way wireless communication link (e.g., Advanced Radio Communication System) with Intercity Transit is used for relaying vehicle position and control measures. Intercity Transit can process this information, update the transit schedule and make real-time schedule information available to the Puget Sound Traveler Information System via a wire-line link.

Market Package	Description
Transit Fixed Route Operations (APTS2)	This market package performs automatic driver assignment and monitoring, as well as vehicle routing and scheduling for Intercity Transit fixed-route services. This service uses the existing AVL database as a source for current schedule performance data, and is implemented through data processing and information display at Intercity Transit center. This data is exchanged using the existing wire-line link to the information service provider, like the Puget Sound Regional Traveler Information System, where it is integrated with that from other transportation modes to provide the public with integrated and personalized dynamic schedules.
Demand Response Transit Operations (APTS3)	This market package performs automatic driver assignment and monitoring as well as vehicle routing and scheduling for demand response transit services provided by Intercity Transit and special needs transportation services. This package uses the existing AVL database to monitor current status of the transit fleet and supports allocation of these fleet resources to service incoming requests for transit service while also considering traffic conditions. Intercity Transit center provides the necessary data processing and information display to assist the transit operator in making optimal use of the transit fleet. The Information Service Provider Subsystem may either be operated by transit management center or be independently owned and operated by a separate service provider. In the first scenario, the traveler makes a direct request to a specific para-transit service. In the second scenario, a third party service provider, like the Area for Coordinated Council for Transportation (ACCT) determines which para-transit service is a viable means of satisfying a traveler request and uses wire-line communications to make a reservation for the traveler.
Transit Passenger and Fare Management (APTS4)	This market package allows for the management of passenger loading and fare payments onboard Intercity transit vehicles using electronic means (e.g., automatic passenger counter and fare card). 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 onboard the transit vehicle to allow fare payment. Data is processed, stored, and displayed on the transit vehicle and communicated as needed to the Intercity transit center using wireless infrastructure.
Transit Security (APTS5)	This market package provides for the physical security of transit passengers. An onboard security system is deployed to perform surveillance and warn of potentially hazardous situations. Public areas (e.g. stops, park and ride lots, stations) are also monitored. Information is communicated to the Intercity transit center using the existing or emerging wireless (vehicle to center) or wire-line (area to center) infrastructure. Security related information is also transmitted to the Thurston County E911 Call Center or the Local Police when an emergency is identified that requires an external response.
Transit Maintenance (APTS6)	This market package supports automatic maintenance scheduling and monitoring. Onboard condition sensors monitor critical system status and transmit critical status information to the Intercity transit center. Hardware and software in the transit center processes these data and schedules maintenance activities.

Market Package	Description
Multi-Modal Coordination (APTS7)	This market package establishes two-way communications between the regional transit agencies of Intercity Transit and Pierce Transit, and traffic agencies like Thurston County and Tacoma TOC, to improve service coordination. Inter-modal 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. More limited local coordination between the transit vehicle and the individual city arterial intersection for signal priority is also supported by this package.
Transit Traveler Information (APTS8)	This market package provides Intercity transit users at transit stops and onboard 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 (computerized Telephone Information System) are also represented by this market package.
Electronic Payment Market Package	
Electronic Fee/Payment Collection (ATMS10)	This market package provides means for electronic fee collections and payment services for Intercity transit and other transportation systems like the special needs transportation services. Dedicated short range communication between the roadway equipment and the vehicle is required as well as wireline interfaces between transit agencies and the financial infrastructure that supports fee collection.
Traveler Services Market Packages	
Broadcast Traveler Information (ATIS1)	This market package provides the user with a basic set of ATIS services; its objective is early acceptance. It involves the collection of traffic conditions, advisories, and general public transportation and includes the real-time dissemination of this information over a wide area through existing infrastructures and low cost user equipment (e.g., FM sub-carrier, cellular data broadcast) and through commercial media broadcast. Different from the market package ATMS6--Traffic Information Dissemination -- that provides the more basic HAR and DMS information capabilities, ATIS1 provides the more sophisticated digital broadcast service. Successful deployment of this market package relies on availability of real-time transportation data from the Tacoma TOC on the roadway conditions in the surrounding area and dissemination of this information through an efficient mechanism like the established Puget Sound regional traveler information system. However, wireless services such as FM sub-carrier broadcast and cellular data broadcast generally require public/private partnerships.

Market Package	Description
Interactive Traveler Information (ATIS2)	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. The traveler can obtain current information regarding traffic conditions, transit services, and ride share/ride match information. These services are likely to be provided by the Puget Sound Regional Traveler Information System for travelers in the Thurston region. A range of two-way wide-area wireless and wire-line communications systems may be used to support the required digital communications between traveler and the information service provider. A variety of interactive devices may be used by the traveler to access information prior to a trip or en-route; including phone, Personal Digital Assistant, and a personal computer. Successful deployment of this market package relies on availability of real-time transportation data from the Tacoma TOC and other regional counties and cities.
Freight Mobility Market Packages	
Fleet Administration (CVO1)	This market package keeps track of vehicle location, itineraries, and fuel usage at the Fleet and Freight Management Subsystem using a cell based or satellite data link and the pre-existing wireless infrastructure. The vehicle has a processor to interface to its sensor (e.g., fuel gauge) and to the cellular data link. The Fleet and Freight Management Subsystem can provide the vehicle with dispatch instructions, and can process and respond to requests for assistance and general information from the vehicle via the cellular data link. The market package also provides the Fleet Manager, WSDOT Commercial Vehicle Operations, with connectivity to intermodal transportation providers using the existing wire-line infrastructure.
Electronic Clearance (CVO3)	This market package provides for automated clearance at roadside check facilities. The roadside check facility communicates with Washington State Patrol CVO sites over wire-line to retrieve infrastructure snapshots of critical carrier, vehicle, and driver data to be used to sort passing vehicles. This package allows a good driver/vehicle/carrier to pass roadside facilities at highway speeds using transponders and dedicated short range communications to the roadside. The roadside check facility may be equipped with AVI, weighing sensors, transponder read/write devices, and computer workstation processing hardware, software, and databases.
CV Administrative Processes (CVO4)	This market package provides for electronic application, processing, fee collection, issuance, and distribution of CVO credential and tax filing. Through this process, carriers, drivers, and vehicles may be enrolled in the electronic clearance program provided by a separate market package which allows commercial vehicles to be screened at mainline speeds at commercial vehicle check points operated by Washington State Patrol. Through this enrollment process, current profile databases are maintained in the Commercial Vehicle Administration Subsystem and snapshots of this database are made available to the commercial vehicle check facilities at the roadside to support the electronic clearance process.

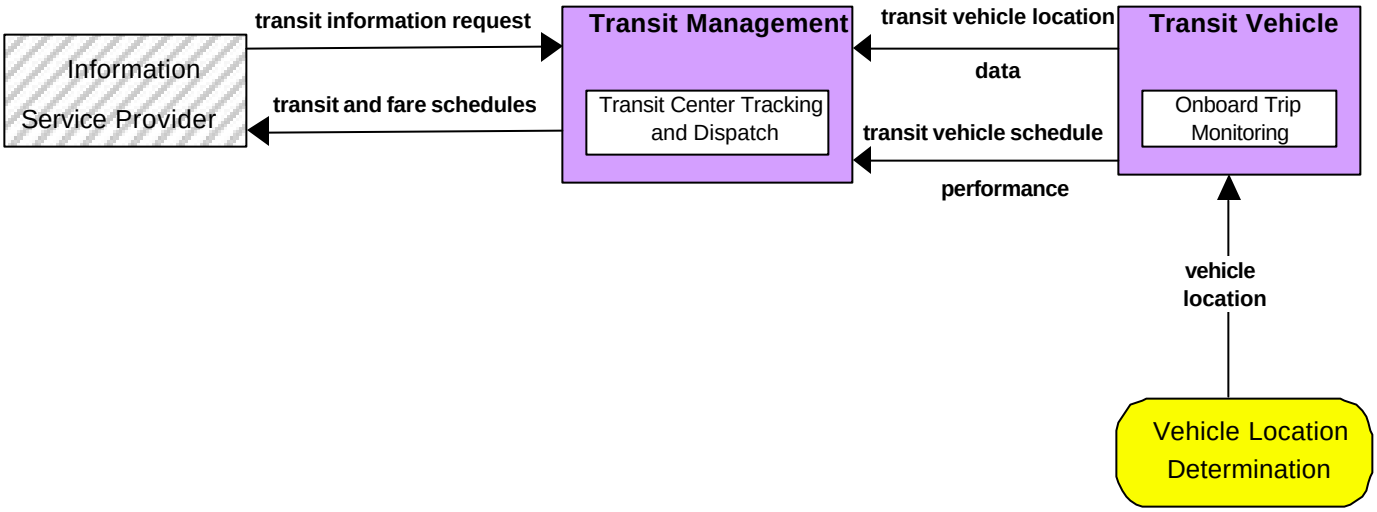
Market Package	Description
CVO Fleet Maintenance (CVO9)	This market package supports maintenance of CVO fleet vehicles through close interface with on-board monitoring equipment and AVLS capabilities with in the Fleet and Freight Management Subsystem operated by Washington State Patrol in coordination with WSDOT Commercial Vehicle Division. Records of vehicle mileage, repairs, and safety violations are maintained to assure safe vehicles on the highway.
Emergency Management Market Packages	
Emergency Response (EM1)	This market package provides the computer-aided dispatch systems, emergency vehicle equipment, and wireless communications that enable safe and rapid deployment of appropriate resources to an emergency. Coordination between the Thurston County E911 Call Center, Washington State Patrol, and the local police and fire supports emergency notification and coordinated response between agencies. Existing wide area wireless communications would be utilized between these agencies and their Emergency Vehicles to enable an incident command system and provide support at the emergency location. The emergency centers in the Thurston area would include hardware and software for tracking the emergency vehicles.
Emergency Routing (EM2)	This market package supports dynamic routing of Thurston County emergency vehicles and coordination with the Washington State Patrol for special priority on the selected route(s). In this market package, the Information Service Provider Subsystem would typically be integrated with the Emergency Management Subsystem in a public safety communications center. The Emergency Vehicle would also optionally be equipped with dedicated short range communications for local signal preemption.
Mayday Support (EM3)	This package allows the user (driver or non-driver) to initiate a request for emergency assistance and enables the Thurston County E911 Call Center to locate the user and determine the appropriate response. The request from the traveler needing assistance may be manually initiated or automated and linked to vehicle sensors. The data is sent to the Emergency Management subsystem using wide area wireless communications with voice as an option. Providing user location implies either a location technology within the user device or location determination within the communications infrastructure.
Information Storage and Management Market Packages	
ITS Data Mart (AD1)	This market package provides a focused archive that houses data collected and owned by Thurston County, WSDOT, and other regional cities. 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. It provides the basic data quality, data privacy, and meta-data management common to all ITS archives and provides general query and report access to archive data users.

Market Package	Description
ITS Data Warehouse (AD2)	This market package includes all the data collection and management capabilities provided by the ITS Data Mart, managed by the individual counties, cities and WSDOT, and adds the functionality and interface definitions that allow collection of data from Thurston County, regional cities, Thurston County Emergency Services, and Intercity Transit. It performs the additional transformations and provides the additional meta-data management features that are necessary so that all this data can be managed in a single repository with consistent formats. The potential for large volumes of varied data suggests additional on-line analysis and data mining features that are also included in this market package in addition to the basic query and reporting user access features offered by the ITS Data Mart.
ITS Virtual Data Warehouse (AD3)	This market package provides the same broad access to multi-modal, multidimensional data from varied data sources as in the ITS Data Warehouse Market Package, but provides this access using enhanced interoperability between physically distributed ITS archives that are each locally managed. Requests for data that are satisfied by access to a single repository in the ITS Data Warehouse Market Package are parsed by the local archive and dynamically translated to requests to remote archives which relay the data necessary to satisfy the request.

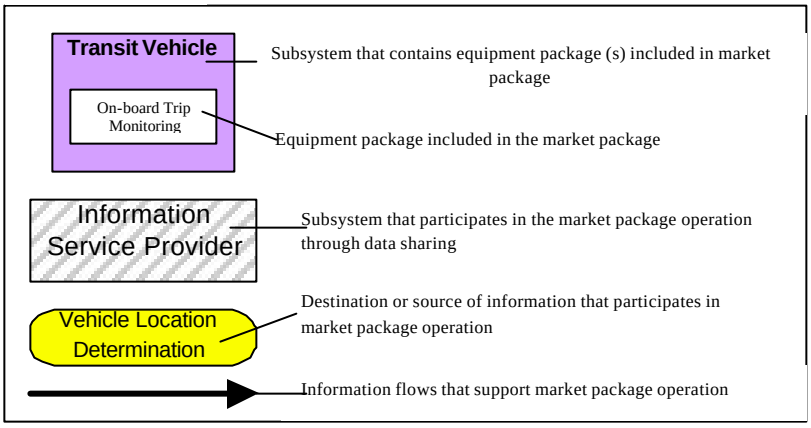
APPENDIX E

THURSTON REGION MARKET PACKAGE DIAGRAMS

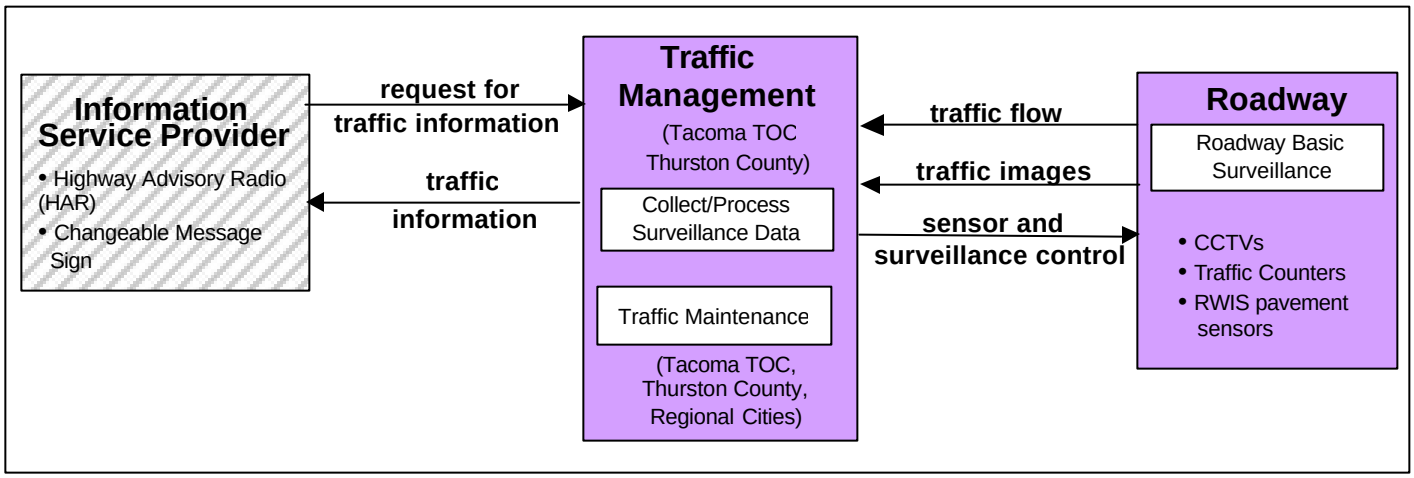
AN EXAMPLE OF A TYPICAL MARKET PACKAGE DIAGRAM AND ITS COMPONENTS



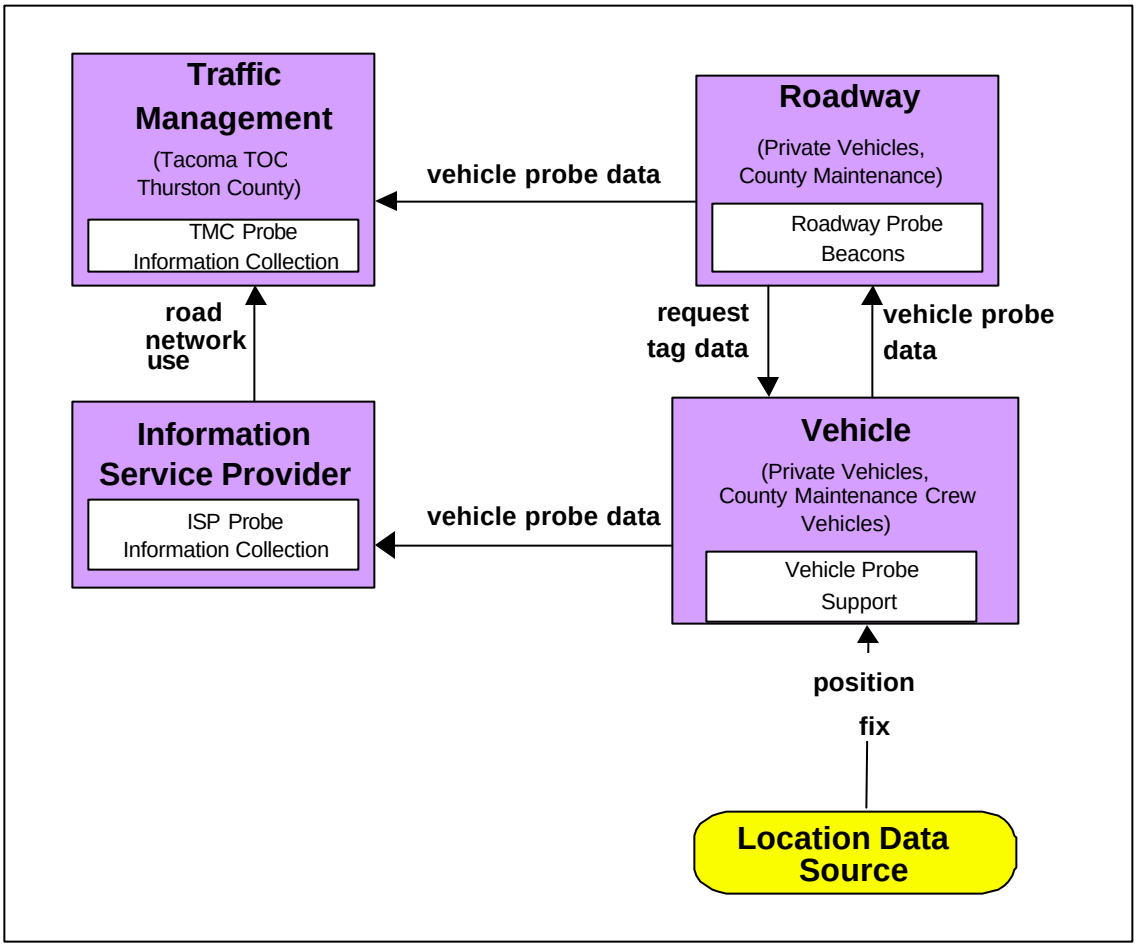
LEGEND



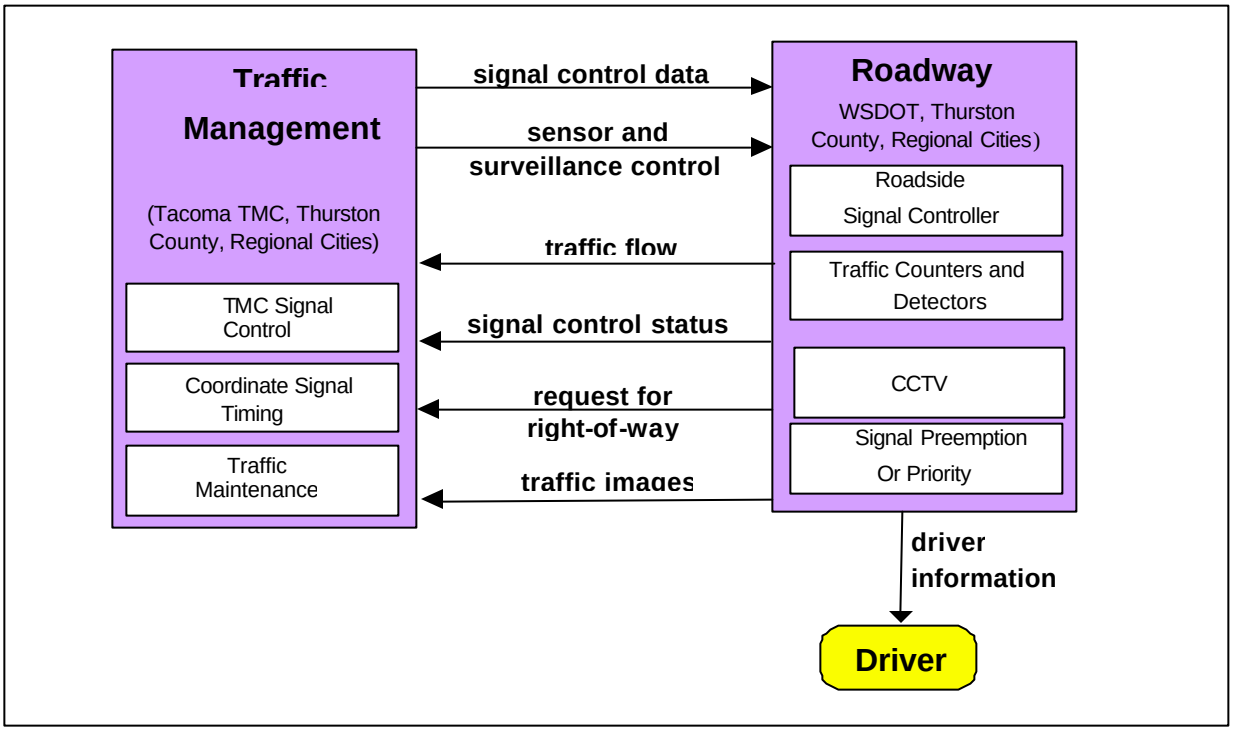
ATMS01: NETWORK SURVEILLANCE



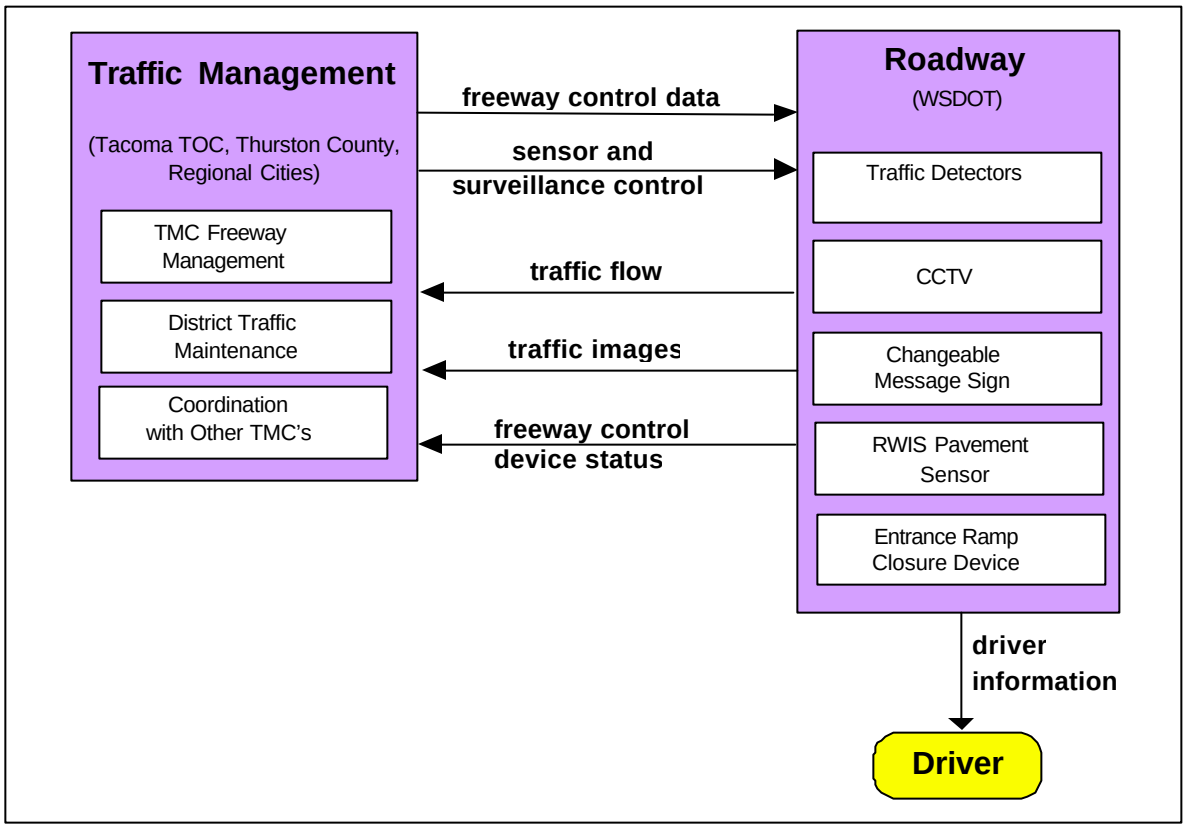
ATMS02: PROBE SURVEILLANCE



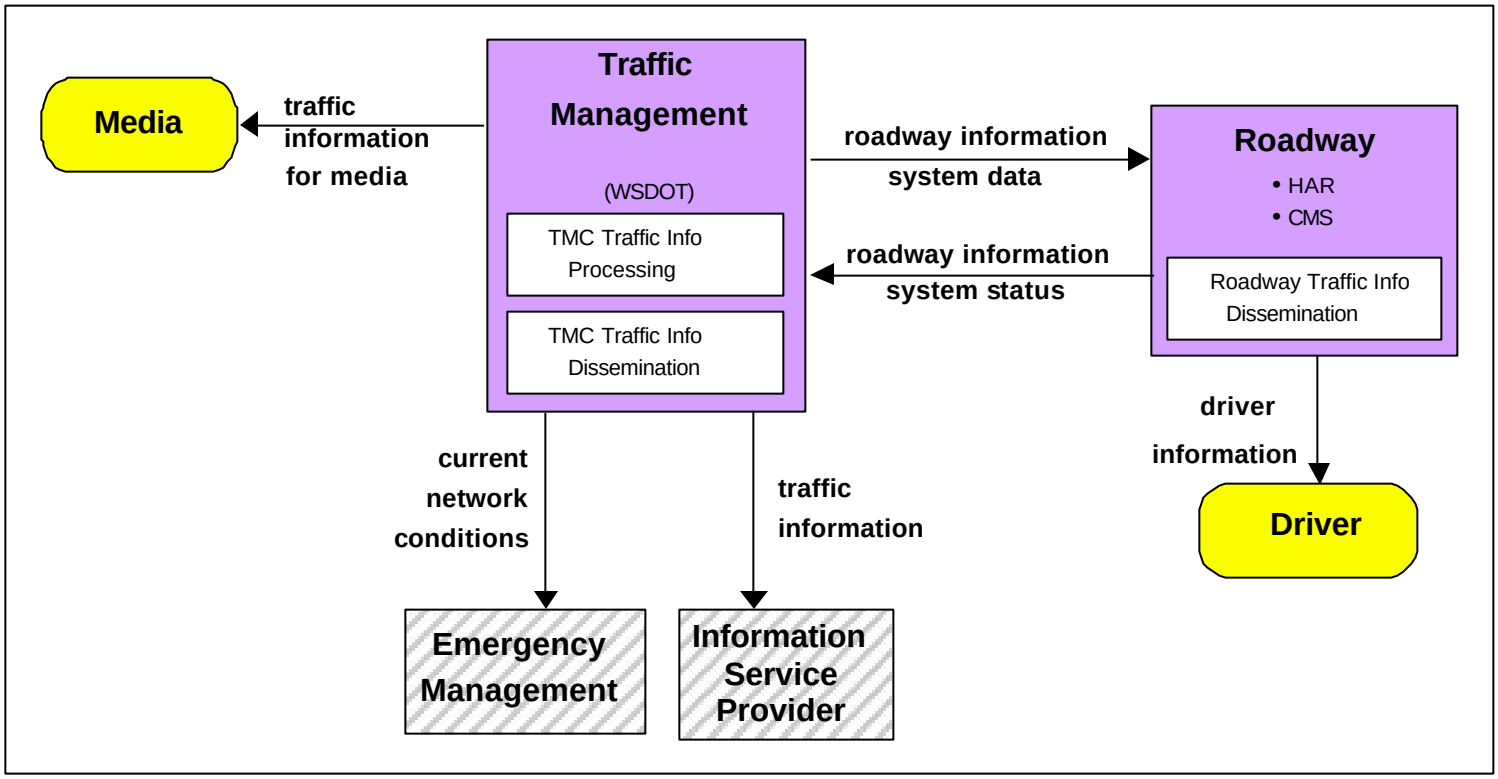
ATMS03: SURFACE STREET CONTROL



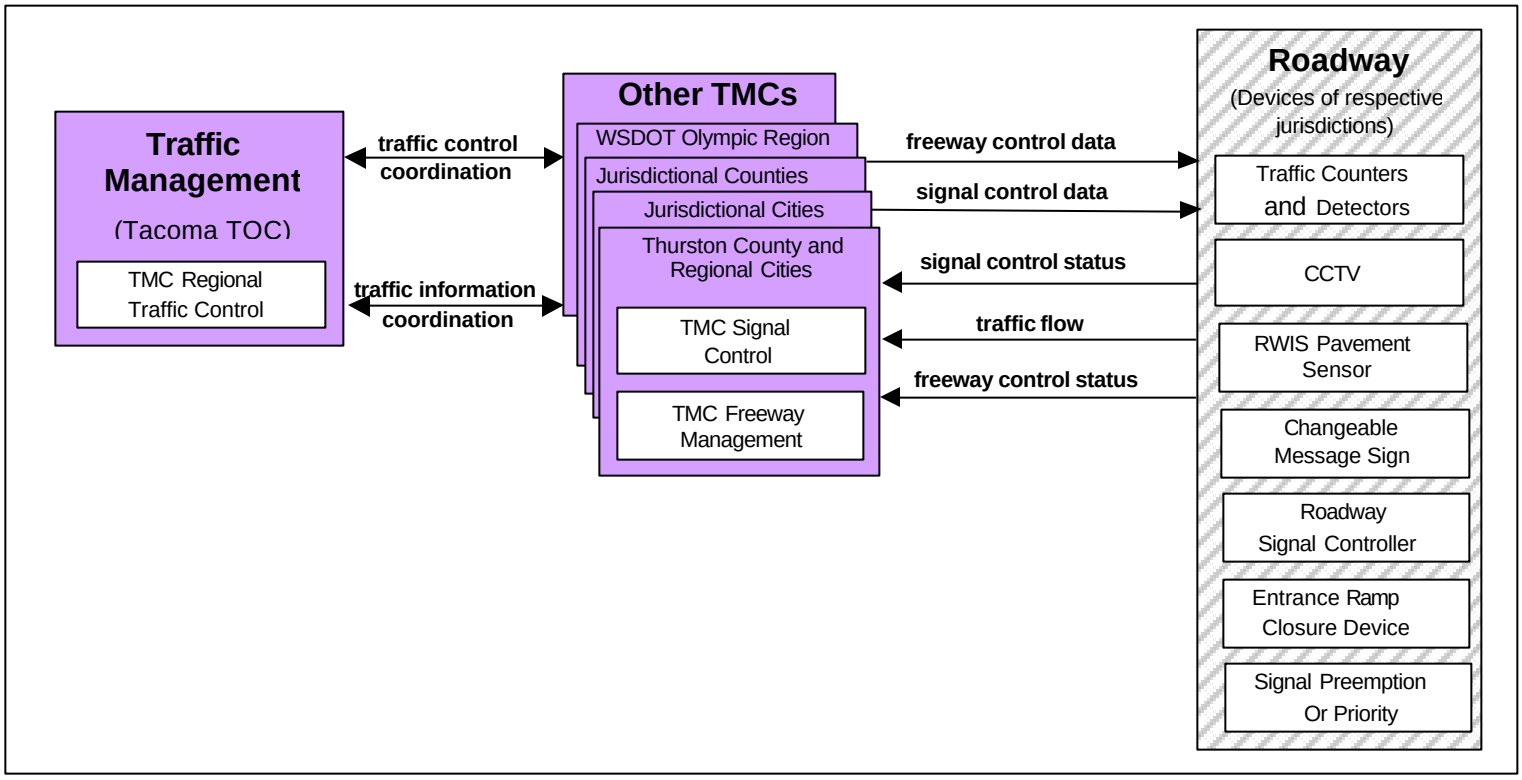
ATMS04: FREEWAY CONTROL



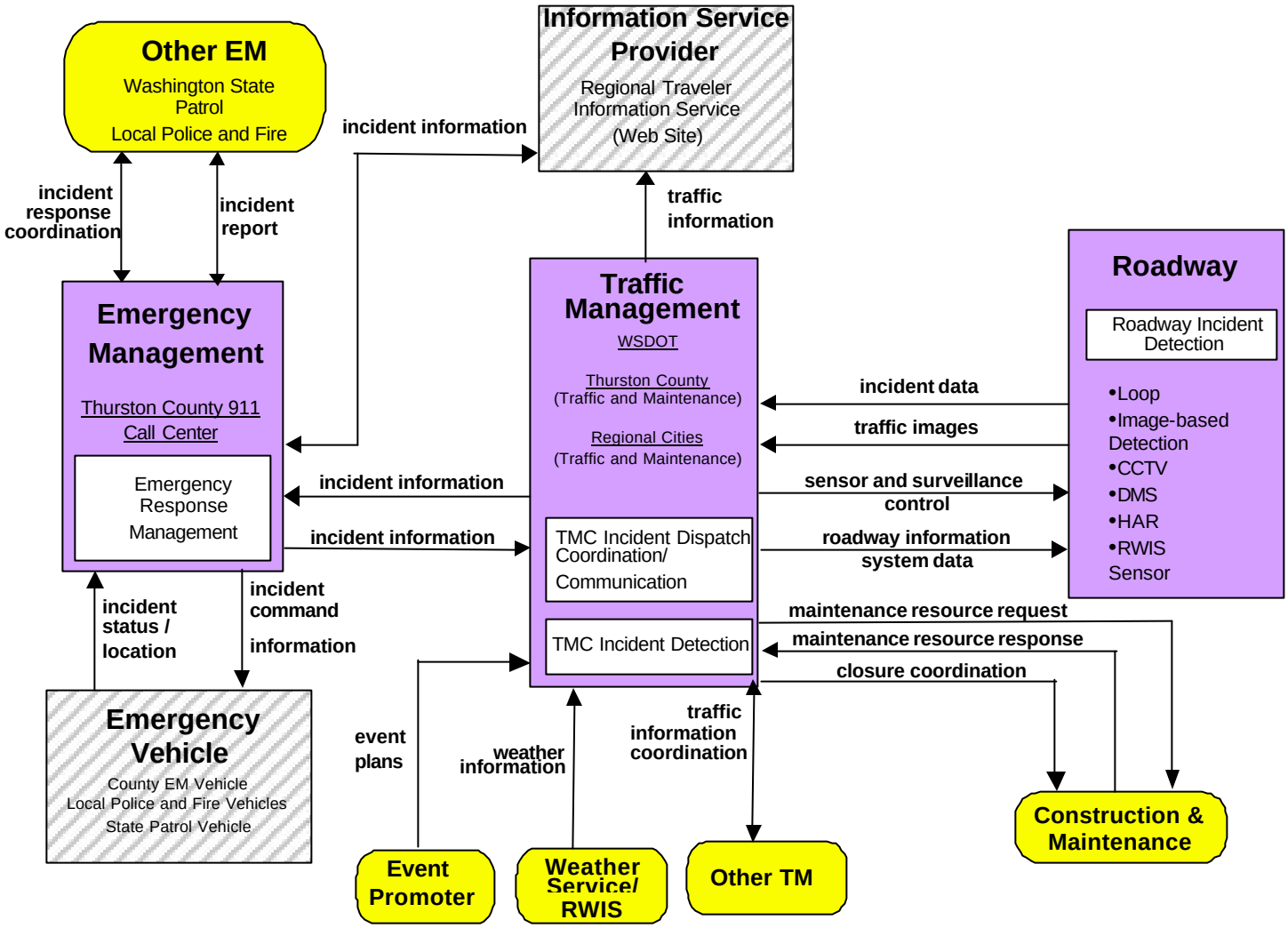
ATMS06: TRAFFIC INFORMATION DISSEMINATION



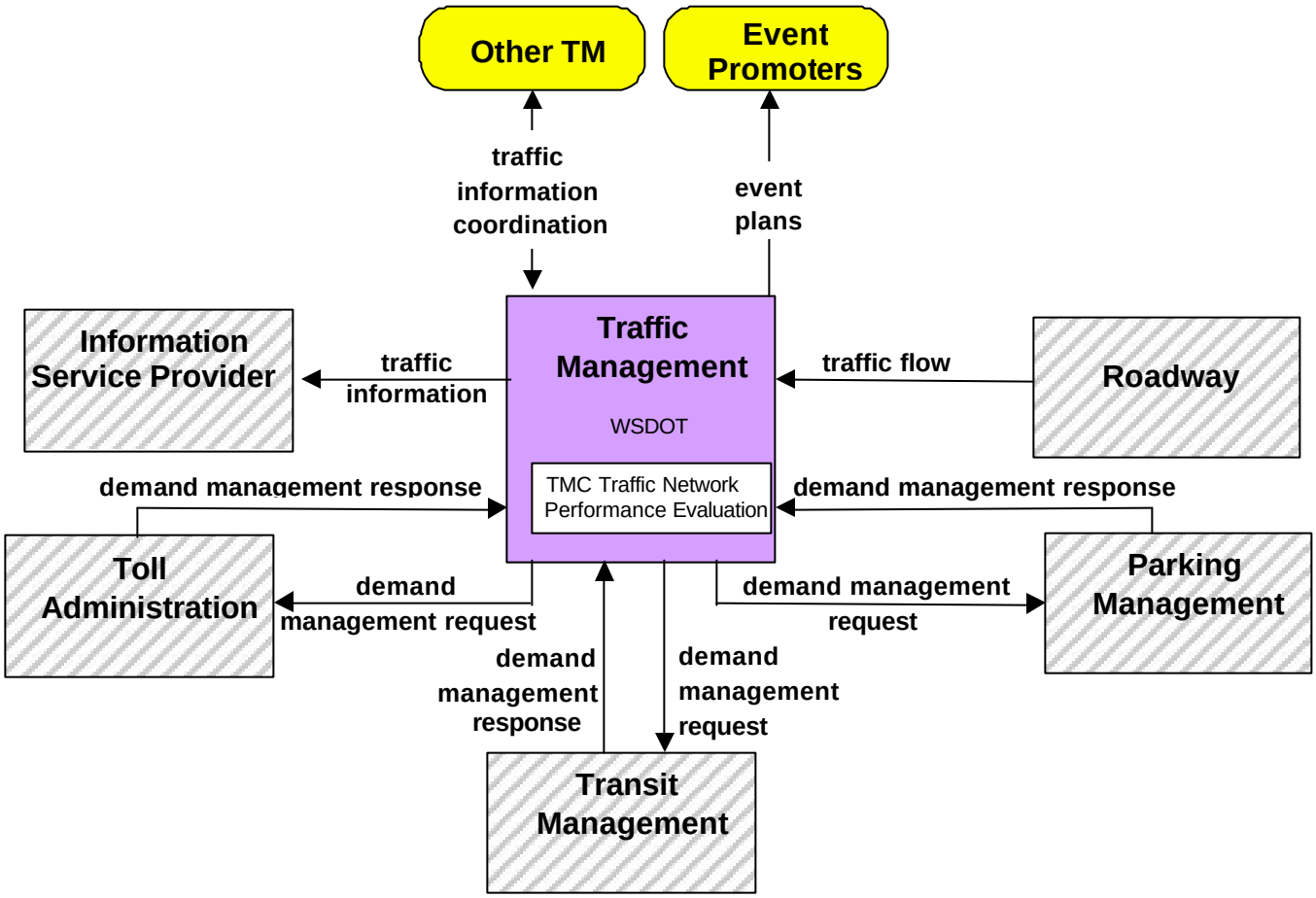
ATMS07: REGIONAL TRAFFIC CONTROL



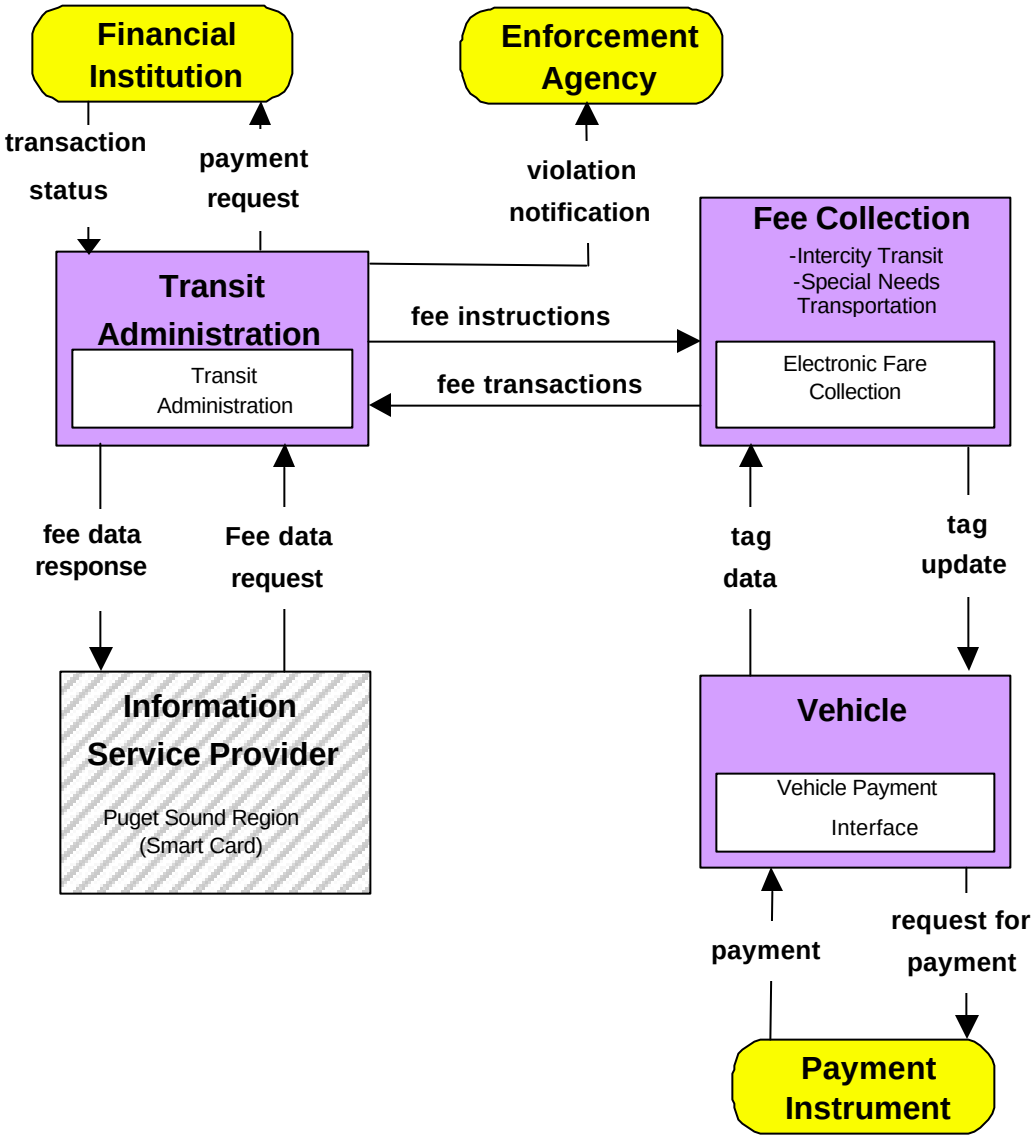
ATMS08: INCIDENT MANAGEMENT



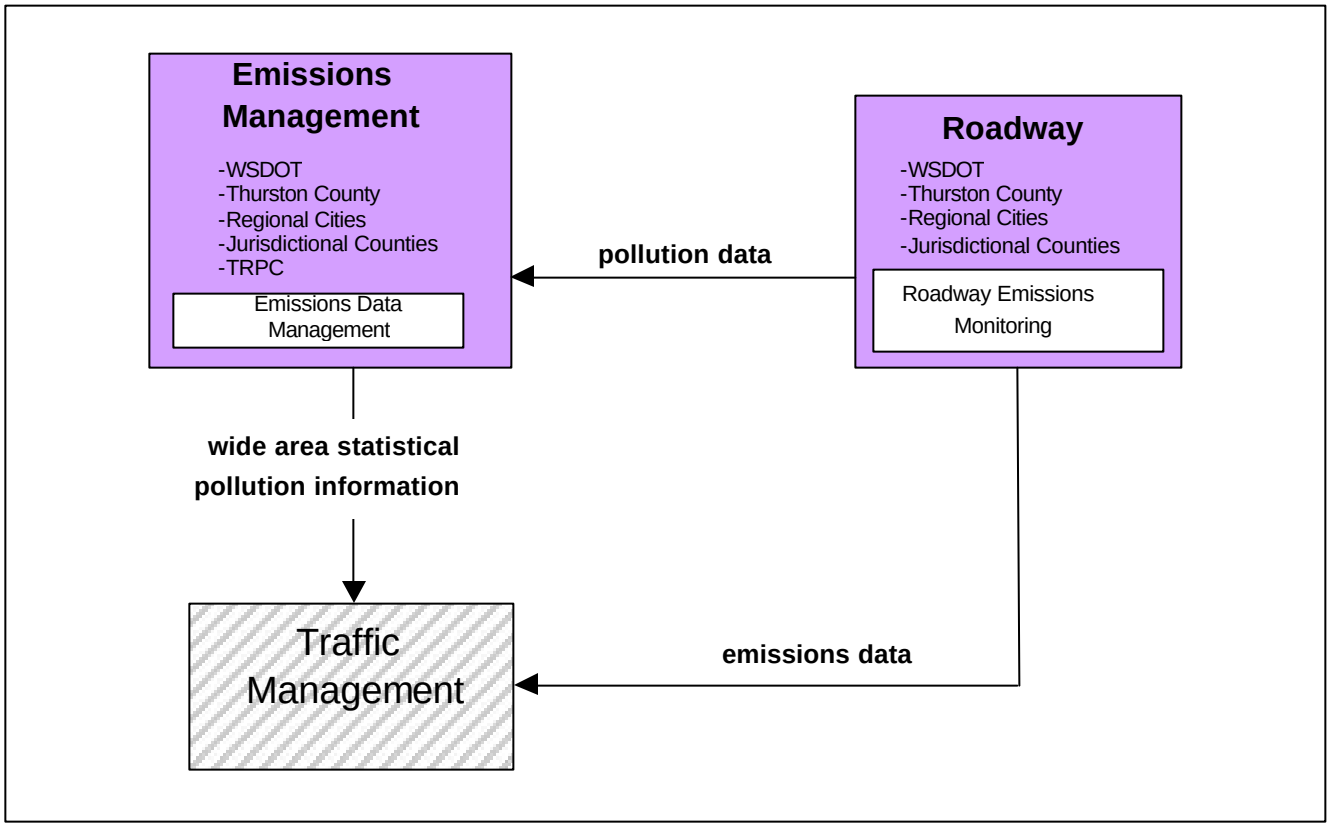
ATMS09: TRAFFIC FORECAST AND DEMAND MANAGEMENT



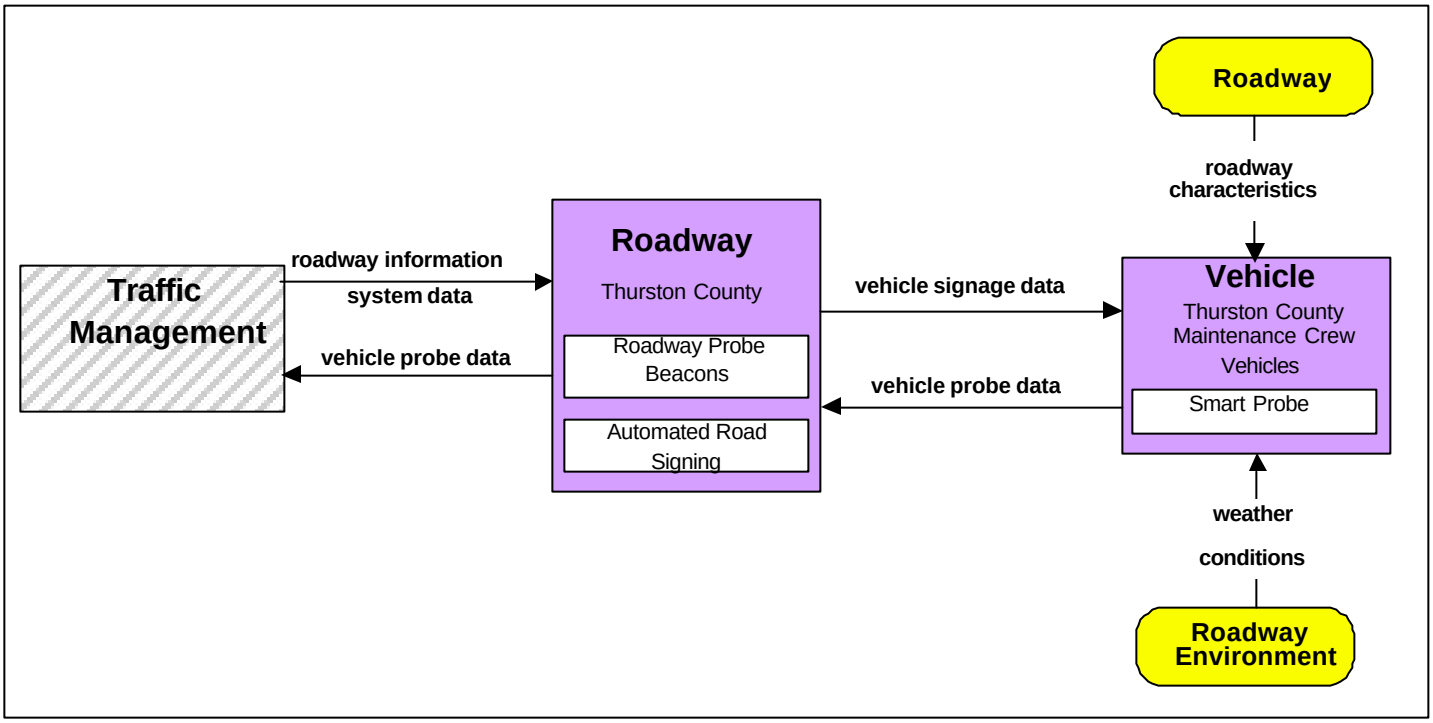
ATMS10: ELECTRONIC PAYMENT/FEE COLLECTION



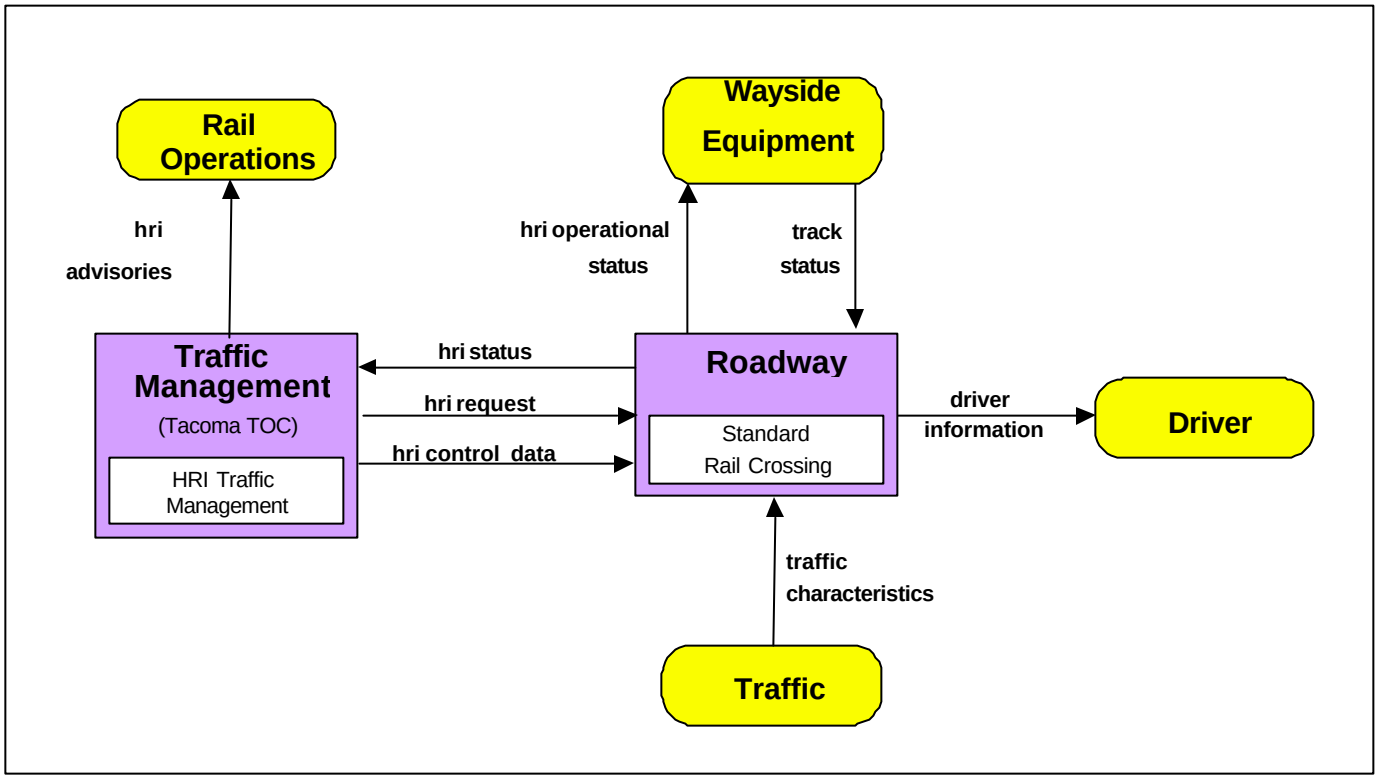
ATMS11: EMISSIONS MONITORING AND MANAGEMENT



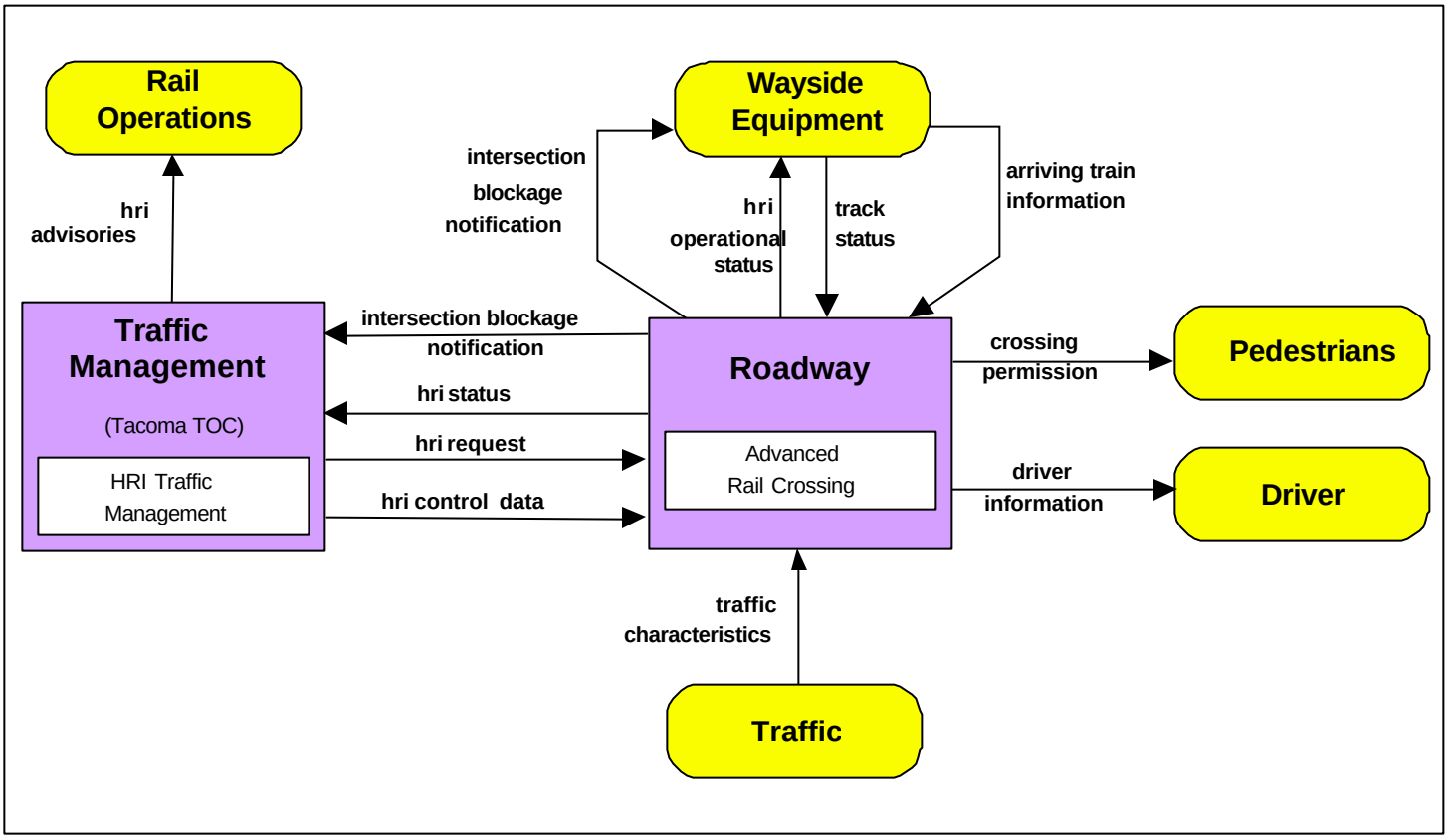
ATMS12: VIRTUAL TMC AND SMART PROBE DATA



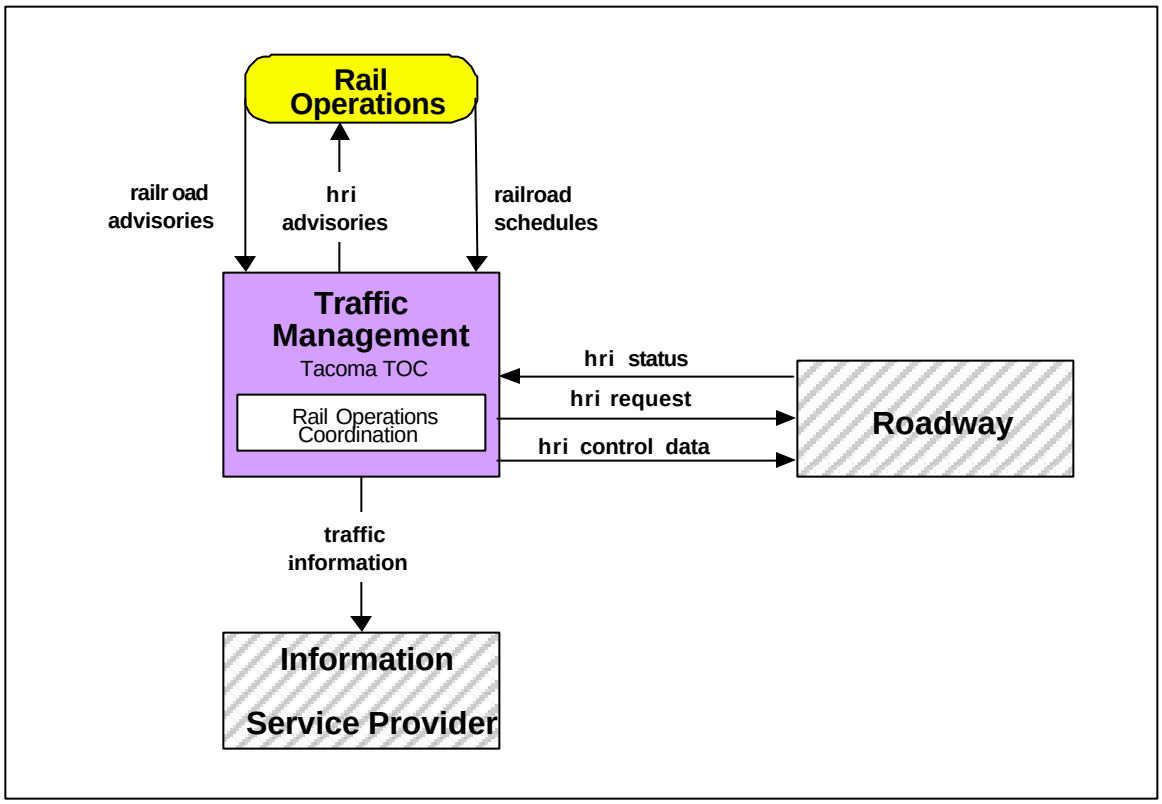
ATMS13: STANDARD RALROAD CROSSING



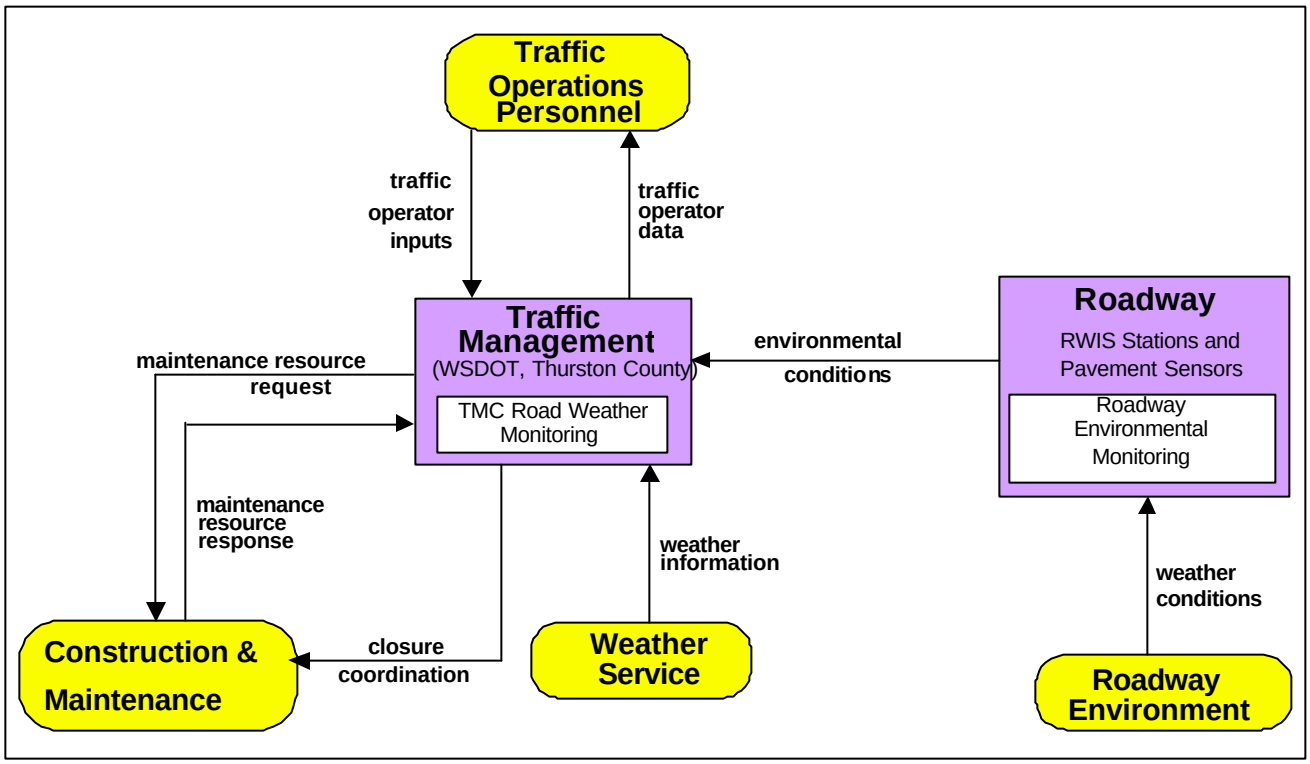
ATMS14: ADVANCED RAILROAD CROSSING



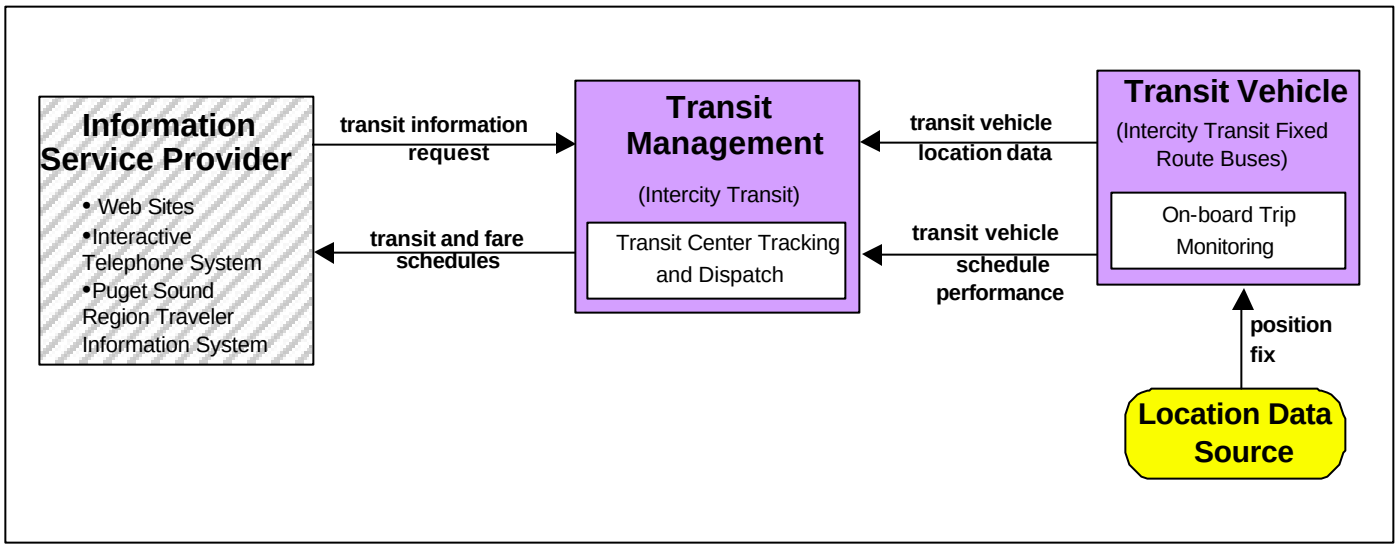
ATMS15: RAILROADS OPERATIONS COORDINATION



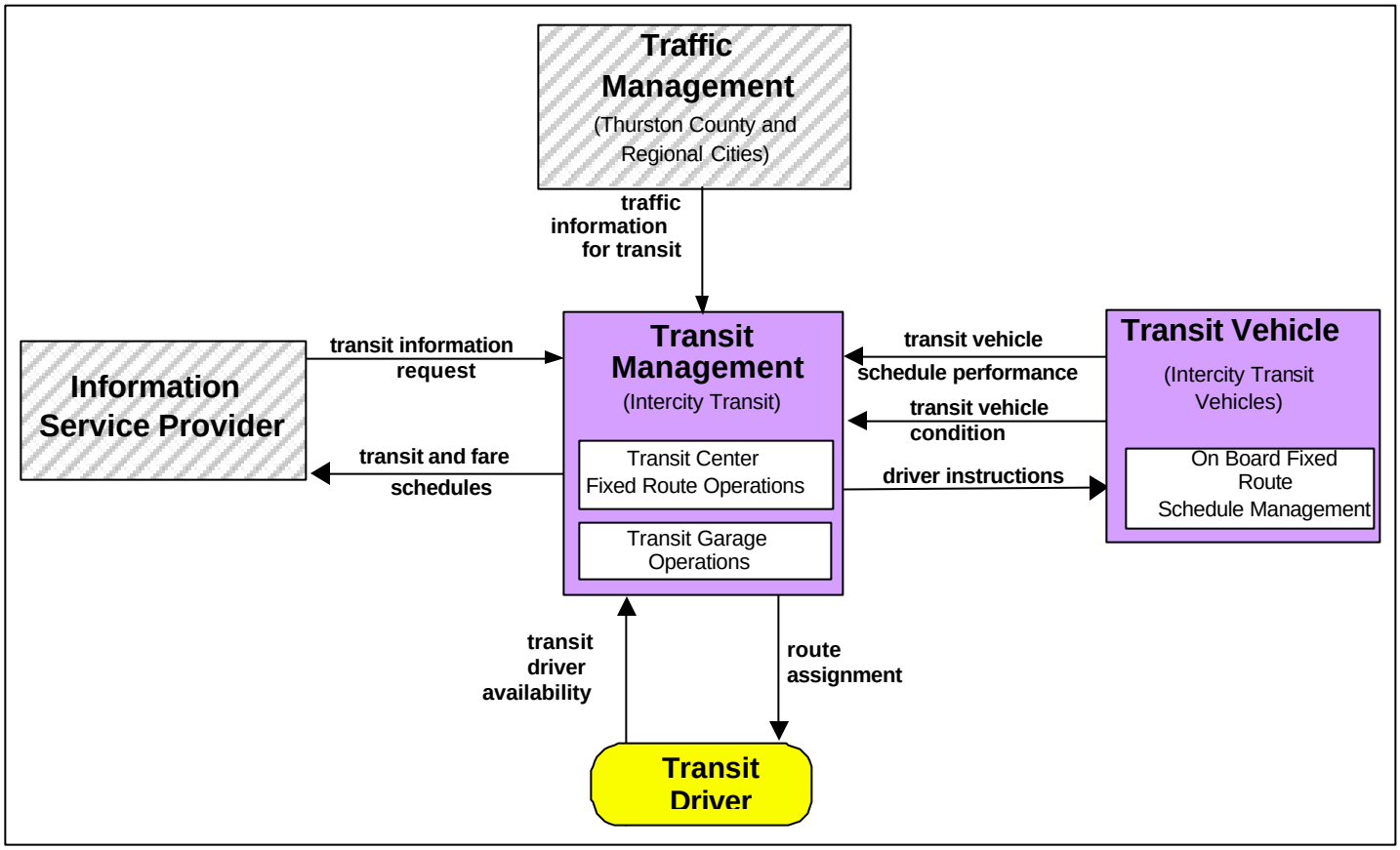
ATMS18: ROAD WEATHER INFORMATION SYSTEM



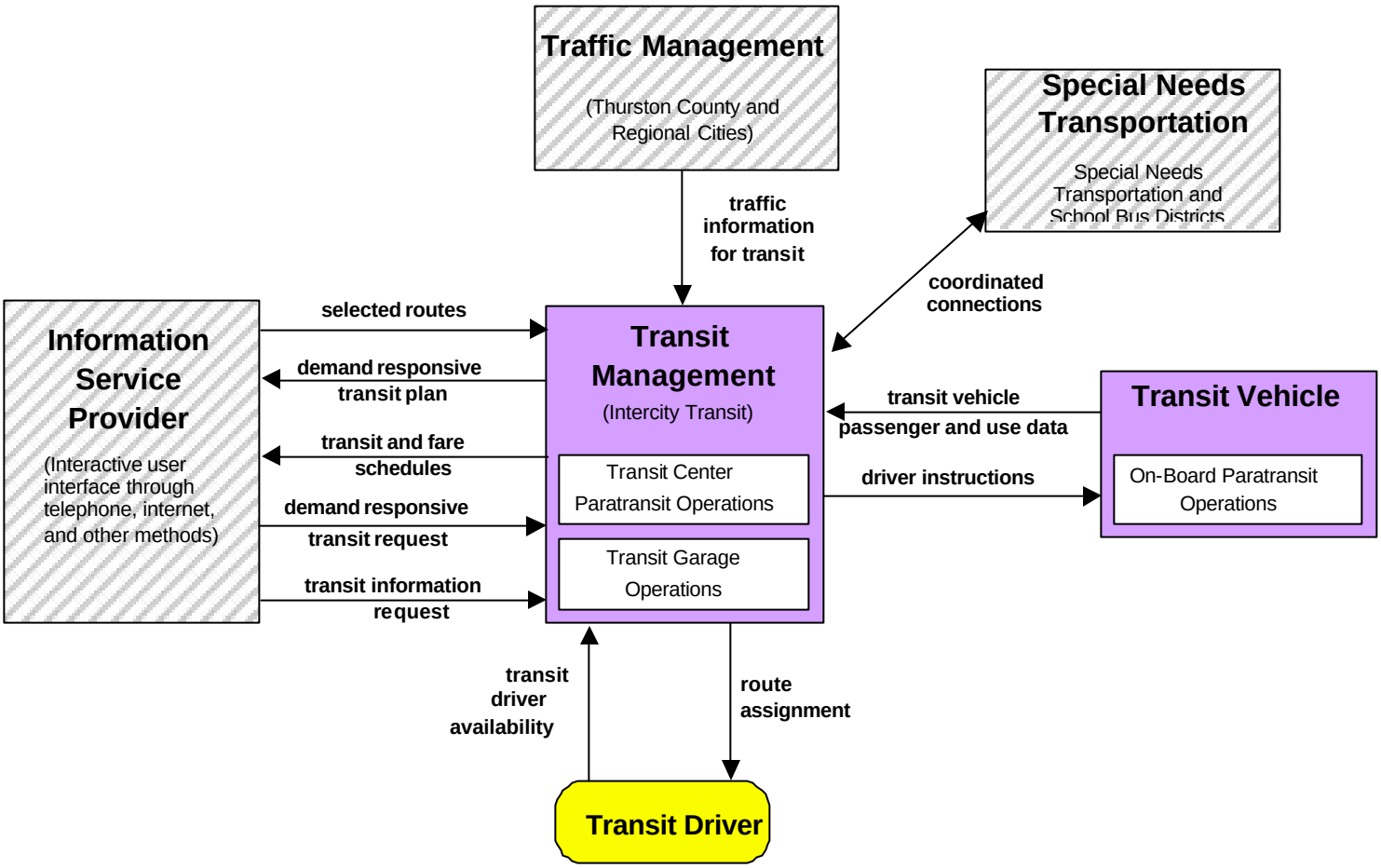
APTS01: TRANSIT VEHICLE TRACKING



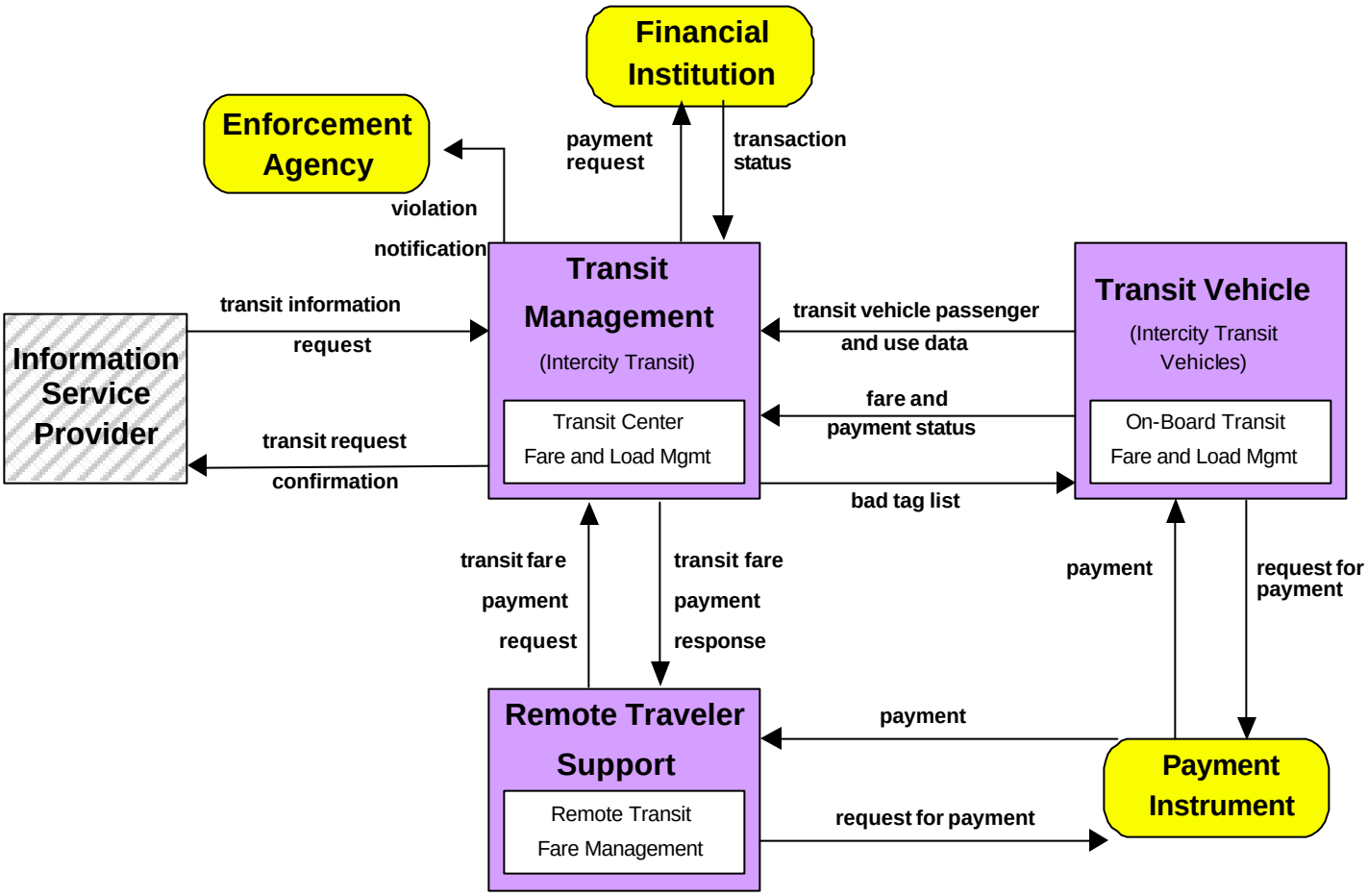
APTS02: TRANSIT FIXED ROUTE OPERATIONS



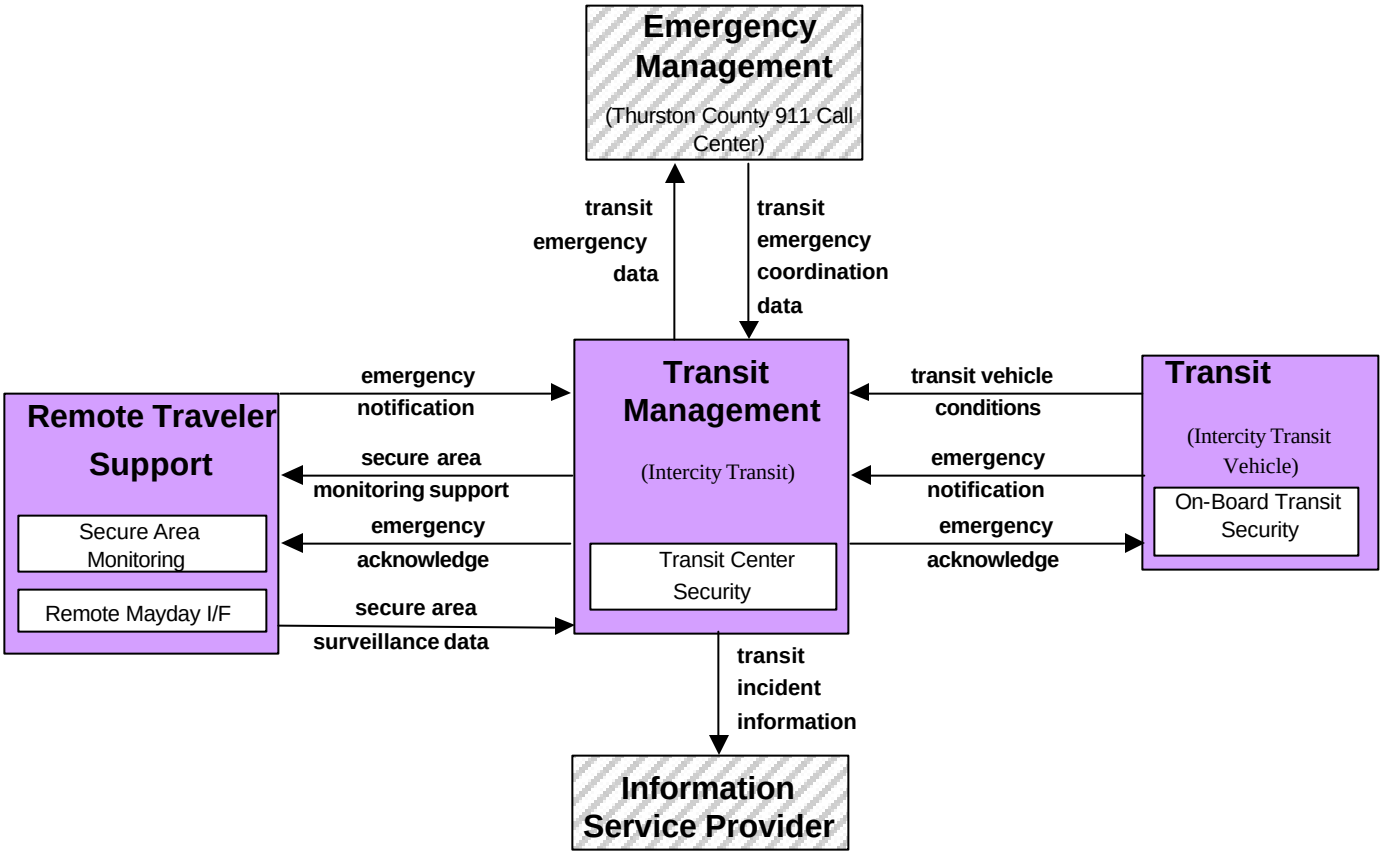
APTS03: DEMAND RESPONSIVE TRANSIT OPERATIONS



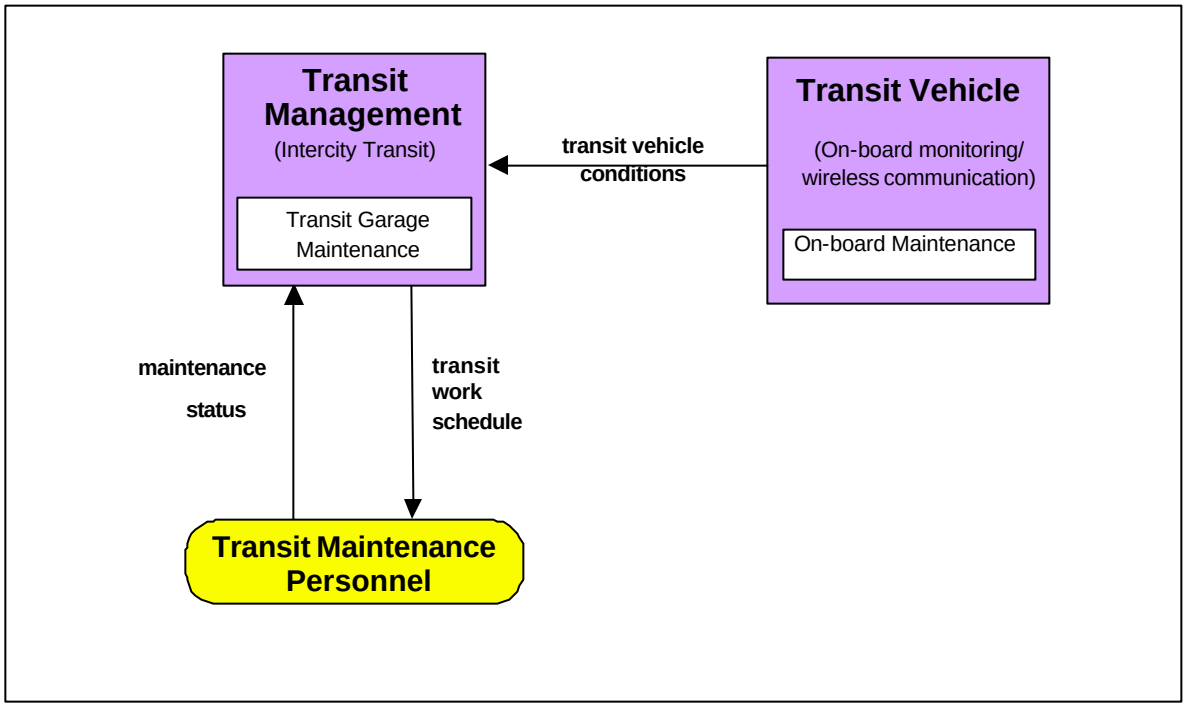
APTS04: TRANSIT PASSENGER AND FARE MANAGEMENT



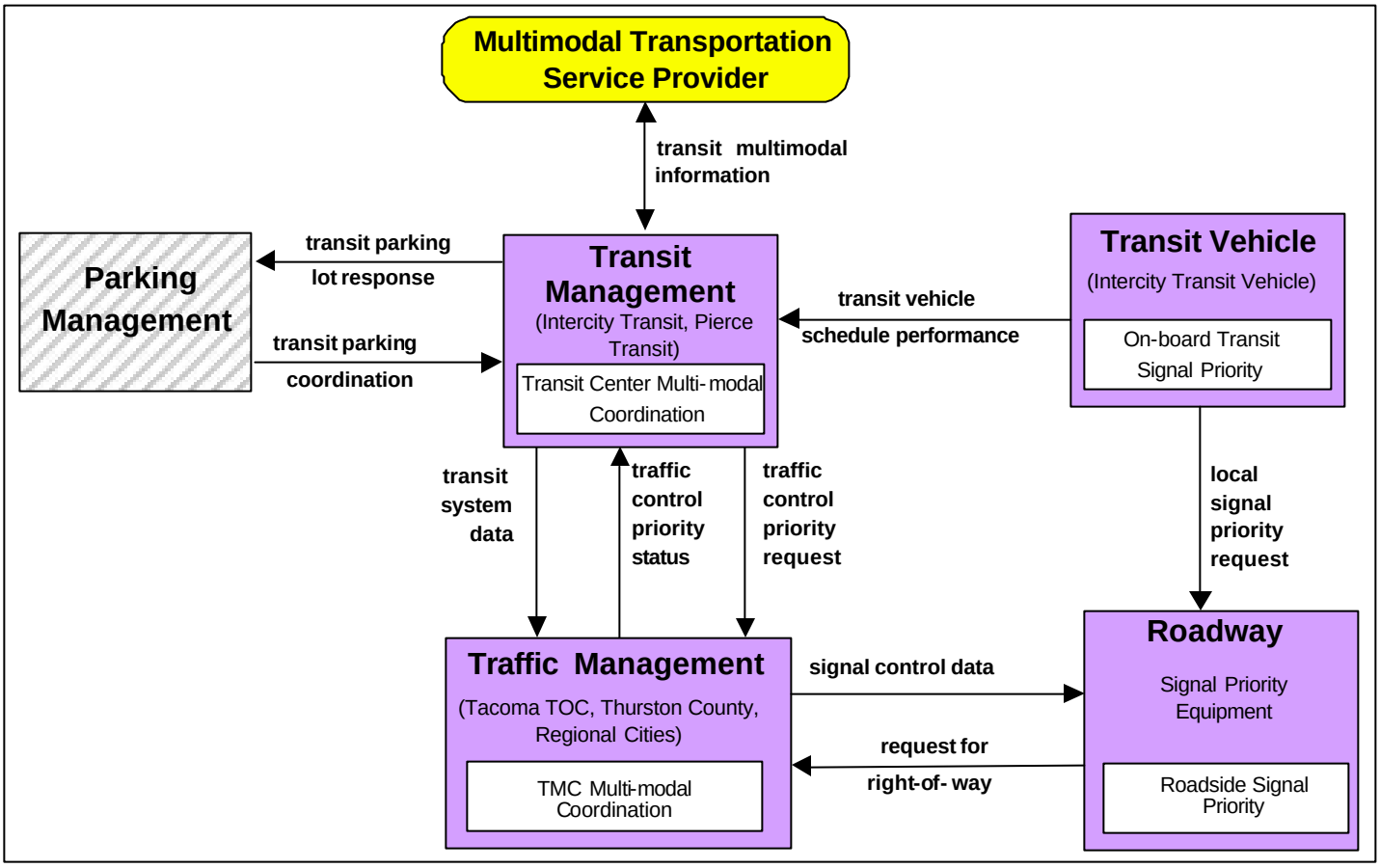
APTS05: TRANSIT SECURITY



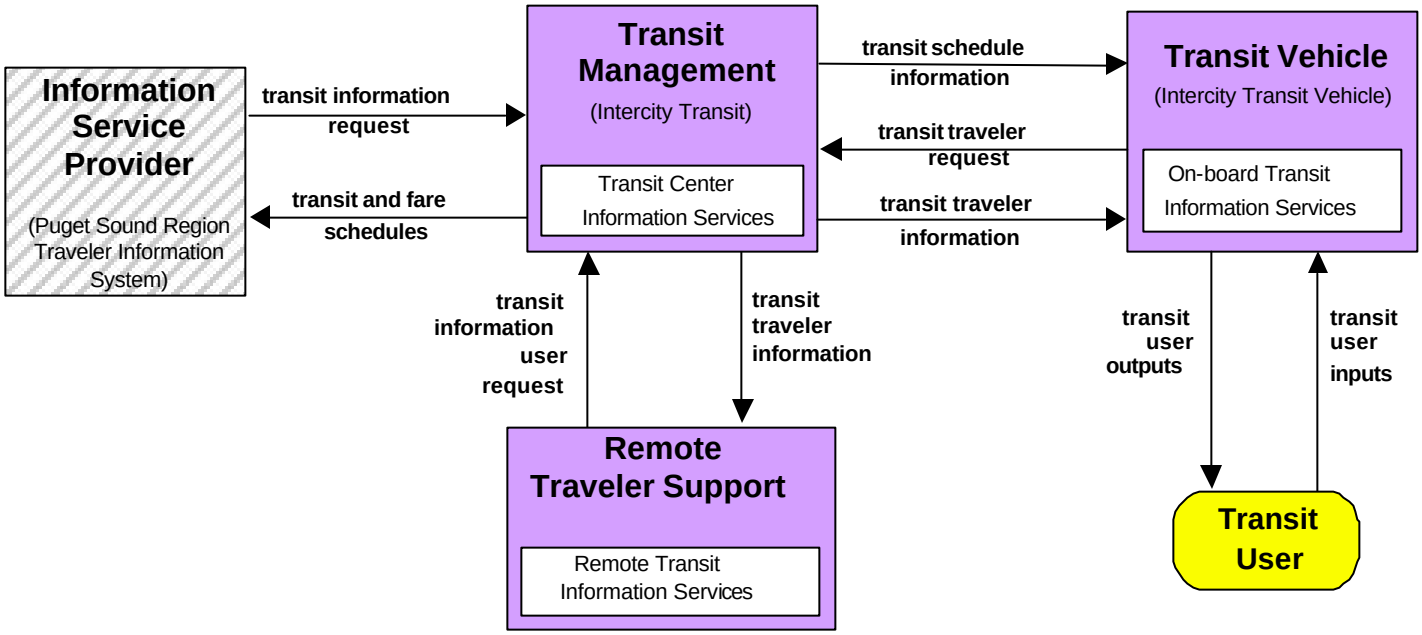
APTS06: TRANSIT MAINTENANCE



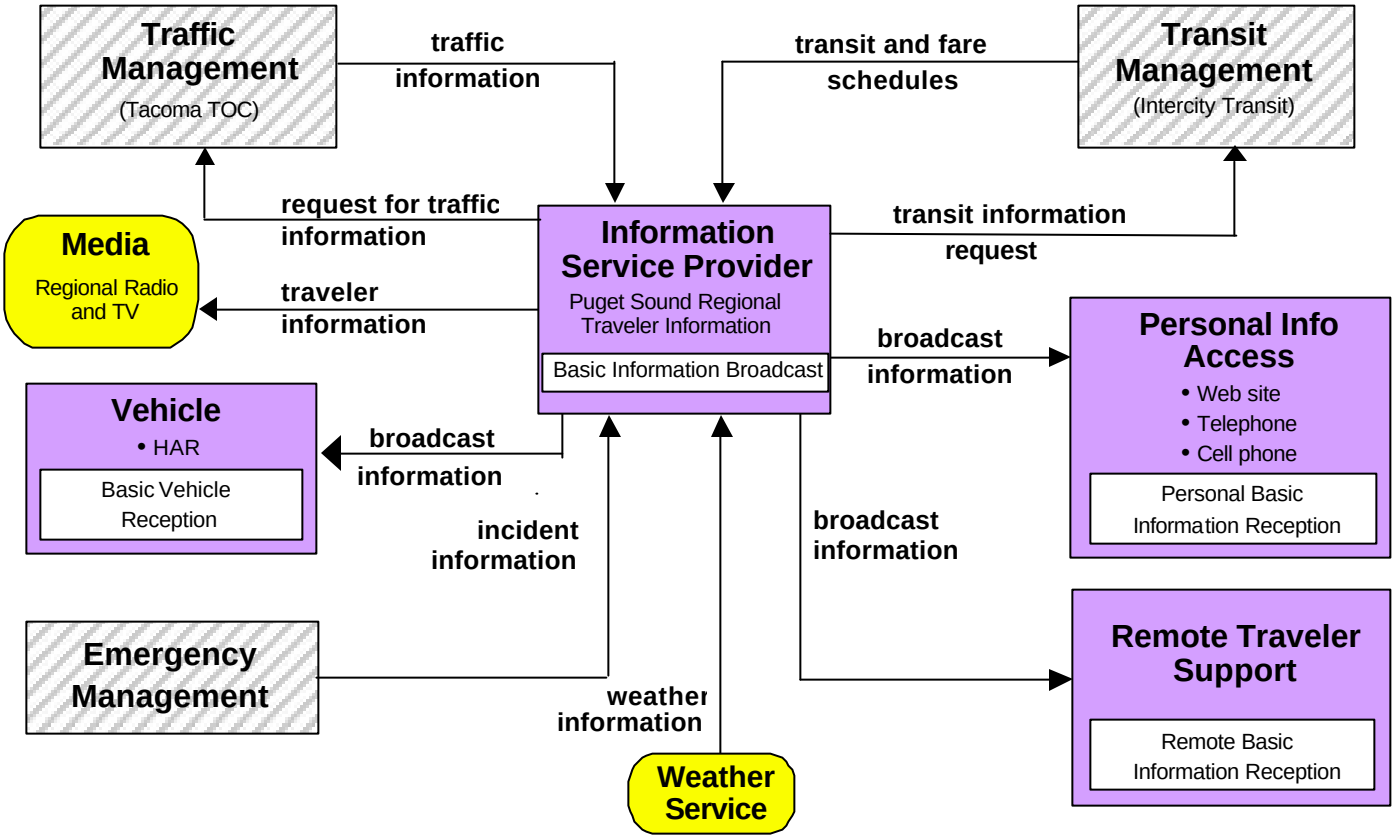
APTS07: MULTI-MODAL COORDINATION



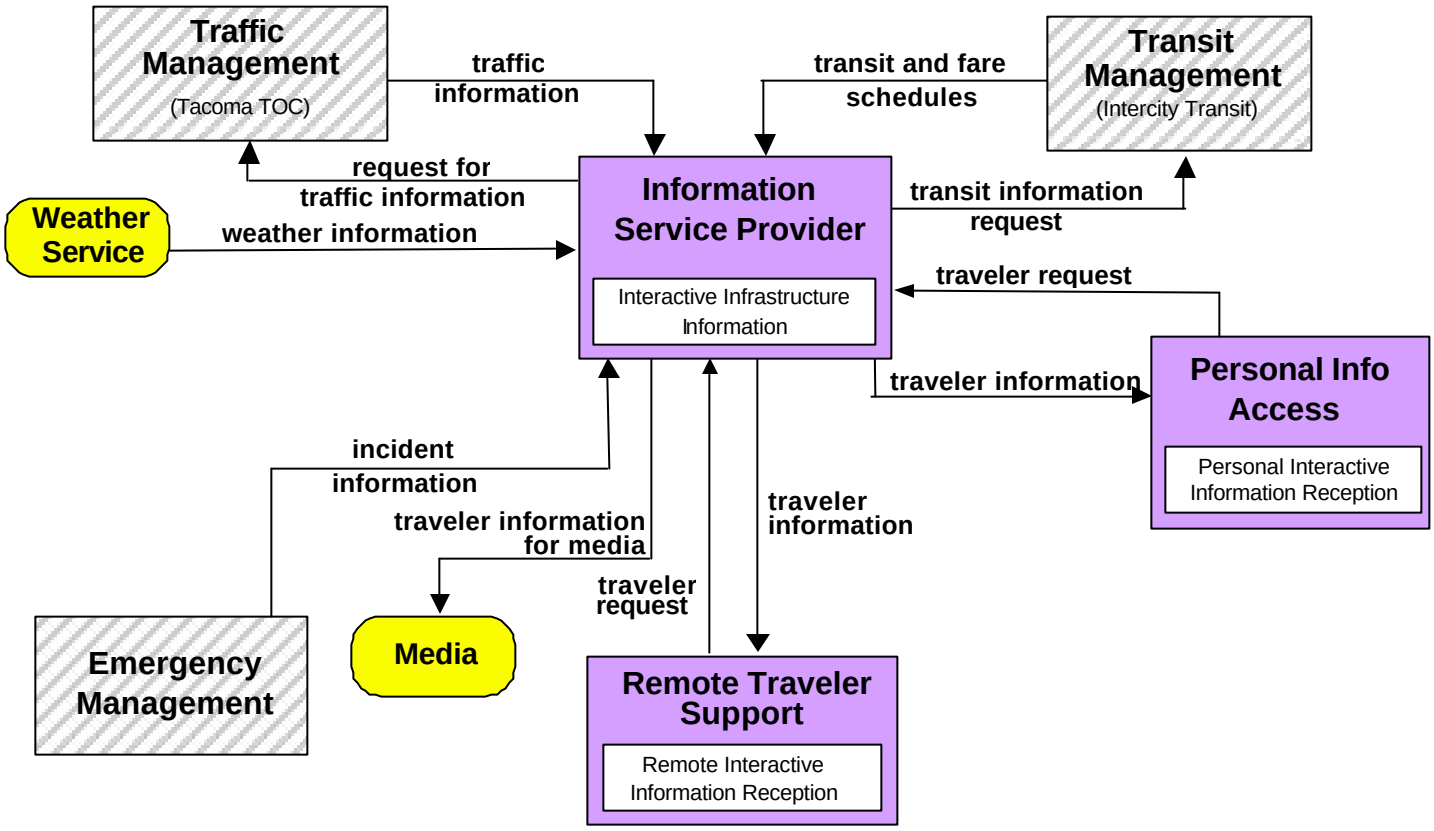
APTS08: TRANSIT TRAVELER INFORMATION



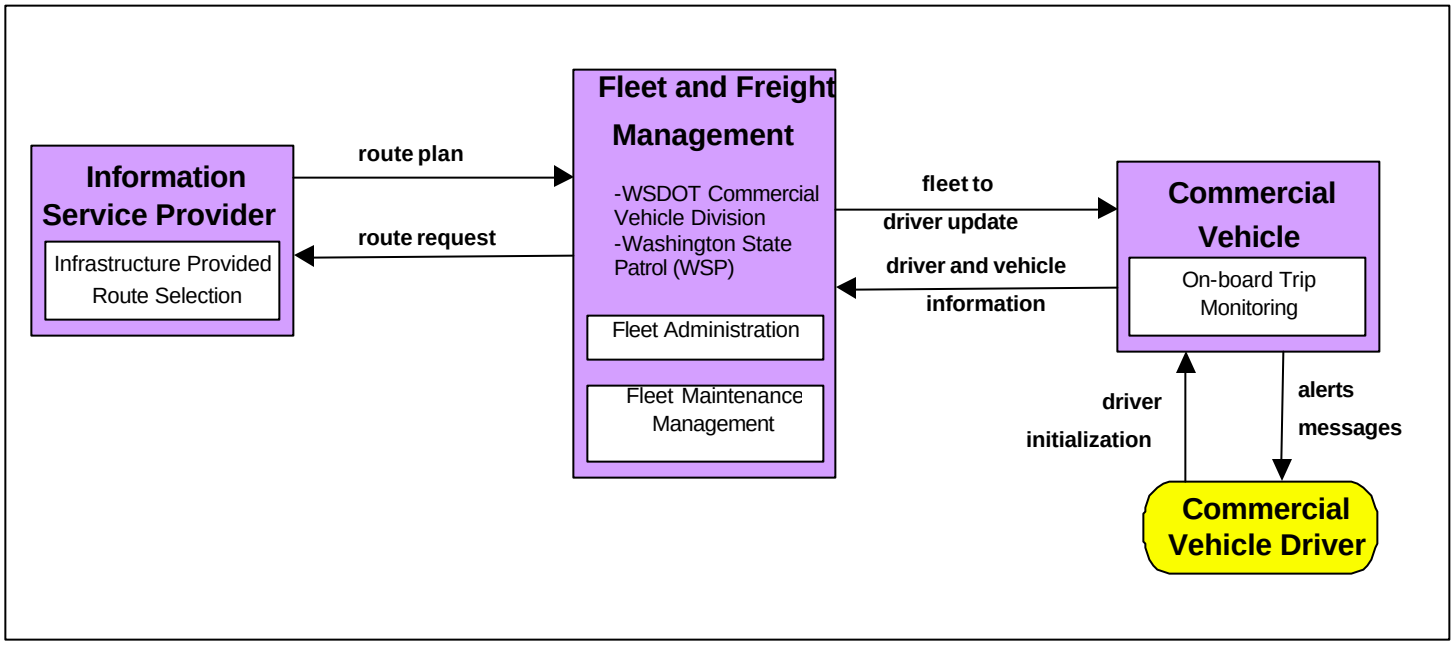
ATIS1: BROADCAST TRAVELER INFORMATION



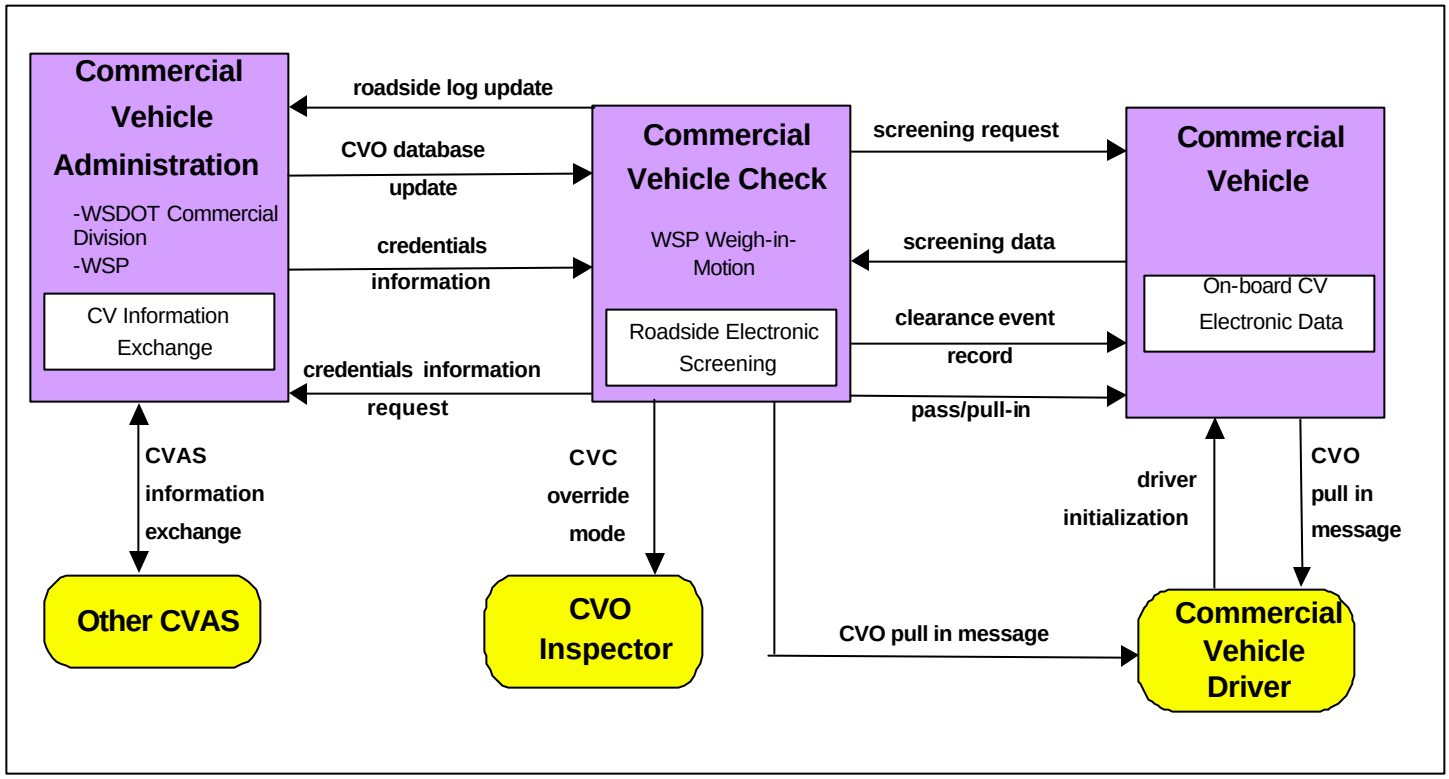
ATIS2: INTERACTIVE TRAVELER INFORMATION



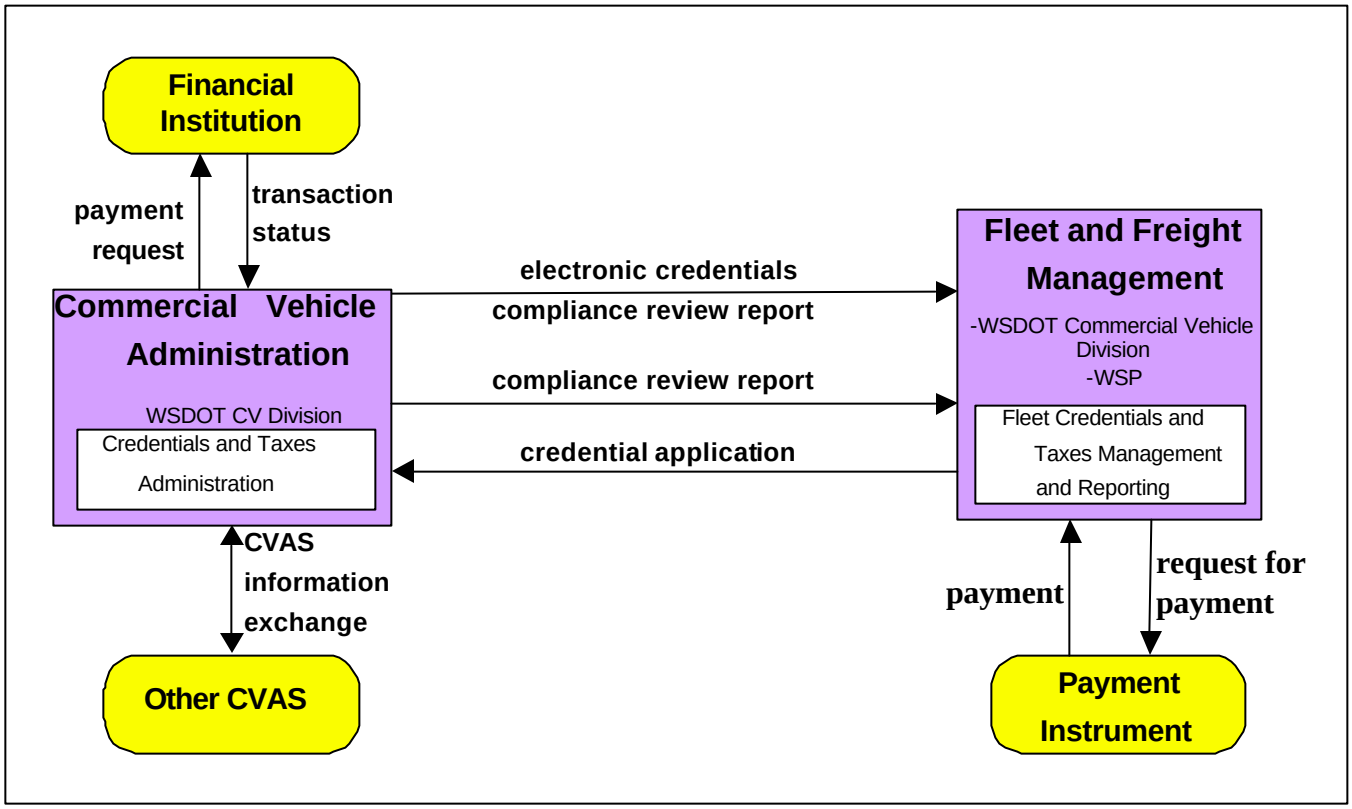
CVO1: FLEET ADMINISTRATION



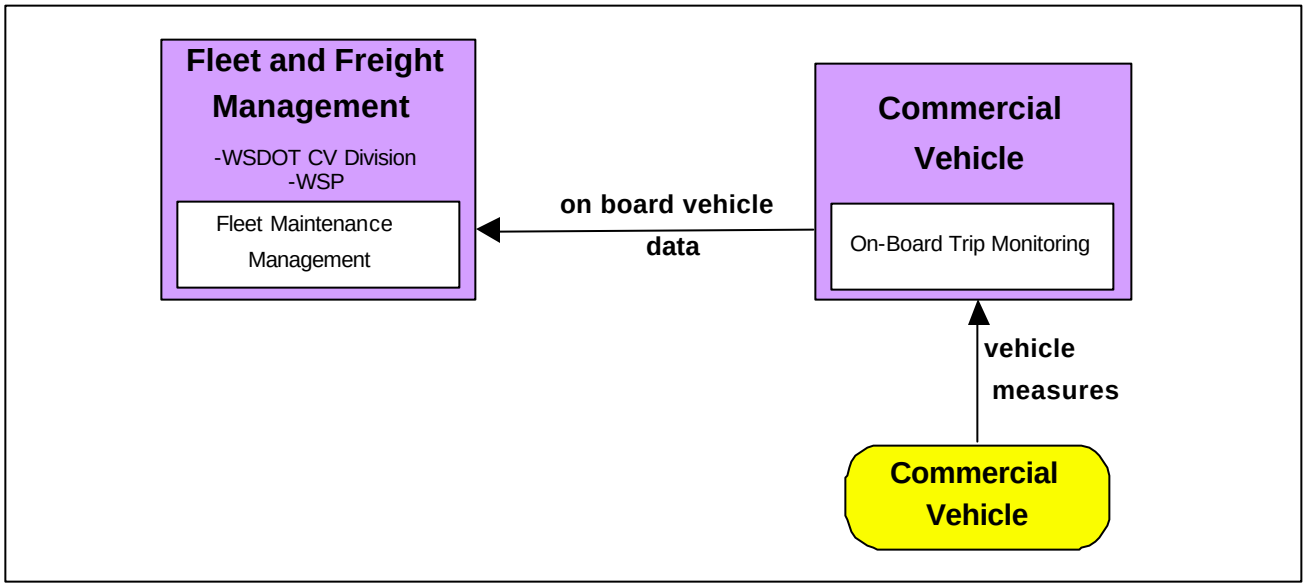
CVO3: ELECTRONIC CLEARANCE



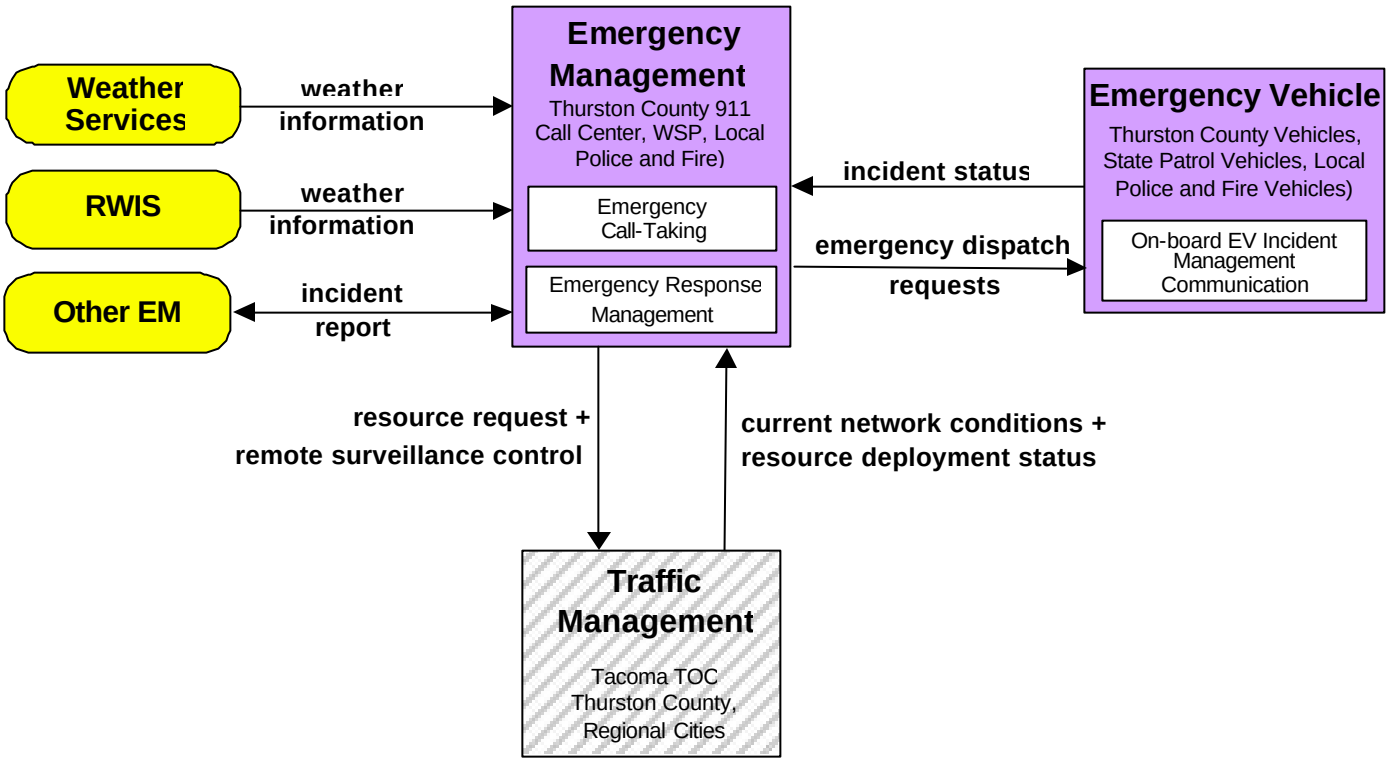
CVO4: CV ADMINISTRATIVE PROCESSES



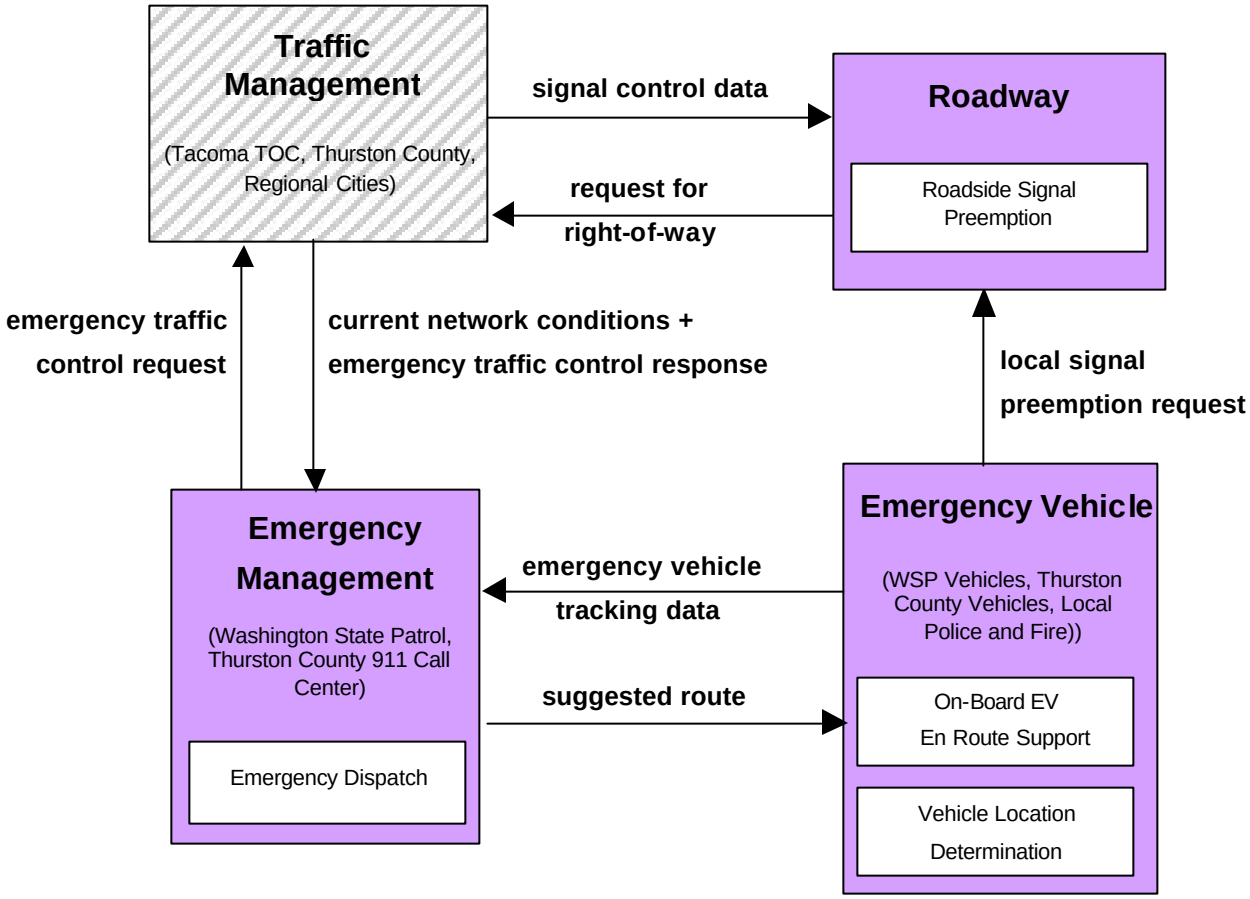
CVO9: CVO FLEET MAINTENANCE



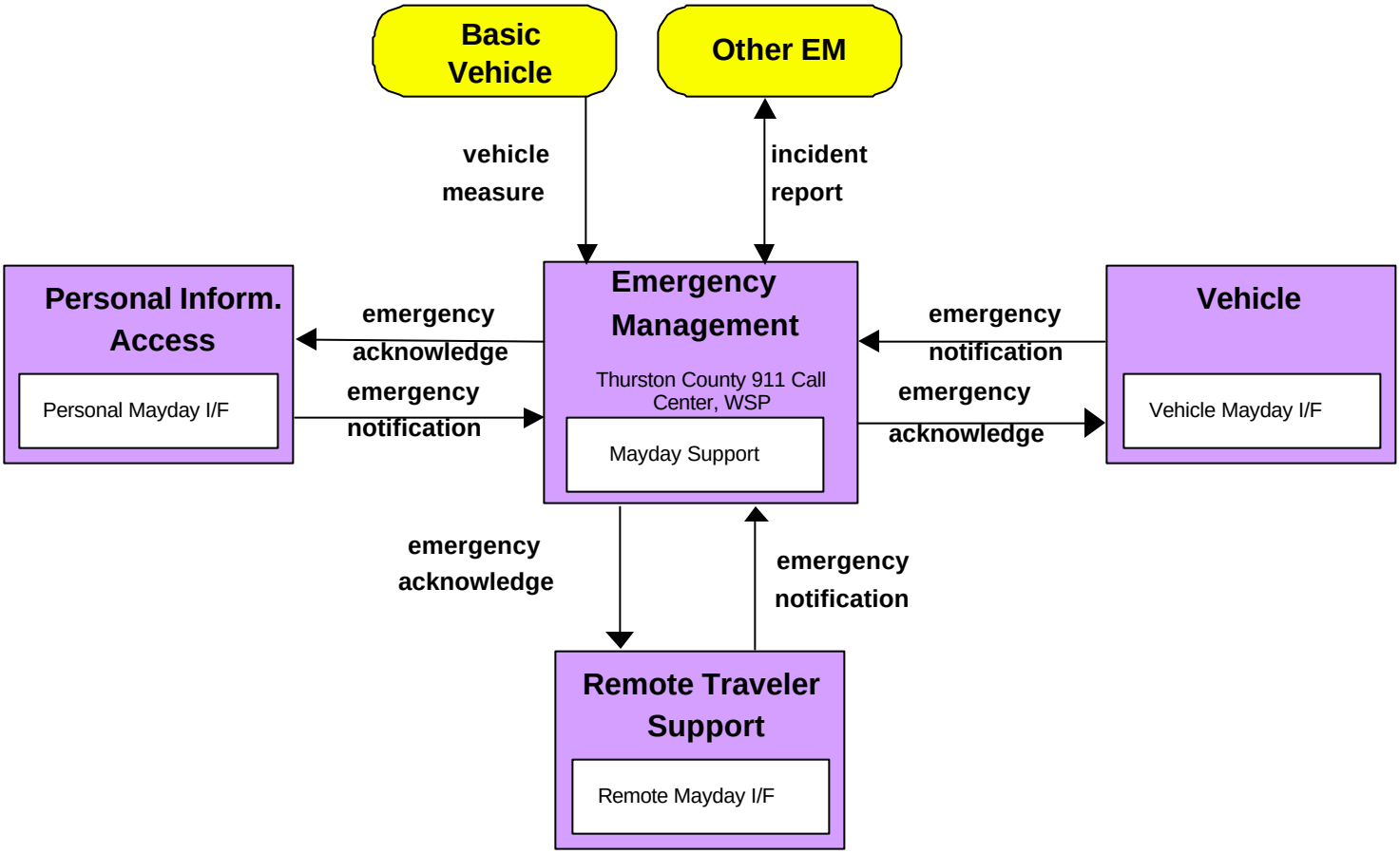
EM1: EMERGENCY RESPONSE



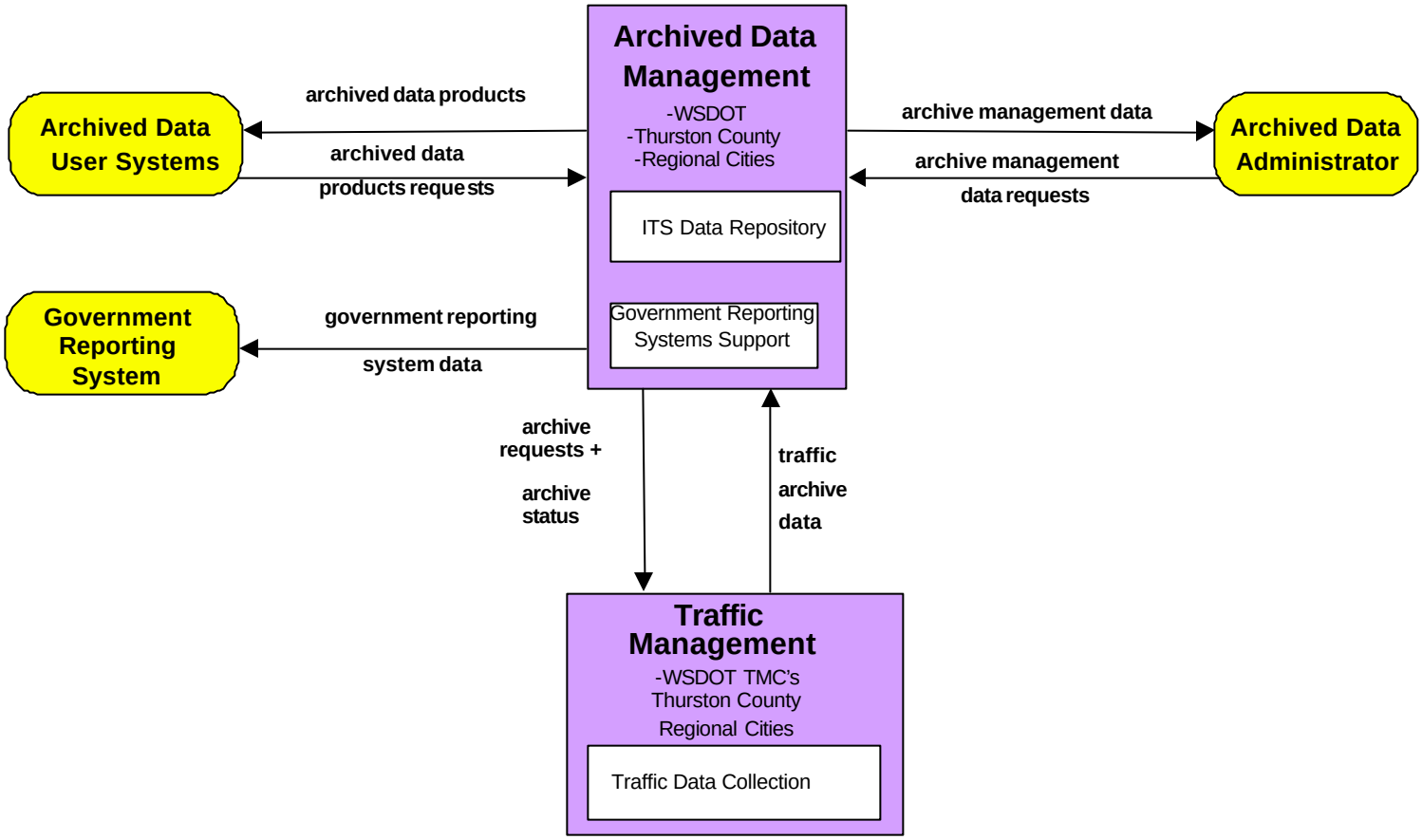
EM2: EMERGENCY ROUTING



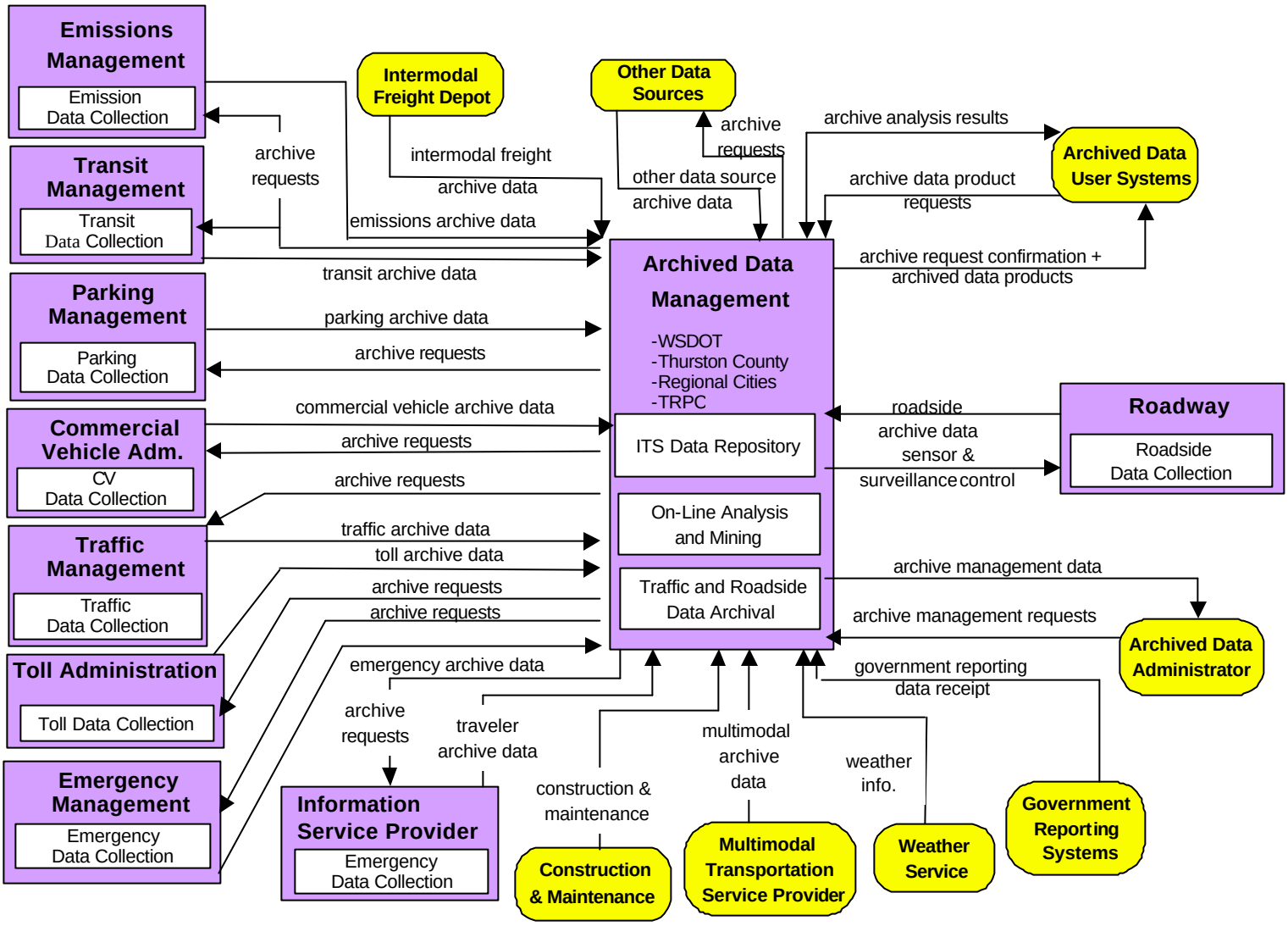
EM3: MAYDAY SUPPORT



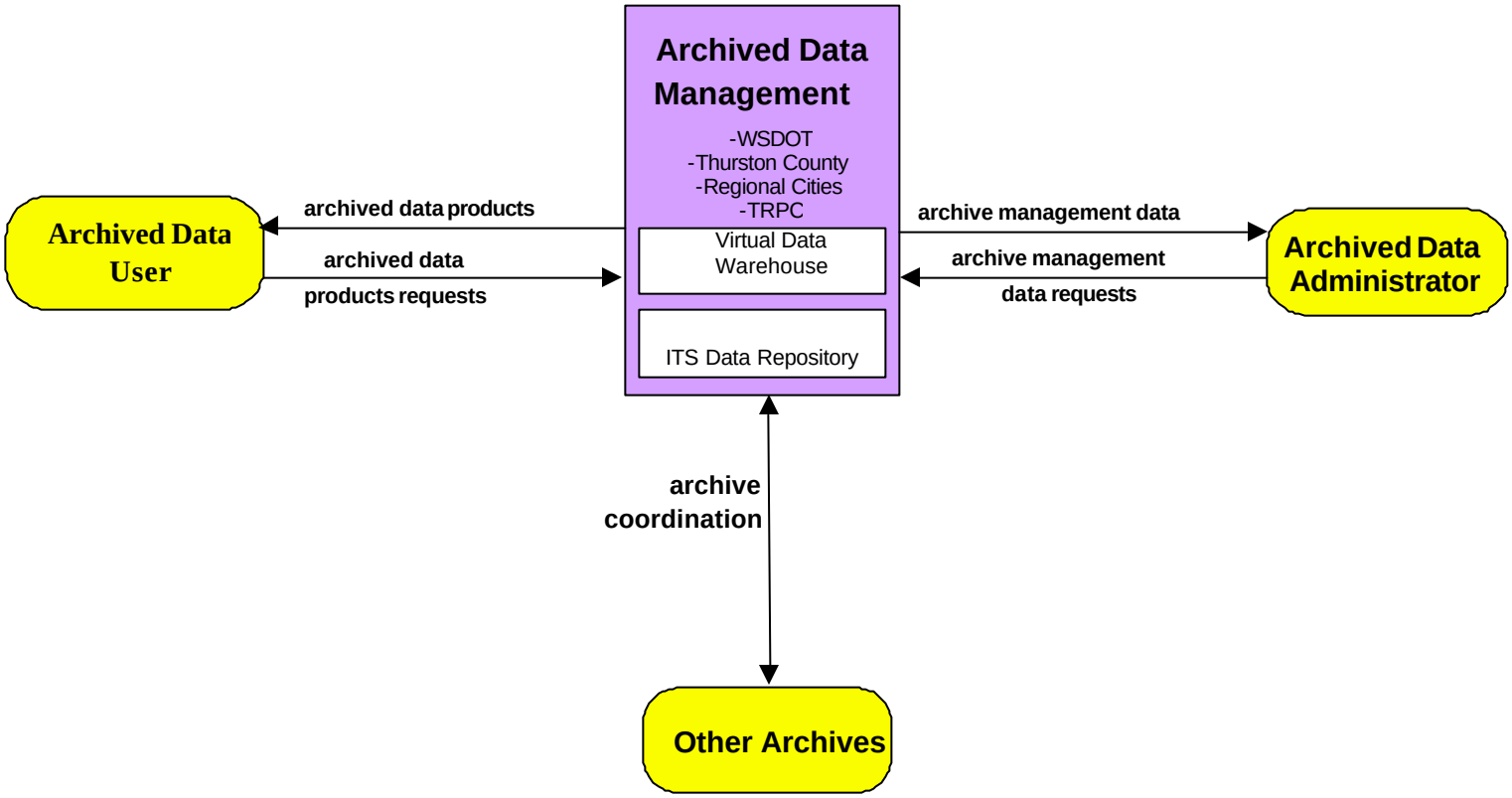
AD1: ITS DATA MART



AD2: ITS DATA WAREHOUSE



AD3: ITS VIRTUAL DATA WAREHOUSE



APPENDIX F

THURSTON REGION EQUIPMENT PACKAGE DESCRIPTIONS AND ASSOCIATED PROCESS SPECIFICATIONS (P-SPECS)

Thurston Region Equipment Package	Description	Associated P-Specs
ITS Data Repository	This equipment package collects data and data catalogs from one or more data sources and stores the data in a focused repository that is suited to a particular set of ITS data users. This equipment package includes capabilities for performing quality checks on the incoming data, error notification, and archive to archive coordination. This equipment package supports a broad range of implementations, ranging from simple data marts that collect a focused set of data and serve a particular user community to large-scale data warehouses that collect, integrate, and summarize transportation data from multiple sources and serve a broad array of users within a region.	8.1, 8.2, 8.5
Traffic and Roadside Data Archival	This equipment package collects and archives traffic, roadway, and environmental information for use in off-line planning, research, and analysis. The equipment package controls and collects information directly from equipment at the roadside, reflecting the deployment of traffic detectors that are used primarily for traffic monitoring and planning purposes rather than for traffic management.	8.9
Virtual Data Warehouse Service	This equipment package provides capabilities to access "in-place" data from geographically dispersed archives and coordinate information exchange with a local data warehouse. While many of the functions performed by this equipment package are similar to the functions inherent in other archived data management subsystem equipment packages (e.g. data management, fusion, analysis) this equipment package also provides the specialized publishing, directory services, and transaction management functions associated with coordinating remote archives. In addition, this equipment package performs functions on an as-needed basis, thereby negating the need to maintain the comprehensive set of data from the remote archives in the local data warehouse.	8.4
Credentials and Taxes Administration	This Equipment package provides administrative capabilities for commercial vehicle operations including database management and administrator-to-roadside and administrator-to-administrator interfaces. For example, this Equipment package would manage the electronic credentials database for a state, perform reconciliation of mileage and fuel taxes (possibly post trip), and interface with roadsides performing credential checks. This equipment package communicates with similar packages in other CVAS locations to exchange credentials database information. Example locations would be state agency or regional offices that are involved with commercial vehicle operations.	2.5.2, 2.5.7
CV Data Collection	This equipment package collects and stores commercial vehicle information that is collected in the course of Commercial Vehicle Administration Subsystem operations. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.	2.5.9
CV Information Exchange	This equipment package supports the exchange of safety and credentials data among jurisdiction. The package also supports the exchange of safety and credentials data between agencies (for example, an administrative center and the roadside check facilities) within a single jurisdiction. Data are collected from multiple authoritative sources and packaged into snapshots (top-level summary and critical status information) and profiles (detailed and historical data).	2.5.6

Thurston Region Equipment Package	Description	Associated P-Specs
Roadside Electronic Screening	This Equipment package provides the Commercial Vehicle Check Subsystem the capabilities for two-way communication with approaching properly equipped commercial vehicles at mainline speeds, reading tags for automated vehicle identification and credential checking. There will be a capability to appropriately screen all vehicles, not just those that are equipped. This Equipment package shall be able to process the data from the commercial vehicles along with accessed database information to determine whether a pull-in message is needed or to generate random pull-in messages with provisions for facility operators and enforcement officials to have manual override capabilities. Support shall be provided to both interstate and intrastate carriers.	2.3.1, 2.3.4, 2.3.5
On-board CV Electronic Data	This Equipment package provides the Commercial Vehicle Subsystem the capability for two-way data exchange between the vehicle and the roadside facility with the transmission of information such as status of driver, vehicle, and carrier IDs and cargo information. The driver, vehicle and carrier are identified via the tag so that actual weight from roadside mainline weigh-in-motion may be checked. This includes only the equipment on the commercial vehicle including a processor/tag for identification, especially a HAZMAT identification. The actual reading and processing required for the credential checking and weigh-in-motion will be performed by the roadside.	2.2.3, 2.3.7, 2.4.3, 2.4.4, 2.4.6, 2.6.2, 2.6.3, 2.6.4, 2.6.5
On-board Trip Monitoring	This Equipment package provides the capabilities to support fleet management with automatic vehicle location and automated mileage and fuel reporting and auditing. This package may also record other special events resulting from communication with roadside equipment. This includes only the equipment on board the vehicle to support this function including the vehicle location devices such as GPS equipment, communication interfaces, a processor to record trip length, and the sensors/actuators/interfaces necessary to record mileage and fuel usage.	2.1.5, 2.2.2, 2.2.4, 2.4.1, 2.4.3, 2.4.5
Emergency Call-Taking	This Equipment package supports the emergency call-taker, collecting available information about the caller and the reported emergency, and forwarding this information to other equipment packages that formulate and manage the emergency response. This equipment package receives 9-1-1, 7-digit local access, and motorist call-box calls and interfaces to other agencies to assist in the verification and assessment of the emergency and to forward the emergency information to the appropriate response agency.	5.1.1, 5.1.3, 5.2
Emergency Data Collection	This equipment package collects and stores emergency information that is collected in the course of operations by the Emergency Management Subsystem. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.	5.6
Emergency Dispatch	This Equipment package supports efficient dispatch of emergency vehicles. It tracks emergency vehicles, dispatches these vehicles to an incident, and provides safe and efficient routes based on real-time traffic information.	5.2, 5.3.2, 5.3.6, 5.3.7, 5.5
Emergency Response Management	This Equipment package develops and stores emergency response plans and manages overall coordinated response to emergencies. It tracks the availability of resources and assists in the appropriate allocation of these resources for a particular emergency response. This Equipment package provides coordination between multiple allied agencies before and during emergencies to implement emergency response plans and track progress through the incident. It provides vital communications linkages which provide real-time information to emergency response personnel in the field.	5.1.2, 5.1.3, 5.1.4, 5.1.5, 5.2, 5.3.1, 5.3.4, 5.5

Thurston Region Equipment Package	Description	Associated P-Specs
Mayday Support	This Equipment package receives Mayday messages, determines an appropriate response, and either uses internal resources or contacts a local agency to provide that response. The nature of the emergency is determined based on the information in the mayday message as well as other inputs. This package effectively serves as an interface between automated mobile mayday systems and the local public safety answering point for messages which require a public safety response.	5.1.1, 5.1.2, 5.1.3, 5.1.6, 5.2
Emissions Data Collection	This equipment package collects and stores air quality and emissions management information that is collected in the course of Emissions Management Subsystem operations. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.	1.5.9
Emissions Data Management	This Equipment package assimilates and stores air quality measures and roadside collected emissions data. General air quality measures are distributed as general traveler information and also may be used for in demand management programs. Collected roadside emissions are analyzed and used to detect, identify, and notify concerned parties regarding vehicles that exceed emissions standards.	1.5.1, 1.5.2, 1.5.3, 1.5.4, 1.5.7, 1.5.8
On-board EV En-route Support	This Equipment package provides capabilities that support safe and expedient arrival on the incident scene. This package provides dispatch and routing information, tracks the vehicle, and preempt signals via short range communication directly with traffic control equipment at the roadside.	5.3.3, 5.3.5
On-board EV Incident Management Communication	This Equipment package provides a direct interface between the emergency vehicle and incident management personnel.	5.3.5
Fleet Administration	This Equipment package provides route plan information from the FMS to the TMS for network performance evaluation. It also provides for vehicle tracking, dispatch, and reporting to the fleet management center personnel.	2.1.2, 2.1.4, 2.1.6, 2.61
Fleet Maintenance Management	This Equipment package provides the capability to use vehicle mileage data to automatically generate preventative maintenance schedules for each specific vehicle by utilizing vehicle tracking data from the prerequisite tracking Equipment package. In addition, capability to automatically ensure that proper service personnel are provided information for maintenance activities and to record and verify that maintenance work was performed shall be provided.	2.1.6
Fleet Credentials and Taxes Management and Reporting	This Equipment package provides the Fleet and Freight Management Subsystem the capabilities to purchase credentials and file trip reports electronically by the fleet managers, to perform automated enrollment at the roadside facilities, and electronically manage the credentials checking by the roadside commercial vehicle inspectors. The electronic purchase shall be performed in accordance with developing standards such that a single integrated system for electronic payments might develop ensuring that deployment across multiple agency political boundaries is performed without degradation. Inherent to credential management shall be the management of the vehicles, with a prerequisite of the vehicle tracking software from the Fleet Administration Equipment package.	2.1.1, 2.1.3, 2.2.1, 7.5.4

Thurston Region Equipment Package	Description	Associated P-Specs
Basic Information Broadcast	This Equipment package provides the capabilities to collect, process, store, bill, and disseminate traveler information including traveler, transit, ridematching, traffic, and parking information. The traveler information shall include maintaining a database of local area services available to travelers with up-to-the-minute information and providing an interactive connectivity between, sponsors, and providers of services. The transit information shall include the latest available information on transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence. The traffic information shall include latest available information on traffic and highway conditions, and current situation information in real-time including incidents, road construction, recommended routes, current speeds on specific routes, current parking conditions in key areas, schedules for any current or soon to start events, and current weather situations. This Equipment package shall also provide users with real-time travel related information while they are traveling, and disseminate to assist the travelers in making decisions about transfers and modification of trips. These capabilities shall be provided using equipment such as a fixed facility with a communications system such as a data Subcarrier multiplexing device.	1.1.4.5, 1.1.4.6, 4.1.8, 6.1.1, 6.2.1.1, 6.2.1.3, 6.2.1.4, 6.2.1.5, 6.5.1, 7.4.2
Interactive Information Reception	This Equipment package shall have as prerequisite the capabilities of the Basic Information Broadcast Equipment package. This Equipment package augments the Basic Information Broadcast Equipment package by providing the capabilities for interactive traveler information.	1.1.4.5, 1.1.4.6, 4.1.8, 6.1.1, 6.1.2, 6.1.3, 6.1.4, 6.2.1.2, 6.5.1, 6.6.1, 6.6.2.3, 6.6.2.4, 6.6.4, 6.6.5, 7.1.6, 7.2.6, 7.3.2, 7.4.1.6, 7.4.2, 7.4.3
Personal Basic Information Reception	This Equipment package shall provide the capability for travelers to interface with the ISP Subsystem Basic Information Broadcast Equipment package and receive formatted traffic advisories including accurate traveling information concerning available travel options and their availability, and congestion information from their Personal Information Access Subsystem to include their homes, place of work, major trip generation sites, personal portable devices, and over multiple types of electronic media such as facsimile machines, portable AM/FM radios, and a pager processor.	6.8.3.2, 6.8.3.3
Personal Interactive Information Reception	This Equipment package shall provide the capability for travelers to interface with the ISP Subsystem Infrastructure Equipment packages including the Interactive Infrastructure Information Equipment package, and the Infrastructure Provided Route Selection, Yellow Pages and Reservation, and Dynamic Ridesharing Equipment packages. These capabilities shall be provided using the Personal Information Access Subsystem equipment such as cellular telephone, interactive TV, Personal Computer, and pager with alpha display using communication medium and equipment such as two-way radio, CATV, and wireless data transceivers.	6.8.3.1, 6.8.3.2, 6.8.3.3, 7.5.3
Personal Location Determination	This equipment package determines current location information and provides this information to other equipment packages that use the location information to provide various ITS services.	6.8.1.3

Thurston Region Equipment Package	Description	Associated P-Specs
Personal Mayday Interface	This Equipment package shall provide the capability to initiate a distress signal and cancel a prior issued manual request for help using the Personal Information Access Subsystem. This capability shall be provided using equipment such as a processor to automatically dial the Emergency Management Subsystem and provide location.	6.8.1.5, 6.8.2.1, 6.8.2.2
Roadside Signal Priority	This Equipment package shall provide the capability to receive vehicle signal priority requests and control roadside signals accordingly.	1.2.7.1, 1.2.7.3
Advanced Rail Crossing	This equipment package manages highway traffic at highway-rail intersections (HRIs) where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). It includes all capabilities from the Standard Rail Crossing equipment package and augments these with additional safety features. The active warning systems supported by this market package includes positive barrier systems which preclude entrance into the intersection when the barriers are activated. Like the Standard package, the HRI equipment is activated on notification by wayside interface equipment which detects, or communicates with the approaching train. In this equipment package, additional information about the arriving train is also provided by the wayside interface equipment so that the train's direction of travel, its estimated time of arrival, and the estimated duration of closure may be derived. This enhanced information may be conveyed to the driver prior to, or in context with, warning system activation. This equipment package also includes detection capabilities which enable it to detect an entrapped or otherwise immobilized vehicle within the HRI and provide an immediate notification to the wayside interface equipment and traffic management.	1.1.1.1, 1.6.1.1, 1.6.1.2.4, 1.6.1.4.3, 1.6.1.5, 1.6.1.6.1, 1.6.1.6.2, 1.6.3.1, 1.6.3.2, 1.6.3.3, 1.6.5.1
Roadside Data Collection	This equipment package collects traffic, road, and environmental conditions information for use in transportation planning, research, and other off-line applications where data quality and completeness take precedence over real-time performance. This equipment package includes the sensors, supporting roadside infrastructure, and communications equipment that collects and transfers information to a center for archival.	1.1.1.4
Roadway Basic Surveillance	This Equipment package provides the capabilities to monitor traffic flow in major intersections and on main highways for urban areas and to monitor road conditions using fixed equipment such as loop detectors and wireline communication.	1.1.1.1, 1.3.1.3
Roadway Emissions Monitoring	This Equipment package monitors emissions and general air quality and communicates the collected information back to the emissions management subsystem where it can be monitored, analyzed, and used. This equipment package supports point monitoring of individual vehicle emissions as well as general monitoring of standard air quality measures.	1.5.5, 1.5.6
Roadway Environmental Monitoring	This Equipment package measures environmental conditions and communicates the collected information back to a center where it can be monitored and analyzed. A broad array of general weather and road surface information may be collected. Weather conditions that may be measured include temperature, wind, humidity, precipitation, and visibility. Surface and sub-surface sensors can measure road surface temperature, moisture, icing, salinity, and other measures. Air quality monitoring can include point monitoring of individual vehicles as well as general monitoring of standard air quality measures.	1.1.1.3

Thurston Region Equipment Package	Description	Associated P-Specs
Roadway Freeway Control	Ramp meters, CMS and other freeway control effects which will control traffic on freeways.	1.1.1.1, 1.2.7.2, 1.2.7.5
Roadway Incident Detection	This Equipment package provides incident detection capability to reside at the roadside. For example, advanced CCTV's with built-in incident detection algorithms would allow the actual detection function to be roadside rather than transmitting images to a center for visual or automated detection.	1.1.1.1
Roadway Probe Beacons	This Equipment package monitors traffic and road conditions by collecting information from passing vehicles that are equipped with a transponder or other short range communications device. The probe data collected by this equipment package may include link travel times, average speeds, road conditions, and any other data that can be measured and communicated by passing vehicles. This equipment package consists of roadside equipment that communicates with passing vehicles using dedicated short range communications, collects the information provided by the vehicles, and forwards this information back to the Traffic Management Subsystem.	1.1.6
Roadway Signal Controls	This Equipment package provides the capabilities to control traffic signals at major intersections and on main highways for urban areas. This Equipment package is generally constrained to a single jurisdiction.	1.1.1.1, 1.2.7.1, 1.2.7.2
Roadway Traffic Information Dissemination	This Equipment package provides the roadside elements of traffic information dissemination including DMS and HAR.	1.2.7.1, 1.2.7.5
Standard Rail Crossing	This Equipment Package manages highway traffic at highway-rail intersections (HRIs) where operational requirements do not dictate advanced features (e.g., where rail operational speeds are less than 80 miles per hour). Either passive (e.g., the crossbuck sign) or active warning systems (e.g., flashing lights and gates) are supported depending on the specific requirements for each intersection. These traditional HRI warning systems may also be augmented with other standard traffic management devices. The warning systems are activated on notification by interfaced wayside equipment of an approaching train. The equipment at the HRI may also be interconnected with adjacent signalized intersections so that local control can be adapted to highway-rail intersection activities. Health monitoring of the HRI equipment and interfaces is performed; detected abnormalities are reported through interfaces to the wayside interface equipment and the traffic management subsystem.	1.1.1.1, 1.2.7.1, 1.6.1.2.1, 1.6.1.2.2, 1.6.1.2.3, 1.6.1.2.5, 1.6.1.2.6, 1.6.1.3, 1.6.1.4.2, 1.6.1.4.4, 1.6.1.7.1, 1.6.1.7.2, 1.6.1.7.3, 1.6.3.1, 1.6.5.2, 1.6.5.3
Remote Basic Information Reception	This Equipment package shall provide the capability for travelers to interface with the ISP Subsystem Basic Information Broadcast Equipment package and receive formatted traffic advisories including accurate traveling information concerning available travel options and their availability, and congestion information at the Remote Traveler Support Subsystem.	6.3.2, 6.3.3
Remote Interactive Information Reception	This Equipment package shall provide the capability for travelers to interface with the ISP Subsystem Infrastructure Equipment packages including the Interactive Infrastructure Information Equipment package, the Infrastructure Provided Route Selection, Yellow Pages and Reservation, and Dynamic Ridesharing Equipment packages. These capabilities shall be provided using the Remote Traveler Support Subsystem equipment such as interactive TV and kiosk using communication medium and equipment such as CATV and wireline and wireless data transceivers.	6.3.3, 6.3.4, 7.3.4, 7.5.2, 7.5.5

Thurston Region Equipment Package	Description	Associated P-Specs
Remote Mayday Interface	This Equipment package provides the capability to report an emergency and summons assistance. The equipment includes a traveler interface that facilitates generation of a distress signal under duress and wireline communications that carries this distress signal and allows follow-up verification and determination of the nature of the emergency and the required response. This equipment package notifies either the Emergency Management or Transit Management Subsystem depending on the implementation.	4.4.1.8, 6.3.3
Remote Transit Fare Management	This Equipment package provides the capability for the traveler to use a common fare medium for all applicable surface transportation services, to pay without stopping, have payment media automatically identified as void and/or invalid and eligibility verified. This may be implemented as a payment instrument reader at a kiosk. In addition, capability to provide expansion into other uses for payment medium such as retail and telephone and for off-line billing for fares paid by agencies shall be supported.	4.7.2.1, 4.7.2.2, 4.7.2.3, 4.7.2.4, 4.7.2.5, 4.7.2.6, 4.7.2.7, 7.3.4, 7.5.2
Remote Transit Information Services	The Equipment package furnishes transit users with real-time travel-related information at transit stops, multi-modal transfer points, and other public transportation areas. It provides transit users with the latest available information on transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events. In addition to tailored information for individual transit users, this equipment package supports general annunciation and/or display of imminent arrival information and other information of general interest to transit users.	4.7.1.1, 4.7.1.2
Secure Area Monitoring	This Equipment package provides the capability to monitor the safety of transit users at Remote Traveler Subsystem locations. It collects surveillance images and data and relays this information back to the Transit Management Subsystem.	4.4.1.7
Collect Traffic Surveillance	This Equipment package collects, stores, and provides electronic access to the traffic surveillance data.	1.1.2.1, 1.1.2.2, 1.1.2.3, 1.1.4.1, 1.1.4.2, 1.1.4.4
HRI Traffic Management	This equipment package monitors highway-rail intersection (HRI) equipment at the roadside, which manages highway traffic. Various levels of roadside equipment may be interfaced to, and supported by, this equipment package to include standard speed active warning systems and high speed systems which provide additional information on approaching trains and detect and report on obstructions in the HRI. This equipment package remotely monitors and reports the status of this roadside equipment. A two way interface supports explicitly status requests or remote control plan updates to be generated by this equipment package. Status may also be received periodically in the absence of a request or asynchronously in the event of a detected failure or other unsafe condition at the intersection.	1.6.2.1, 1.6.2.2, 1.6.4.1, 1.6.4.2
Rail Operations Coordination	This equipment package provides strategic coordination between rail operations and traffic management centers. It receives train schedules, maintenance schedules, and any other forecast events which will result in highway-rail intersection (HRI) closures from Rail Operations. The provided information is used to develop forecast HRI closure times and durations which may be applied in advanced traffic control strategies or delivered as enhanced traveler information. This equipment package includes the processing and algorithms necessary to derive HRI closure times and the communications capabilities necessary to communicate with rail operations and interface to the traffic control and information distribution capabilities included in other Traffic Management Subsystem equipment packages.	1.1.3, 1.6.2.1, 1.6.2.3

Thurston Region Equipment Package	Description	Associated P-Specs
TMC Freeway Management	Control system for efficient freeway management including integration of surveillance information with freeway road geometry, vehicle control such as ramp metering, CMS, HAR. Interface to coordinated traffic subsystems for information dissemination to the public.	1.1.4.2, 1.2.2.1, 1.2.4.2
TMC Incident Detection	This Equipment package provides the capability to traffic managers to detect and verify incident. This capability includes analyzing and reducing the collected data from traffic surveillance equipment, including planned incidents and hazardous conditions.	1.3.1.1, 1.3.1.2, 1.3.2.1, 1.3.2.2, 1.3.2.3, 1.3.2.4, 1.3.2.5, 1.3.4.2, 1.3.4.3
TMC Incident Dispatch, Coordination/Communication	This Equipment package provides the capability for an incident response formulation function minimizing the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.	1.1.5.1, 1.2.4.1, 1.2.4.2, 1.3.2.3, 1.3.3, 1.3.4.1, 1.3.4.2, 1.3.4.4, 1.3.4.5, 1.3.5, 1.3.6, 1.3.7
TMC Multi-Modal Coordination	This Equipment package provides the capability of signal control at the traffic management subsystem to provide signal priority for transit vehicles	1.2.2.1, 1.2.2.2, 1.4.2
TMC Probe Information Collection	This Equipment package provides the capability to accept and process probe vehicle information. This capability shall be provided through the use of additional hardware and probe vehicle control and tracking software.	1.1.2.5, 1.1.4.1
TMC Regional Traffic Control	This Equipment package provides capabilities in addition to those provided by the TMC Basic Signal Control Equipment package for analyzing, controlling, and optimizing area-wide traffic flow. These capabilities provide for wide area optimization integrating control of a network signal system with control of freeway, considering current demand as well as expected demand with a goal of providing the capability for real-time traffic adaptive control while balancing inter-jurisdictional control issues to achieve regional solutions. These capabilities are best provided using a Traffic Management Center (TMC) to monitor and manage freeway ramp meters and intersection traffic signals and software to process traffic information and implement traffic management measures (e.g., ramp metering, signalization, and traffic coordination between both local and regional jurisdiction). The TMC shall be able to communicate with other TMCs in order to receive and transmit traffic information on other jurisdictions within the region.	1.1.4.2, 1.1.5, 1.2.4.1, 1.2.4.2
TMC Road Weather Monitoring	This equipment package assimilates current and forecast road conditions and weather information using a combination of weather service information and an array of environmental sensors deployed on and about the roadway. The collected road weather information is monitored and analyzed to detect and forecast environmental hazards such as icy road conditions and dense fog. This information can be used to more effectively deploy road maintenance resources, issue general traveler advisories, and support location specific warnings to drivers.	1.1.2.1, 1.1.2.2, 1.1.4.1, 1.3.2.1, 1.3.2.2, 1.3.4.2, 1.3.4.5

Thurston Region Equipment Package	Description	Associated P-Specs
TMC Signal Control	This Equipment package provides the capability for traffic managers to monitor and manage the traffic flow at signalized intersections. This capability includes analyzing and reducing the collected data from traffic surveillance equipment and developing and implementing control plans for signalized intersections. Control plans may be developed and implemented that coordinate signals at many intersections under the domain of a single traffic management subsystem. In advanced implementations, this package collects route planning information and integrates and uses this information in predicting future traffic conditions and optimizing the traffic control strategy for these conditions. These capabilities are achieved through real-time communication of logged routes from an Information Service Provider. The planned control strategies can be passed back to the Information Service Provider so that the intended strategies can be reflected in future route planning.	1.1.2.2, 1.1.4.2, 1.2.11, 1.2.2.2, 1.2.4.1
TMC Traffic Information Dissemination	This Equipment package provides the capability to disseminate incident related information to travelers, potential travelers, and private information service providers. These capabilities shall be provided using a workstation type processor within a facility connected to traveler information providers by utilizing existing wireline links.	1.1.4.1, 1.1.4.2, 1.1.4.3, 1.3.4.3
TMC Traffic Network Performance Evaluation	This Equipment package provides the capability to predict travel demand patterns to support traffic flow optimization, demand management, and incident management. This Equipment package requires the data collected by surveillance Equipment packages as well as input from other management subsystems including the ISP Subsystem, Transit Management Subsystem.	1.1.2.1, 1.1.2.2, 1.1.3, 1.1.5, 1.2.6.1, 1.2.6.2, 1.4.1, 1.4.2, 1.4.4, 1.4.5
Traffic Data Collection	This equipment package collects and stores traffic information that is collected in the course of traffic operations performed by the Traffic Management Subsystem. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.	1.1.4.7
Traffic Maintenance	This Equipment package provides monitoring and remote diagnostics of field equipment to detect field equipment failures, issues problem reports, and tracks the repair or replacement of the failed equipment.	1.1.1.2, 1.2.8.1, 1.2.8.2, 1.2.8.3, 1.2.8.4
Transit Center Fare and Load Management	This Equipment package provides the capability to accept collected data required to determine accurate ridership levels and implement variable and flexible fare structures. Support shall be provided for the traveler for use of a fare medium for all applicable surface transportation services, to pay without stopping, have payment media automatically identified as void and/or invalid and eligibility verified, and allow for third party payment. In addition, capability to provide expansion into other uses for payment medium such as retail and telephone and for off-line billing for fares paid by agencies shall be supported. This Equipment package also supports the capability for two-way voice communication between the transit vehicle driver and a facility, two-way data communication between the transit vehicles and a facility, sensor data to be transmitted from the transit vehicles to a facility, and data transmission from individual facilities to a central facility for processing/analysis if desired. These capabilities shall be provided through a workstation type processor with GUI, high capacity storage, ride share software housed in a building with dialup lines and wireline telephone and require integration with an existing Transit Center Tracking and Dispatch Equipment package.	4.6.8, 5.4.5, 7.3.1.1, 7.3.1.2, 7.3.1.3, 7.3.1.4, 7.3.1.5, 7.3.1.6, 7.1.3.7

Thurston Region Equipment Package	Description	Associated P-Specs
Transit Center Fixed Route Operations	This Equipment package enhances the planning and scheduling associated with fixed route transit services. The package allows fixed-route services to develop, print and disseminate schedules and automatically updates customer service operator systems with the most current schedule information. Current vehicle schedule adherence and optimum scenarios for schedule adjustment shall also be provided.	4.1.6, 4.2.2, 4.2.3.1, 4.2.3.2, 4.2.3.4, 4.2.3.5, 4.2.3.6
Transit Center Information Services	This equipment package collects the latest available information for a transit service and makes it available to transit customers and to Information Service Providers for further distribution. Customers are provided information at transit stops and other public transportation areas before they embark and on-board the transit vehicle once they are enroute. Information provided can include the latest available information on transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events. In addition to general service information, tailored information (e.g., itineraries) are provided to individual transit users.	4.1.5, 4.1.6, 4.2.3.3, 4.6.8
Transit Center Multi-Modal Coordination	This Equipment package provides the transit management subsystem the capability to determine the need for transit priority on routes and at certain intersections and request transit vehicle priority at these locations. It also supports schedule coordination between transit properties and coordinates with other surface and air transportation modes.	4.1.2.4, 4.1.4, 4.1.5, 4.1.7, 4.2.3.2, 4.2.3.7, 4.2.3.8
Transit Center Paratransit Operations	This Equipment package provides the capability to automate the planning and scheduling, allowing improvements in paratransit routes and services to develop, printing and disseminating schedules, and automatically updating customer service operator systems with the most current schedule. In addition, this Equipment package provides the capability to assign drivers to routes in a fair manner while minimizing labor and overtime services, including driver preferences and qualifications, and automatically tracking and validating the number of work hours performed by each individual driver. These capabilities shall be provided through the utilization of dispatch and fleet management software running on a workstation type processor.	4.1.6, 4.2.1.1, 4.2.1.2, 4.2.1.3, 4.2.1.4
Transit Center Security	This Equipment package provides the capability to monitor key transit locations and transit vehicles with both video and audio systems automatically alerting operators and police of potential incidents and supporting traveler activated alarms. The monitoring equipment shall also include capabilities to assist in responding to terrorist incidents.	4.4.1.1, 4.4.1.3, 3.3.1.4, 4.4.1.6, 4.4.2, 4.4.3, 7.3.3
Transit Center Tracking and Dispatch	This Equipment package provides the capabilities for monitoring transit vehicle locations and determining vehicle schedule adherence. The Equipment package shall also furnish users with real-time travel related information, continuously updated with real-time information from each transit system within the local area of jurisdiction, inclusive of all transportation modes, from all providers of transportation services, and provide users with the latest available information on transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents conditions, weather conditions, and special events. This Equipment package also supports the capability for two-way voice communication between the transit vehicle driver and a facility, two-way data communication between the transit vehicles and a facility.	4.1.6, 4.2.3.9
Transit Data Collection	This equipment package collects and stores transit information that is collected in the course of transit operations performed by the Transit Management Subsystem. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.	4.2.4

Thurston Region Equipment Package	Description	Associated P-Specs
Transit Garage Maintenance	This Equipment package provides advanced maintenance functions for the transit property. It collects operational and maintenance data from transit vehicles, manages vehicle service histories, and monitors drivers and vehicles. It collects vehicle mileage data and uses it to automatically generate preventative maintenance schedules for each vehicle by utilizing vehicle tracking data from a prerequisite vehicle tracking equipment package. In addition, it provides information to proper service personnel to support maintenance activities and records and verifies that maintenance work was performed. This equipment package receives special events and real-time incident data from the traffic management subsystem and assigns operators to vehicles and transit routes. Garage maintenance also receives information about incidents involving transit vehicles from the TMC in order to dispatch tow trucks and other repair vehicles.	4.3.1, 4.3.2, 4.3.3, 4.3.4, 4.3.5, 4.3.6, 4.3.7
Transit Garage Operations	This Equipment package automates and supports the assignment of transit vehicles and drivers to enhance the daily operation of a transit service. It provides the capability to assign drivers to routes or service areas in a fair manner while minimizing labor and overtime services, considering driver preferences and qualifications, and automatically tracking and validating the number of work hours performed by each individual driver.	4.5.1, 4.5.2, 4.5.3, 4.5.4, 4.5.5, 4.5.6, 4.5.7, 4.5.8
On-board Fixed Route Schedule Management	This Equipment package provides the capabilities for automated planning and scheduling, by collecting data for schedule generation. Capability shall also be provided to automatically determine optimum scenarios for schedule adjustment. This Equipment package also supports the capability for two-way voice communication between the transit vehicle driver and a facility, two-way data communication between the transit vehicles and a facility, on-board safety sensor data to be transmitted from the transit vehicles to a facility, and data transmission from individual facilities to a central facility for processing/analysis if desired.	4.1.2.1, 4.1.2.2, 4.1.2.3
On-board Maintenance	This Equipment package provides the capability to use transit vehicle mileage data to automatically generate preventative maintenance schedules for each specific bus by utilizing vehicle tracking data and storing with a trip computer. It also provides the capability for real-time condition monitoring on board the vehicle, and transmission of this information via two-way communication to the management center.	4.1.1, 4.1.9
On-board Paratransit Operations	This equipment package forwards paratransit dispatch requests to the driver and forwards acknowledgements to the center. It coordinates with, and assists the driver in managing multi-stop runs associated with demand responsive, flexibly routed transit services.	4.2.1.5, 4.2.16

Thurston Region Equipment Package	Description	Associated P-Specs
On-board Transit Fare and Load Management	This Equipment package provides the capability to collect data required to determine accurate ridership levels and implement variable and flexible fare structures. Support shall be provided for the traveler for use of a fare medium for all applicable surface transportation services, to pay without stopping, have payment media automatically identified as void and/or invalid and eligibility verified, and allow for third party payment. In addition, capability to provide expansion into other uses for payment medium such as retail and telephone and for off-line billing for fares paid by agencies shall be supported. This Equipment package also supports the capability for two-way voice communication between the transit vehicle driver and a facility, two-way data communication between the transit vehicles and a facility, sensor data to be transmitted from the transit vehicles to a facility, and data transmission from individual facilities to a central facility for processing/analysis if desired. These capabilities require integration with an existing On-board Trip Monitoring Equipment package.	4.6.1, 4.6.2, 4.6.3, 4.6.4, 4.6.5, 4.6.6, 4.6.7, 7.3.5
On-board Transit Information Services	The Equipment package furnishes enroute transit users with real-time travel-related information. Current information that can be provided to transit users includes transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events are provided. In addition to tailored information for individual transit users, this equipment package also supports general annunciation and/or display of general schedule information, imminent arrival information, and other information of general interest to transit users.	6.2.1.6, 6.2.3
On-board Transit Security	This Equipment package provides the capability to monitor the safety of transit vehicles using on-board safety sensors, processors and communications from the prerequisite On-board Trip Monitoring Equipment package.	4.4.1.2, 4.4.1.5
On-board Transit Signal Priority	This Equipment package provides the capability for transit vehicles to request signal priority through short range communication directly with traffic control equipment at the roadside.	4.1.2.5
On-board Transit Trip Monitoring	This Equipment package provides the capabilities to support fleet management with automatic vehicle location and automated mileage and fuel reporting and auditing. This package may also record other special events resulting from communication with roadside equipment. This includes only the equipment on board the vehicle to support this function including the vehicle location devices such as GPS equipment, communication interfaces, a processor to record trip length, and the sensors/actuators/interfaces necessary to record mileage and fuel usage.	4.1.1, 4.1.3
Vehicle Location Determination	This equipment package determines current location information and provides this information to other equipment packages that use the location information to provide various ITS services.	6.7.2.2
Vehicle Probe Support	This Equipment package includes capabilities for the probe vehicle to identify its location, measure traffic conditions such as link travel time and speed and possibly environmental hazards such as icy road conditions, and transmit these data to either the ISP or TMC.	3.2.3.5

Thurston Region Equipment Package	Description	Associated P-Specs
Basic Vehicle Reception	This Equipment package shall provide the capability for drivers to interface with the ISP Subsystem Basic Information Broadcast Equipment package and receive formatted traffic advisories including accurate traveling information concerning available travel options and their availability, and congestion information in their vehicle. These capabilities shall be based upon the reception of infrastructure information using in-vehicle devices such as an in-vehicle AM/FM radio with data Subcarrier connected with the existing audio system and a dash-mounted LCD.	6.2.2, 6.2.5
Interactive Vehicle Reception	This Equipment package shall provide the capability for drivers to interface with the ISP Subsystem Infrastructure Equipment packages including the Interactive Infrastructure Information Equipment package, the Infrastructure Provided Route Selection, Yellow Pages and Reservation, and Dynamic Ridesharing Equipment packages. These capabilities shall be provided using the Vehicle Subsystem equipment.	6.2.2, 6.2.5
Vehicle Mayday Interface	This Equipment package shall provide the capability for an in-vehicle manually initiated distress signal with cancel a prior issued manual request for help feature. This capability shall include automatically identifying that a collision had occurred using equipment such as collision detection sensors with interface to mayday type equipment that would automatically detect vehicle problems and for some cases, automatically send appropriate distress signals to the Emergency Management Subsystem.	3.3.2, 3.3.3, 6.2.5, 6.7.1.1, 6.7.1.2

APPENDIX A

USER SERVICE REQUIREMENTS AND ASSOCIATED PROCESS SPECIFICATIONS (P-SPECS)

User Services and User Service Requirements	Associated P-Specs
1.1 Pre-trip Travel Information	
Thurston Regional ITS shall provide a Pre-Trip Travel Information (PTTI) capability to assist regional travelers, public agencies and commercial operators in making mode choices, travel time estimates, and/or route decisions prior to trip departure. Thurston Regional PTTI will consist of three major functions, which are: (1) Current Situation Information, (3) Trip Planning Service, and (4) User Access. Information will be integrated from various transportation modes and presented to the user for their information and decision-making.	1.1.4.6, 4.4.1.8, 6.1.1, 6.1.2, 6.5.1, 6.8.3.1, 6.8.3.2, 6.8.3.3
1.2 En-route Driver Information	
Thurston Regional ITS shall include an En-Route Driver Information function. Driver Information provides vehicle drivers with traffic and roadway status information, while en-route, which will allow alternative routes to be chosen for their destination. Driver Information consists of two major functions, which are (1) Driver Advisory and (2) In-vehicle Signing.	1.1.1.3, 1.1.3, 6.2.1.1, 6.2.1.2, 6.2.1.3, 6.2.1.4, 6.2.2, 6.2.3, 6.2.5
1.3 Route Guidance	
Thurston Regional ITS shall include a Route Guidance function. Route Guidance will provide travelers with directions to selected destinations. Four Route Guidance functions are potentially provided, these are: (1) Provide Directions, (2) Static Mode, (3) Real-Time Mode, and (4) User Interface.	1.6.1.1, 6.2.5, 6.6.1, 6.6.2.2, 6.6.2.3, 6.6.2.4, 6.6.2.6, 6.6.3, 6.6.4, 6.6.5
1.4 Ride Matching and Reservation	
Thurston Regional ITS shall include a Ride Matching function. Ride Matching will provide travel users with information on rideshare providers. Three major functions are provided which are (1) Rider Request, (2) Transportation Provider Services, and (3) Information Processing.	1.2.4.1, 1.2.4.2, 1.2.7.1, 1.2.7.5, 6.1.1, 6.1.2, 6.4.1, 6.4.2, 6.6.1, 6.6.4, 6.8.3.1, 6.8.3.2, 6.8.3.3, 7.4.2
1.5 Traveler Services Information	
Thurston Regional ITS shall include a Traveler Services Information function. Traveler Services Information provides travelers with service and facility data for the purpose of assisting prior to embarking on a trip or after the traveler is underway. The two functions included in this capability are: (1) Information Receipt and (2) Information Access.	1.2.4.1, 1.2.4.2, 1.2.7.1, 1.2.7.5, 6.1.1, 6.1.2, 6.2.1.2, 6.2.1.4, 6.2.3, 6.5.1, 6.5.2, 6.8.1.5, 6.8.3.1, 6.8.3.2

User Services and User Service Requirements	Associated P-Specs
1.6 Traffic Control	
Thurston Regional ITS shall provide a seamless city, county and state Traffic Control capability. Traffic Control provides the capability to efficiently manage the movement of traffic on streets and highways. This will also include control of network signal systems with eventual integration of freeway and arterial control. Four functions are provided which are: (1) Traffic Flow Optimization, (2) Traffic Surveillance, (3) Control Function, and (4) Provide Information.	1.1.1.1, 1.1.2.1, 1.1.2.2, 1.1.2.3, 1.1.3, 1.1.4.1, 1.1.4.2, 1.1.4.4, 1.1.4.6, 1.1.5, 1.2.1, 1.2.2.1, 1.2.2.2, 1.2.4.1, 1.2.4.2, 1.2.4.3, 1.2.5.1, 1.2.6.1, 1.2.6.2, 1.2.7.1, 1.2.7.5, 5.3.2, 5.3.7, 6.1.1, 6.1.4
1.7 Incident Management	
Thurston Regional ITS shall include an Incident Management function. Incident Management will identify incidents, formulate response actions, and support initiation and ongoing coordination of those response actions. Six major functions are provided which are: (1) Scheduled/Planned Incidents, (2) Identify Incidents, (3) Formulate Response Actions, (4) Support Coordinated Implementation of Response Actions, (5) Support Initialization of Response to Actions, and (6) Predict Hazardous Conditions.	1.1.1.1, 1.1.1.3, 1.1.2.2, 1.1.4.3, 1.2.7.2, 1.2.7.4, 1.2.8.1, 1.2.8.2, 1.2.8.3, 1.2.8.4, 1.3.1.1, 1.3.2.1, 1.3.2.2, 1.3.2.3, 1.3.2.4, 1.3.2.5, 1.3.3, 1.3.4.1, 1.3.4.2, 1.3.4.3, 1.3.4.4, 1.3.4.5, 1.3.5, 1.3.6, 1.3.7, 4.4.1.8, 6.6.1, 6.5.1, 6.6.2.3
1.8 Travel Demand Management	
Thurston Regional ITS Travel Demand Management will generate and communicate management and control strategies that will support and facilitate the implementation of TDM programs, policies and regulations. It consists of two major functions which are: (1) Increase Efficiency of Transportation System and (2) Provide Wide Variety of Mobility Options.	1.1.1.1, 1.1.1.2, 1.1.2.2, 1.2.5.1, 1.2.6.1, 1.2.7.3, 1.4.1, 1.4.2, 1.4.4, 1.4.5, 4.2.3.7, 6.1.1, 6.1.2, 6.2.1.6, 6.2.5, 6.4.2, 7.3.1.3
1.9 Emissions Testing and Mitigation	
Thurston Regional ITS shall include an Emissions Testing and Mitigation Function. This function will provide state and local governments with the capability to enhance their air quality control strategies. It will provide both area wide and roadside emissions monitoring.	1.5.1, 1.5.2, 1.5.3, 1.5.4, 1.5.5, 1.5.6, 1.5.7, 1.5.8
1.10 Highway-Rail Intersection	
Thurston Regional ITS shall include a Highway-Rail Intersection function to control highway and rail traffic in at-grade crossings. Two sub-services are supported: (1) Standard Speed Rail which is applicable to light rail transit, commuter rail and heavy rail trains with operational speeds up to 79 miles per hour (MPH); and (2) High Speed Rail which is applicable to all passenger and freight trains with operational speeds from 80 to 125 MPH.	1.1.2.2, 1.2.4.3, 1.2.7.1, 1.6.1.1, 1.6.2.1, 1.6.1.4.1, 1.6.1.6.1, 1.6.1.7.2, 1.6.2.2, 1.6.2.3, 1.6.3.1, 1.6.3.2, 1.6.3.3, 1.6.4.1, 1.6.4.2, 1.6.5.1, 1.6.5.3

User Services and User Service Requirements	Associated P-Specs
2.1 Public Transportation Management	
Thurston Regional ITS shall include a Public Transportation Management function.	4.1.1, 4.1.2.1, 4.1.2.2, 4.1.2.3, 4.1.2.4, 4.1.2.5, 4.1.3, 4.1.4, 4.1.5, 4.1.6, 4.1.7, 4.1.8, 4.1.9, 4.2.2, 4.2.3.1, 4.2.3.2, 4.2.3.4, 4.2.3.5, 4.2.3.9, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 4.3.5, 4.3.6, 4.3.7, 4.4.1.2, 4.4.1.3, 4.4.1.4, 4.4.1.5, 4.4.1.6, 4.4.1.7, 4.4.1.8, 4.5.1, 4.5.2, 4.5.3, 4.5.4, 4.5.5, 4.5.6, 4.5.7, 4.5.8
2.2 En-Route Transit Information	
Thurston Regional ITS shall include an En-Route Transit Information function. En-Route Transit Information provides travelers with real-time transit and high-occupancy vehicle information allowing travel alternatives to be chosen once the traveler is en-route. This capability integrates information from different transit modes and presents it to travelers for decision-making. It consists of three major functions which are: (1) Information Distribution, (2) Information Receipt, and (3) Information Processing.	1.3.1.3, 4.1.7, 4.2.2, 4.2.3.5, 4.7.1.1, 4.7.1.2, 5.1.5, 6.1.3, 6.2.1.1, 6.2.1.2, 6.2.1.3, 6.2.1.4, 6.2.2
2.3 Personalized Public Transit	
Thurston Regional ITS shall include a Personalized Public Transit function.	4.2.1.1, 4.2.1.2, 4.2.1.3, 4.2.1.4, 4.2.1.5, 4.2.1.6, 4.2.3.3, 4.2.3.5, 4.2.3.6, 4.6.4, 4.6.5, 6.1.1, 6.4.4, 6.8.3.2, 6.8.3.3, 7.3.1.3
2.4 Public Travel Security	
Thurston Regional ITS shall include a Public Travel Security function to create an environment of safety in public transportation.	4.4.1.1, 4.4.1.2, 4.4.1.3, 4.4.1.6, 4.4.1.7, 4.4.2, 4.4.3, 4.4.1.8, 6.1.1

User Services and User Service Requirements	Associated P-Specs
3.0 Electronic Payment	
Thurston Regional ITS shall include an Electronic Payment capability. Electronic Payment Services allows travelers to pay for transportation services by electronic means. Functions included are (1) Electronic Fare Collection, and (2) Electronic Payment Services Integration.	1.4.2, 1.4.4, 1.4.5, 4.6.1, 4.6.2, 4.6.3, 4.6.4, 4.6.5, 4.6.6, 4.6.7, 4.6.8, 4.7.2.1, 4.7.2.2, 4.7.2.3, 4.7.2.4, 4.7.2.5, 4.7.2.6, 4.7.2.7, 5.4.5, 5.4.7, 6.2.1.6, 7.3.1.3, 7.3.1.4, 7.3.4, 7.3.5, 7.4.1.6, 7.4.1.7, 7.4.1.8, 7.4.3, 7.5.1, 7.5.2, 7.5.3, 7.5.4, 7.5.5
4.1 Commercial Vehicle Electronic Clearance	
Thurston Regional ITS shall include a Commercial Vehicle Electronic Clearance capability.	2.3.1, 2.3.4, 2.3.5, 2.3.7, 2.4.4
4.3 On-Board Safety Monitoring	
Thurston Regional ITS shall include an On-Board Safety Monitoring function, that provides monitoring and warnings of safety problems. Of primary importance is to inform the driver, as soon as possible, of any problem that has been detected. Of secondary importance is notifying the carrier of detected safety problems. Last in importance is the notification of appropriate enforcement agencies.	2.3.1, 2.3.3.1, 2.3.4, 2.3.7, 2.4.1
4.4 Commercial Vehicle Administrative Processes	
Thurston Regional ITS shall include a Commercial Vehicle Administrative Process function. This will consist of two services to include: (1) Electronic Purchase of Credentials, and (2) Automated Mileage and Fuel Reporting and Auditing.	2.1.1, 2.1.2, 2.2.1, 2.2.2, 2.2.3, 2.4.4
4.6 Commercial Fleet Management	
Thurston Regional ITS shall include a Commercial Fleet Management function.	2.1.1, 2.1.3, 2.1.4, 2.1.5, 2.2.1, 2.2.3, 2.2.4, 2.4.4, 2.5.2
5.1 Emergency Notification and Personal Security	
Thurston Regional ITS shall include an Emergency Notification And Personal Security function that provides for the faster detection and reporting of accidents, and receipt of notification by travelers involved in an incident.	3.3.2, 3.3.3, 6.7.1.1, 6.7.1.2, 6.8.2.1, 6.8.2.2

User Services and User Service Requirements	Associated P-Specs
5.2 Emergency Vehicle Management	
Thurston Regional ITS shall include an Emergency Vehicle Management Service.	5.1.4, 5.3.1, 5.3.2, 5.3.3, 5.3.4, 5.3.6, 5.3.7, 6.6.1
7.1 Archived Data Function	
Thurston Regional ITS shall provide an Archived Data Function to control the archiving and distribution of ITS data. The Archived Data User Service helps achieve the ITS information goal of unambiguous interchange and reuse of data and information throughout all functional areas. The Archived Data User Service provides the Historical Data Archive Repositories and controls the archiving functionality for all ITS data with five major functions: (1) the Operational Data Control function to manage operations data integrity, (2) the Data Import and Verification function to acquire historical data from the Operational Data Control function, (3) the Automatic Data Historical Archive function for permanently archiving the data, (4) the Data Warehouse Distribution function which integrates the planning, safety, operations, and research communities into ITS and processes data products for these communities; and (5) the ITS Community Interface which provides the ITS common interface to all ITS users for data products specification and retrieval.	1.1.1.4, 1.1.4.4, 1.1.4.6, 1.1.4.7, 1.1.5, 1.2.2.2, 1.2.6.1, 1.2.6.2, 4.1.8, 4.2.4, 6.1.1, 6.1.2, 6.1.5, 6.1.6, 6.2.1.2, 6.4.1, 6.5.2, 6.6.1, 6.6.2.2, 6.6.2.6, 6.6.5, 8.1, 8.2, 8.4, 8.5

APPENDIX B

PROCESS SPECIFICATIONS (P-SPECS) DESCRIPTIONS

P-Spec Nbr	Description
1.1.1.1	This process shall be responsible for collecting surveillance obtained from the roadside, vehicles, pedestrians (travelers using other modes of transport), railroad grade and multimodal crossings. Where any of the data is provided in analog form, the process shall be responsible for converting it into digital form and calibrating. The converted data shall be sent to other processes for distribution, further analysis and storage.
1.1.1.2	This process shall be responsible for collecting sensor status, identifying faults, and logging faults that have been detected by processes in other parts of the Manage Traffic function. It shall be possible for the faults to have been detected locally at the sensors, or centrally through communications links with the sensors. The process shall pass on new fault data to another processes for communication to the Construction and Maintenance terminator and shall receive fault clearances from the same terminator. It shall also maintain a store of the current fault state of all sensors. The process shall provide facilities that enable traffic operations personnel to review and update the current fault status of all sensors. Details of faulty and fixed equipment shall be passed by the process to the traffic control strategy selection process so that it can adjust its strategy to take account of the fault(s).
1.1.1.3	This process shall be responsible for collecting data obtained from environmental sensors. Where any of the data is provided in analog form, the process shall be responsible for converting it into digital form and calibrating. The converted data shall be sent to other processes for distribution, further analysis and storage.
1.1.1.4	This process shall collect and monitor sensor data from the roadside. The process shall collect the sensor data including sensor status and sensor faults from roadside equipment and distribute it to the Manage Archive Data function. The process shall run when a request for data is received from an external source.
1.1.2.1	This process shall receive data from other processes and store the data into the long term and current data stores. The data shall comprise sensor data, both smoothed and unsmoothed: processed sensor surveillance data, data sent to control indicators (output devices e.g. intersection controllers, pedestrian controllers, dynamic message signs, ramp metering equipment), parking lot management data and other street equipment, the status data received from the indicators, plus current traffic conditions, planned events, current incidents, parking lot states, freeway ramp states, link travel times, roadway conditions provided by vehicle probes, and selected traffic control strategy. The data stored by the process in the current data store shall be the values collected over a relatively short period of time. The data stored in the long term data store shall be retained for a longer period. The data retained in the long term data store may be aggregated so as to reduce the storage requirements for long historical records, the amount of aggregation to be an implementation decision.
1.1.2.2	This process shall receive and process data from sensors (both traffic and environmental) at the roadway. The process distributes data to Provide Device Control processes that are responsible for freeway, highway rail intersections, parking lot, surface street and freeway management. It also sends the data to another Provide Traffic Surveillance process for loading into the stores of current and long term data. Information about the various sensors to aid in this processing and distribution of data is accessed from the data store.
1.1.2.3	This process shall be responsible for the maintenance of the store of static data used in the processing of sensor data. This sensor data shall be used to provide traffic surveillance information for use by other processes within the Manage Traffic function. The store shall contain data showing the relationship between sensors and the surface street and freeway network, i.e. where they are located, to which part(s) of the network their data applies, the type of data, etc. It shall also hold information about the ownership of each link (that is, the agency or entity responsible for collecting and storing surveillance of the link) in the network which shall be used by processes involved in exchanging surveillance information (and optionally control) with other Traffic Management Subsystems (TMS's). The contents of the store shall be provided by the Plan System Deployment function.

P-Spec Nbr	Description
1.1.3	This process shall be responsible for continually producing and updating a predictive model of the traffic flow conditions in the road or freeway network served by the Manage Traffic function that an instance of this process is allocated to. The prediction shall be based on current surveillance, historic traffic data and surveillance, current incidents, planned events, current traffic control strategy, data received fromother Traffic Management Subsystems (TMS's) serving other geographic and/or jurisdictional areas, and current and predicted weather conditions. The predictive model of traffic flow produced by this process shall be used by processes in the Manage Traffic function and other ITS functions.
1.1.4.1	This process shall on request retrieve traffic data from the data stores managed by other processes in the Provide Traffic Surveillance facility of the Manage Traffic function. It shall be possible for requests to originate from traffic operations personnel, the media operator, the Manage Demand facility within the Manage Traffic function, the Plan System Deployment function and the Provide Driver and Traveler Services function. With the exception of those from the Manage Demand facility and the Plan System Deployment function, all requests shall be provided by interface processes. The process shall also generate traffic data for output by other processes to in-vehicle signage functions.
1.1.4.2	This process shall provide the interface through which traffic operations personnel can obtain access to the data stored by other processes in the Provide Traffic Surveillance facility of the Manage Traffic function, and set up the parameters that govern the data that is available to non-traffic operations people via a separate process to the media operator. This stored data shall comprise current and long term (historic) data on traffic conditions, weather conditions and roadside equipment activity, plus prediction estimates of traffic conditions. The data shall apply to some or all of the surface street and freeway network served by the specific instance of the Manage Traffic function. Where appropriate and/or requested by the traffic operations personnel, the process shall provide the data output in the form of an overlay onto a map of the relevant part(s) of the surface street and freeway network served by the instance of the function. The process shall obtain the map from a local data store, which it shall enable the traffic operations personnel to update as and when required.
1.1.4.3	This process shall be responsible for providing the interface between the media and the process responsible for obtaining data from the stores of traffic data maintained by other processes within the Provide Traffic Surveillance facility of the Manage Traffic function. The process shall enable the media to request and be provided with current, long term (historic) and predicted traffic data. The data may be provided in one or more formats: as a data stream, as processed and displayed to Traffic Operations Personnel (e.g. graphical summaries of link speeds),or as a display (with data included on a map of relevant part(s) of the road and freeway served by the Manage Traffic function. The media shall only be able to request and see displayed that data that the traffic operations personnel have made available, through the use of the definition in the traffic data media parameters.
1.1.4.4	This process shall provide updates to a store of digitized map data when a request is received from traffic operations personnel via their interface process. The map data shall be for use as the background for displays of traffic data requested by traffic operations personnel and media operators through their respective interface processes. This process shall obtain the new map data from either a specialized data supplier or some other appropriate data source.
1.1.4.6	This process shall provide customized sets of traffic data for broadcast, advisories, and personalized data to travelers, traveler information data archive, and the media. This process shall use the parameters in the data store 'traffic_data_retreival_parameters' to define exactly what data shall be retrieved as a result of each request. The process shall select the appropriate subset of traffic data which will be sent to each ITS function which is requesting data. The process shall accept traveler profiles for use in determining what personalized data to send to the traveler. The process shall send kiosk and personal traffic requests to the archival process.
1.1.4.7	This process shall collect traffic data and ahs operational data to distribute to the Manage Archive Data function. The process shall run when a request for data is received from an external source, or when fresh data is received.

P-Spec Nbr	Description
1.1.5	This process shall exchange data with similar processes in other Traffic Management Subsystems (TMS's). The other TMS can be adjacent geographically, under control of a different jurisdiction, or part of a more complex hierarchy. The exchange of data shall be triggered by either a request from a remote TMS for data from the TMS to which the Manage Traffic function belongs, or because data needs to be sent from the local TMS to a remote TMS. This data shall include traffic control preemption for vehicle routes which pass through the local network but have a destination in an area served by a remote TMS, or include data about an incident that has an impact on the traffic conditions in the network served by a remote TMS. The data received from remote TMS's shall be used either to vary the current traffic control strategy to give signal preemption to emergency vehicles or enable the passage of commercial vehicles with unusual loads, or as input to the local traffic predictive model estimation process.
1.2.1	This process shall select the appropriate traffic control strategy to be implemented over a road and/or freeway section served by the specific instance of the Manage Traffic function. The strategy shall be selected by the process from a number that are available, e.g. adaptive control, fixed time control, local operations. The selected strategy shall be passed by the process to the actual control processes for implementation according to the part of the network to which it is to be applied, i.e. surface roads, freeways (i.e. limited access roads), ramps and/or parking lots. The definition of strategy can be extended to include a strategy for the operations of sensors such as video cameras used to provide traffic surveillance data. The process shall make it possible for the current strategy selection to be modified to accommodate the effects of such things as incidents, emergency vehicle preemption, the passage of commercial vehicles with unusual loads, equipment faults and overrides from the traffic operations personnel. The strategy for control of freeways and parking lots is through use of DMS signs and lane indicators. The strategy for control of ramps is through the timing plans for ramp meters. The selected strategy shall be sent to the process within the Provide Traffic Surveillance facility responsible for maintaining the store of long term data.
1.2.2.1	This process shall implement selected traffic control strategies and transit vehicle overall priority on some or all of the indicators covering the freeway network served by the Manage Traffic function. It shall implement the strategies only using the indicators (e.g. dynamic message signs (DMS)) specified in the implementation request and shall coordinate its actions with those of the process that controls the road network. The process shall also be capable of monitoring the extra inputs that will arise where tunnels are involved, including the detection of fire and the consequent requirement to re-route traffic.
1.2.2.2	This process shall implement selected traffic control strategies and transit priority on some or all of the indicators covering the road (surface street) network served by the Manage Traffic function. It shall implement the strategies only using the indicators (intersection and pedestrian controllers, variable message signs (dms), etc.) that are specified in the implementation request and shall coordinate its actions with those of the processes that control the freeway network and the ramps that give access to the freeway network.
1.2.4.1	This process shall transfer data to processes responsible for controlling equipment located at the roadside within the road (surface street) network served by the Manage Traffic function. This data shall contain outputs for use by roadside indicators, such as intersection and pedestrian controllers, dynamic message signs (DMS), highway advisory radio (HAR), etc. Data for use by in-vehicle signage equipment shall be sent to another process for output to roadside processes. All data shall be sent to this process by processes within the Manage Traffic function. This process shall also be responsible for the monitoring of input data showing the way in which the indicators are responding to the data that they are being sent, and the reporting of any errors in their responses as faults to the Collect and Process Indicator Fault Data facility within the Manage Traffic function. All output and input data shall be sent by the process to another process in the Manage Traffic function to be loaded into the store of long term data.

P-Spec Nbr	Description
1.2.4.2	This process shall transfer data to processes responsible for controlling equipment located at the roadside within the freeway network served by the Manage Traffic function. This data shall contain outputs for use by roadside indicators, such as dynamic message signs (DMS), etc. Data for use by in-vehicle signage equipment shall be sent to another process for output to roadside processes. All data shall have been sent to this process by processes within the Manage Traffic function. This process shall also be responsible for the monitoring of input data showing the way in which the indicators are responding to the data that they are being sent, and the reporting of any errors in their responses as faults to the Collect and Process Indicator Fault Data facility within the Manage Traffic function. All output and input data shall be sent by the process to another process in the Manage Traffic function to be loaded into the store of long term data.
1.2.4.3	This process shall format and output data for use by roadside processes in creating in-vehicle signage. This process supports a full range of functionality for in-vehicle signage (from display of signage to location specific advisory data). The process shall be capable of outputting some or all of the following advisory data: link state data, current incidents, planned events, and highway rail intersection status. The process shall be capable of outputting some or all of the following signage data: dynamic message sign contents or fixed signage. The data shall be structured by this process so that it can be output by each roadside process to vehicles for use by in-vehicle signage equipment.
1.2.6.1	This process shall maintain the store of static and link data used by other processes within the Manage Traffic function. Link data shall also be sent to the Provide Driver and Traveler Services function to enable it to obtain data about links that are not in the geographic area which it serves.
1.2.6.2	This process shall provide updates of static data to other processes in the Provide Traffic Control facility of the Manage Traffic function. An update of the data shall only be provided when this process has been notified by another process that the contents of the store of static data has been changed. This process shall provide updates to the map update provider about changes to the static data of a particular region.
1.2.7.1	This process shall implement the indicator output data generated by other processes within the Manage Traffic function for use on the roads (surface streets) served by the function. It shall perform the functions needed to provide control at intersections or pedestrian crossings, generate the output for dynamic message signs (dms) and highway advisory radios (HAR), or provide the interface for data to be sent to the units (or systems) that manage multimodal crossings. The dms may be either those that display variable text messages, or those that have fixed format display(s) (e.g. vehicle restrictions, or lane open/close).
1.2.7.2	This process shall monitor the operation of the processes that output in-vehicle signage, highway advisory radio, as well as indicator data in the road (surface street) and freeway network. It shall report any instances where the indicator response does not match that expected from the contents of the indicator control data it is receiving, the in-vehicle signage process reports a fault, or the HAR processes report a fault.
1.2.7.3	This process shall receive indicator (e.g. signal) preemption and priority requests from other functions within ITS. These requests shall enable the process to give selected vehicles (e.g. those that belong to Transit Authorities or Emergency Services) signal preemption or priority at intersections, pedestrian crossings and multimodal crossings in the surface street and freeway network served by the instance of the Manage Traffic function. Sending of the priority request output shall also generate an output to the monitoring process to suspend its activities while the priority request is being served. This process shall only generate its data flow outputs when input data is received.

P-Spec Nbr	Description
1.2.7.4	This process shall output data for use by in-vehicle signage equipment on vehicles traveling along the road (surface street) and freeway network served by the Manage Traffic function. This data shall be able to provide information from any of the types of indicators that are supported by the function, e.g. intersection controller, pedestrian controller, dynamic message sign (dms), plus data about incidents and link information such as speed, travel times or roadway conditions. The process shall be responsible for its own fault monitoring, which shall check that output data is being sent and that it is an accurate representation of the input data. When a fault is detected this process shall report it to the process responsible for the monitoring of roadside equipment faults.
1.2.7.5	This process shall implement the indicator output data generated by other processes within the Manage Traffic function for use on freeways served by the function. It shall perform the functions needed to output control data to ramp metering controllers and multimodal crossings, generate the output for dynamic message signs (dms), or generate the output for highway advisory radios(HAR). The dms may be either those that display variable text messages, or those that have fixed format display(s), for such things as vehicle restrictions, or lane open/close.
1.2.8.1	This process shall collect data about faults in the operation of indicators (e.g. signals, dms, har) that have been detected by processes in other parts of the Manage Traffic function. It shall be possible for the faults to be detected locally at the indicators, or centrally through communications links with the indicators.
1.2.8.2	This process shall collect data about indicator faults that have been detected by processes in other parts of the Manage Traffic function. It shall be possible for the faults to have been detected locally at the indicators, or centrally through communications links with the indicators. The process shall pass on new fault data to another process for communication to the Construction and Maintenance terminator and shall receive fault clearances from the same process communicating with that terminator. It shall also maintain a store of the current fault state of all indicators. The process shall provide facilities that enable traffic operations personnel to review and update the current fault status of all indicators. Details of faulty and fixed equipment shall be passed by the process to the traffic control strategy selection process so that it can adjust its strategy to take account of the current fault(s).
1.2.8.3	This process shall provide an interface for the exchange of data with the Construction and Maintenance terminator. The interface shall be used to both send data containing details of new indicator equipment faults, and to receive clearances when the faults are cleared. The details of new equipment faults and the clearances shall be received from and sent to another process.
1.2.8.4	This process shall provide the interface through which traffic operations personnel access data about faults on indicator equipment controlled by the Manage Traffic function. The process shall enable the personnel to monitor all indicator equipment faults that have been detected, and if necessary, amend that data. It shall also enable the traffic operations personnel to manually input faults in cases where they cannot otherwise be detected.
1.3.1.1	This process shall analyze traffic sensor data, vehicle probe data, or video images for anomalies that could indicate occurrence of an incident. The data may be collected from roads (surface street) and/or highways served by the Manage Traffic function. The process shall pass on any anomalies that it detects to another process in the Manage Incidents facility as possible detected incidents.
1.3.1.3	This process shall process raw traffic image data received from sensors located on the road (surface street) and freeway network served by the Manage Traffic function. The process shall transform the raw data into images that can be sent to another process within the Manage Incidents facility. It shall also act as the control interface through which the images of traffic conditions which are analyzed for incidents can be changed by the traffic operations personnel, who shall also be supplied with images for viewing.

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1.3.2.1	This process shall receive data on possible incidents from other processes within the Manage Incidents facility and other ITS functions. The process shall load all data that it receives into the store of possible incidents. As part of the loading activity, the process shall enter the data into the relevant parts of the standard format for incident data, and shall assign a level of confidence (e.g. related to the source of the data or time of its detection) to that data.
1.3.2.2	This process shall review input data about possible incidents and provide verification of the incident. The process shall have the capability of using algorithms to automatically identify and verify an incident. The process shall have the capability to classify an incident as current incident or a planned event and shall be load the data into the store of possible incidents as either current incidents or planned events. The process shall report any incidents that it is unable to verify or classify to the traffic operations personnel for manual verification and classification. The process shall allow the traffic operations personnel to request all possible incidents and carry out the verification and classification process manually.
1.3.2.3	This process shall receive updates of planned events and review the complete list of them to determine when an incident should be reclassified from planned event to current incident. It shall carry out the re-classification process automatically either upon receiving notice that the store of planned events has been updated, or at some periodic rate. The criteria for reclassifying an incident could be that the planned start time of the event has passed. The process shall request details of planned events from the process that manages their data store and shall send details of any new (re-classified) current incidents to the process that manages their data store. It shall also provide updates of planned events and current incidents to other ITS functions, and details of any new planned events to the process responsible for the output of data to vehicle signage functions.
1.3.2.4	This process shall provide the interface to, and manage the use of the store containing details of planned events. The process shall enter details of all new planned events into the store, retrieve details on request, and delete details of an incident when it has been re-classified as a current incident. The process shall be able to receive details of planned events from within the local Manage Incidents facility, and from similar facilities in other Traffic Management Subsystems (TMS's). When requested, the process shall also be able to provide details of its planned events to the Manage Incidents facilities in other TMS's.
1.3.2.5	This process shall provide the interface to, and manage the use of the store of current incident details. The process shall enter the details of all new current incidents into the store, retrieve details on request, and delete details of incidents when they cease to be current. The process shall be able to receive details of current incidents from within the local Manage Incidents facility, and from similar facilities in other Traffic Management Subsystems (TMS's). When requested, the process shall also be able to provide details of its current incidents to the Manage Incidents facilities in other TMS's.
1.3.3	This process shall provide responses to incidents that become current, i.e. active. Three general strategies for response to incidents can be supported by the process: 1) Operator enters response (there is no set of predetermined responses), 2) the operator selects response from a set of predetermined responses (possibly modifying the response), and 3) the process automatically accesses and implements a response from a set of predetermined responses (while informing the operator of the actions taken). Where predetermined responses are utilized, the operator shall have the capability to view, modify, or override the predetermined response. The predetermined response to each type of incident shall be defined for the process in the store defined_responses_data. If the process cannot find a predetermined response for a particular incident, it shall send the details of the incident to the traffic operations personnel so that they can provide an update to the store of predetermined responses. The process shall output the predetermined responses to an incident when it receives notification from another process in the Manage Incidents facility that a new current incident has occurred. At the same time it shall also output the incident data to the process responsible for providing broadcast data to roadside processes. The other process in the Manage Incidents facility shall also provide details of incidents that have ceased to be current (terminated) so that this process can send out data to clear the actions requested and roadside broadcast information output in response to its occurrence.

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1.3.4.1	This process shall retrieve incident data from the stores of planned events and current incidents that are managed by other processes in the Manage Incidents facility of the Manage Traffic function. The process shall retrieve data as the result of a request which may come from the traffic operations personnel or the media operator. The output shall be returned to the source of the request, except where the media operator has specified that the data should be output to the media system.
1.3.4.2	This process shall provide the interface between the traffic operations personnel and the Manage Incidents facility of the Manage Traffic function. It shall enable the personnel to request and amend details of predicted and current incidents and predetermined incident responses, obtain and control incident video image data and manually re-classify incidents as possible or current or a planned event. It shall also output to the traffic operations personnel incident details to which no predetermined response currently exists. The process shall support inputs from and outputs to the traffic operations personnel. Where appropriate and/or requested by the traffic operations personnel, the process shall provide the output 'display' in a form incorporating a map of the relevant part(s) of the surface street and freeway network served by the function. The process shall obtain the map from a local data store, which it shall request to be updated by another process as and when required.
1.3.4.3	This process shall provide the interface between the Media and the Manage Incidents facility. It shall enable the media to request details of incidents and shall allow transmission of incident information to the media. The media shall also provide raw input data on possible incidents. The process shall enable the output to incorporate a map of the area to which the incidents relate.
1.3.4.4	This process shall provide updates to the store of digitized map data used with displays of incident data produced by processes in the Manage Incidents facility of the Manage Traffic function. The process shall obtain the new data from a map provider or other appropriate data source, on receiving an update request from the traffic operations personnel interface process within the Manage Incidents facility.
1.3.4.5	This process shall provide the capability for the Manage Traffic function to generate and receive requests for resources in responding to incidents. The process shall provide the capability for traffic operations personnel to request resources from the Construction and Maintenance to provide equipment and support for incident response and clean up. The process shall be able to receive resource requests from the Manage Emergency function and respond with the status of the response by Construction and Maintenance or the traffic operations personnel.
1.3.5	This process shall manage the data store containing possible predetermined responses to incidents used within the Manage Incidents facility. These responses shall be those that another process within the facility has found to be worth including in the store of predetermined responses from an analysis of the incident response log. This process shall enable retrieval of the data from the store for presentation to traffic operations personnel and its possible transfer to the process that manages the store of predetermined incident responses that are actually used by other processes in the Manage Incidents facility.
1.3.6	This process shall manage data held in the store of predetermined incident responses that are used by processes within the Manage Incidents facility of the Manage Traffic function. The process shall provide details of the current predetermined responses in response to requests from traffic operations personnel, and shall also update the store with new responses received from the process that manages the store of possible predetermined responses.
1.3.7	This process shall analyze the data in the log of incident responses within the Manage Incidents facility of the Manage Traffic functions. The process shall analyze the log so that possible standard predetermined incident responses can be identified from the data in the incident_response_log data store. Any such possible standard predetermined responses that are identified shall be passed by this process to the process that manages the store of possible predetermined responses.

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1.4.1	This process shall provide the interface between the traffic operations personnel and the processes and data stores used within the Manage Demand facility of the Manage Traffic function. It shall enable the traffic operations personnel to access the data used as input by the demand forecasting process and the results of that process, to request that the input data be updated, set the policies used as input to the Calculate Forecast Demand process, to request that the demand forecasting process runs, and to run the process that implements the results. Where appropriate and/or requested by the traffic operations personnel, the process shall provide the output in a form that includes a map of the relevant part(s) of the road and freeway network served by the Manage Travel Demand function. The process shall obtain the map from a local data store, which it shall request to be updated by another process when required.
1.4.2	This process shall collect data from other ITS functions for use as input to the demand forecasting process within the Manage Demand facility of the Manage Traffic function. The process shall support data retrieval from other functions on request from the traffic operations personnel and through the receipt of unsolicited data from ITS functions. It shall load all the data that it receives in a consistent format into the input store used by the demand forecasting process.
1.4.4	This process shall implement the traffic and travel demand forecast data produced by the demand forecasting process in the Manage Travel Demand facility of the Manage Traffic function. The new demand forecast data shall be implemented in such a way that it can influence the demand from travelers for various types of services provided by ITS functions. The process shall when required, request changes to transit services, and/or the charges for tolls, and/or the use of parking lot spaces (as per the locally determined demand policy). It shall communicate the results of its policy implementation to the process that provides the interface to the traffic operations personnel.
1.4.5	This process shall provide a forecast of traffic and travel demand in the geographic area served by the Manage Traffic function to which this instance of the Manage Travel Demand facility belongs. The process shall base its forecast on the current and predicted traffic levels traveler demand patterns obtained from an analysis of data obtained from elsewhere within the Manage Traffic function and from other ITS functions as well as locally determined demand policy. The process shall produce a demand forecast that changes the way that services are provided by ITS functions according to locally determined demand policy.
1.5.1	This process shall provide the interface between the traffic operations personnel and the processes and data stores used within the Manage Emissions facility of the Manage Traffic function. The process shall enable the personnel to access and update the pollution reference data used by other processes within the facility, and to access the pollution state data provided by those processes. The process shall support inputs from the traffic operations personnel. Where appropriate and/or requested by the traffic operations personnel, the process shall incorporate map data of the relevant part(s) of the surface street and freeway network served by the Manage Traffic function. The process shall obtain the map from a local data store, which it shall request to be updated by another process as and when required.
1.5.2	This process shall process the pollution data being collected from sensors in the geographic area being served by the Manage Traffic function. The process shall integrate data from distributed roadside sensors (provided by another process) with that obtained directly from sensors looking at the general (wide area) environment. The data shall be checked by the process against the pollution levels that have been set up as reference points. If the process finds that the detected levels of pollution exceed the reference levels it shall generate pollution warnings. The process shall send these warnings to other processes in the Manage Traffic function for output to drivers and travelers.
1.5.3	This process shall provide updates to the map data used in displays of pollution data produced by processes in the Manage Emissions facility of the Manage Traffic function. The process shall obtain the map data from a specialist map data supplier or some other appropriate data source, on receiving an update request from the traffic operations personnel interface process within the Manage Emissions facility.

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1.5.4	This process shall manage the store of pollution state data in the Manage Emissions facility of the Manage Traffic function. The data in the store shall be that which has been received by the process from other processes within the facility. The process shall manage the data in the store to enable its contents to be available to other processes within the Manage Traffic function, and to traffic operations personnel, via an interface process within the Manage Emissions facility.
1.5.5	This process shall obtain pollution data about individual vehicles and analyze it against reference data obtained from another process within the Manage Emissions facility of the Manage Traffic function. The process shall use this reference data to determine whether or not a vehicle is possibly violating the acceptable levels of pollution output. When the process determines that a possible violation has occurred, it shall send the detected pollution levels and the vehicle identity to the process responsible for law enforcement in the Manage Emergency Services function for action.
1.5.6	This process shall process the local area pollution data analyzed by sensors looking at the levels of pollution at the roadside within the geographic area served by the Manage Traffic function. The process shall pass the data on to another process within the Manage Emissions facility for integration with wide area pollution data and comparison with thresholds for pollution incidents.
1.5.7	This process shall manage the log of pollution data within the Manage Emissions facility of the Manage Traffic function. The process shall receive data for entry into the log from other processes within the facility. It shall also send the contents of the log to the Manage Archive Data function for use in planning future modifications to the ITS network.
1.5.8	This process shall manage the store of pollution reference data within the Manage Emissions facility of the Manage Traffic function. It shall make the contents of the store available to other processes within the facility that are responsible for emissions management, and on request to the traffic operations personnel interface process. The process shall accept updates to the stored data from the traffic operations personnel interface process.
1.6.1.1	This process is responsible for monitoring local sensor data obtained from traffic surveillance and then determining and reporting the current state of all traffic in the HRI vicinity. The process provides triggers for other processes within Manage HRI Traffic Volume. It also monitors the device controls as they are initiated by the Activate HRI Device Controls process.
1.6.1.4.1	This process is responsible for generating the messages to advise and protect motorists, travelers and train crews approaching and crossing railroad grade crossings. Based on the severity of the hazard condition sent by the Detect HRI Hazards process this process will either send an hri_advisory command for non-time critical data or an hri_alert command for time critical data to the Report Alerts and Advisories. These users that will receive these messages include drivers, bicyclists, and pedestrians.
1.6.1.6.1	This process is responsible for protecting highway vehicles approaching and crossing railroad grade crossings by initiating the closure up to 3 minutes before train arrival. This process receives the near term status of the crossing including any approaching trains or trapped vehicles. With this information along with the local control plan data the predicted hri state is computed and sent to the Detect Imminent Vehicle/Train Collision process. If an hri_predicted_collision message is returned then this process sends out an hri_hazard message to the Detect HRI Hazard which will in turn result in a change to the device control strategy. This process also receives rail operations advisories for processing along with the state and control plan data. As needed this process will output any rail_operations_message data to the Interact with Rail Operations process.
1.6.1.7.2	This process is responsible for controlling vehicular traffic at an active HRI by controlling the operation of traffic control devices in accordance with a predetermined local control plan. The local_control_plan is communicated to the Close_HRI_on_Detection process. This local control plan can be preempted by a strategy_preemption message from the Detect_HRI_Hazards process or by such inputs as an event_notice from the Detect_Roadway_Events process or hri_traffic_surveillance data. The outputs of this process include the command messages to close the HRI, requests for information from the Manage Traffic function, and information about the current hri_traffic_data.

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1.6.2.1	This process is responsible for exchanging routine data with rail operations. Such data being sent to the rail operators includes event schedules, requests for information from the Rail Operators, incident notification based on rail operations messages received from Close_HRI_on_Detection process and hri_priority_message data received from the Manage Alerts and Advisories process. This process receives maintenance schedules, train schedules, and incident notifications from the rail operators. This information is used to develop the rail operations update data that is passed onto the Manage Rail Traffic Control Data process and the rail operations priority data that is sent to the Manage Alerts and Advisories process.
1.6.2.2	This process is responsible for acquiring HRI advisory or alert data from rail operations and for providing HRI status to rail operations. The data managed by this process may be time critical, as in the case of alerts or priority messages, or not time critical, as in the case of advisories.
1.6.2.3	This process is responsible for providing and maintaining a current store of rail operations data. The data is assembled from the rail_operations_update information sent by the Exchange Data with Rail Operations process. Queries for this information are received from the Manage Alerts and Advisories process and the Interact with Vehicle Traffic Management processes.
1.6.3.1	This process is responsible for interfacing to railroad owned and maintained wayside equipment, such as Wayside Interface Units, Crossing Gate Controllers, etc. All these devices are expected to provide real-time information to the HRI about approaching trains and their own health. In addition, advanced implementations will make use of a communications path back to approaching trains provided by the railroad's equipment.
1.6.3.2	This process is responsible for generating advisories/ alerts that are routed to the wayside equipment for transmission to the train crews. If the intersection is blocked, or there is an incident at the intersection this information will be passed to the Interact with Wayside Systems process for routing to the wayside equipment. The wayside equipment can then route the information directly to the train crews, or to rail operations.
1.6.3.3	This process is responsible for automatically protecting commuter, intercity, transit and freight trains as they approach and cross grade crossings. It also reports HRI rail traffic advisories to traffic management and rail operations. It is responsible for verifying and reporting overall HRI status to approaching trains so that crews can act within safe service braking distances. It provides for notification of Automatic Train Stop systems (ATS, PTS, etc) with sufficient advance warning to allow emergency brake application time to stop a train before it encounters an HRI hazard. Finally, it provides automatic status indications about the HRI to the crews of approaching trains.
1.6.4.1	This process is responsible for coordination and managing of HRI closures at the Traffic management Center. It interfaces with Manage Incidents process to provide incident information and to receive strategy overrides as required by the larger incident management function.
1.6.4.2	This process is responsible for interacting with traffic management processes. It collects data from processes that are within the HRI elements located at the roadside and forwards the data as needed to other processes within traffic management. It also acts as the interface between rail operations and traffic management processes through its interface with the Interact with Rail Operations process.
1.6.5.1	This process is responsible for initiating reports of the health status of the HRI to both Traffic Management and Rail Operations. In addition the process initiates reporting of the health status of the HRI to the wayside interface equipment (and ultimately to the train when the advanced HRI functionality is in place).
1.6.5.3	This process is responsible for managing a log of the HRI operation for use in strategy planning, demand management and traffic management.

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2.1.1	This process shall be responsible for providing the commercial vehicle manager with the ability to manage the activities of commercial vehicles. The process shall provide the capability for the manager to obtain commercial vehicle routes. When a route has been confirmed, the process shall enable the manager to enroll commercial vehicles for electronic clearance at roadside check station facilities, to process and pay for electronic credential and tax filing, to send tag data to the Provide Commercial Vehicle On-board Data facility, and to provide vehicle route instructions for use by the commercial vehicle driver. Periodically it shall also send reports about taxes that have been paid to the Administer Commercial Vehicles facility. The process shall also enable the manager to obtain commercial vehicle activity reports from the logs provided by roadside checkstation facilities. It shall be possible to obtain these reports either on request or at periodic intervals.;
2.1.2	This process shall be responsible for providing a static commercial vehicle route using data provided by the commercial vehicle manager. A static route is one which is based on geographic data and therefore takes no account of current or predicted traffic conditions, incidents, etc. The process shall provide the route using its own route generation algorithms and data from its own store of digitized map information.
2.1.3	This process shall be responsible for providing an interface for the commercial vehicle manager. The process shall enable this interface to provide the manager with facilities for the input of data used to set up commercial vehicle routes, to pay the necessary taxes and duties so that a commercial vehicle can be enrolled for a particular route, to exchange general information messages with a driver in a vehicle, and to set up instructions for a driver to take a vehicle on a particular route. It shall be possible for the driver's route instructions input by the manager to include details of the cargo to be picked up and/or dropped off at each point along the route. The enrollment activity supported by the process shall enable a commercial vehicle to pass through the roadside checkstations along its route without stopping, unless safety checks are required. The process shall support inputs from the commercial vehicle manager in both manual and audio form, and shall provide its outputs in audible and visual forms. It shall enable the visual output to be in hardcopy, or as a display.
2.1.4	This process shall be responsible for providing the communications interface and data storage facility for data that is exchanged between the commercial vehicle manager and commercial vehicle drivers in their vehicles. The process shall support the receipt of data from the vehicle consisting of that processed from input received by sensors on board the vehicle and text data used to exchange general information with the driver. Only the output to the vehicle of the data that contains the general text message shall be supported by the process. The process shall enable access to the store of received data by the manager through the manager's interface process.
2.1.5	This process shall be responsible for providing the communications interface through which a commercial vehicle driver can obtain details of the vehicle route that has been provided by the commercial vehicle manager. The process shall enable the output of the route instructions in audio and/or visual form. It shall be possible for the visual form to be either hardcopy output, or in the form of a display. The process shall retain the data for a particular route internally, so that successive requests for details of the same route do not require use of the communications network.
2.2.1	This process shall be responsible for providing the commercial vehicle driver with the ability to manage the activities of a commercial vehicle. In this instance the driver is assumed to be acting in the role of a commercial vehicle manager, and is therefore probably the owner/driver of the vehicle. The process shall provide the capability for the driver to obtain commercial vehicle routes, to enroll commercial vehicles for electronic clearance at roadside check station facilities, and to process and pay for electronic credential and tax filing.
2.2.2	This process shall be responsible for providing a static commercial vehicle route using data provided by the commercial vehicle driver. A static route is one which is based on geographic data and therefore takes no account of current or predicted traffic conditions, incidents, etc. The process shall provide the route using its own route generation algorithms and data from its own store of digitized map information. In this instance the driver is assumed to be acting in the role of a commercial vehicle manager, and is therefore likely to be the owner/driver of the vehicle.

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2.2.3	This process shall be responsible for providing an interface for the commercial vehicle fleet manager. In this instance the driver is assumed to be acting in the role of a commercial vehicle manager, and is therefore likely to be the owner/driver of the vehicle. The process shall enable this interface to provide the driver with facilities for the input of data used to set up commercial vehicle routes, to pay all the necessary taxes and duties so that a commercial vehicle can be enrolled for a particular route, and to obtain a copy of the data collected by processes on-board the vehicle. The enrollment activity supported by the process shall enable a commercial vehicle to pass through the roadside checkstations along its route without stopping, unless safety checks are required. The process shall support inputs from the commercial vehicle driver in both manual and audio form, and shall provide its outputs in audible and visual forms. It shall enable the visual output to be in hardcopy, or as a display.
2.2.4	This process shall be responsible for providing communications between the commercial vehicle driver and the commercial vehicle. In this instance the driver is acting in the role of vehicle manager, and is therefore likely to be the owner/driver of the vehicle. The process shall support the receipt of data from the vehicle consisting of that processed from input received by sensors on board the vehicle The process shall enable access to the store of received data by the driver through the driver's interface process.
2.3.1	This process shall be responsible for the output of pull-in or pass messages to commercial vehicle drivers as they approach the commercial vehicle roadside checkstation or border crossing facilities. The process shall support the use of roadside equipment such as dynamic message signs (DMS), or simple red-green lights, flashing orange lights, etc. to provide the output. These output messages shall be received by the process from other processes responsible for roadside facilities within the Manage Commercial Vehicles function. The process shall support pull-in messages that are the result of checks on a commercial vehicle's electronic credentials, safety and border crossing data, the result of the vehicle's tag not being properly read, or the result of a general pull-in decision for all vehicles being issued by inspectors at the roadside facility. The process shall also generate a message to be sent to the vehicle so that an indication can be output directly to the driver at the same time as it appears on the roadside equipment.
2.3.3.1	This process shall be responsible for providing an interface through which a commercial vehicles roadside checkstation facility can communicate with a passing commercial vehicle. When a request for on-board data is received from another process within the facility, the process shall issue a data request to the identified commercial vehicle. The data received by the process from the vehicle shall be stored in the store of collected data for use by the roadside inspection process.
2.3.4	This process shall be responsible for detecting the presence of commercial vehicles through the use of sensors that can differentiate between the different types of vehicle. The process shall use the sensors to determine the number of axles, gross vehicle weight and weight per axle data for use by inspectors at the roadside checkstation facilities. When a commercial vehicle is detected, the process shall transmit a request for its on-board tag data, which when received shall be passed to other processes within the roadside facility. If no tag data is received, or the data cannot be interpreted correctly, the process shall send a request for the vehicle to pull-in to be output by another process in the roadside checkstation facility.
2.3.7	This process shall be responsible for the output of the pull-in or pass messages to commercial vehicle drivers directly in their vehicles as they approach a commercial vehicle roadside checkstation facility. These messages shall be generated by other processes within the facility that are responsible for checking the commercial vehicle's credentials (including those for border crossing) and safety, or may be the result of the vehicle's tag not being properly read, or may be the result of a general pull-in decision for all vehicles being issued by inspectors at the roadside checkstation facility.
2.4.1	This process shall be responsible for providing the commercial vehicle end of the communications link between itself and a commercial vehicle roadside checkstation facility. The process shall enable an inspector at the facility or elsewhere to have access to the data accumulated on-board the vehicle for use in a vehicle inspection. It shall also enable the inspector to send back data about the result of the inspection for storage on-board the vehicle.

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2.4.4	This process shall be responsible for providing the interface between the commercial vehicle driver and processes on-board the commercial vehicle. The process shall provide interfaces to the processes responsible for collecting, analyzing and storing data about the vehicle, its cargo, the driver, etc., and for the exchange of data with the commercial vehicle manager. The process shall support inputs fro m the driver in both manual and audio form, and shall provide its outputs in audible and visual forms. It shall enable the visual output to be in hardcopy, or as a display.
2.5.2	This process shall be responsible for making payment for electronic credential and tax filing. The data on which the payment is based shall be that for a commercial vehicle's route as provided by the commercial vehicle manager or the commercial vehicle driver who is also the owner of the vehicle. The actual payment activity will be carried out by another process in the Provide Electronic Payment Services function.
3.3.2	This process shall be responsible for sending messages it receives from other processes in this facility to the Manage Emergency Services function. It shall also be responsible for passing on the resulting response to the driver via processes in the Provide Driver and Traveler Services function. This process is also capable of receiving requests for additional data from the Manage Emergency Services function and transmitting follow-up details. This process can also receive commands related to the vehicle's security system from the Manage Emergency Services function and forward the commands to the vehicle's security system.
3.3.3	This process shall be responsib le for preparing and submitting data for transmission to the Manage Emergency Services function. The data shall be sent by this process when an emergency situation is detected by analyzing inputs from the vehicle. This process shall produce its outputs regardless of any action by the driver and shall be designed to be as the result of a crash which may have prevented the driver from initiating the emergency request personally.
4.1.1	This process shall collect and process data available to sensors on-board transit vehicles. This data shall be sent by this process to other processes on-board the transit vehicle and elsewhere in the Manage Traffic function for use in determining vehicle schedule deviations and for storage as operations data.
4.1.2.1	This process shall determine the schedule deviation and estimated times of arrival (ETA) at transit stops of a transit vehicle. The data shall be sent by this process to other processes in the Manage Transit function for use in calculating corrective instructions for output to the transit vehicle drivers, for use in calculation of a much wider return to schedule strategy where more than one vehicle and/or service is involved, and for storage as transit vehicle operational data. This process shall also send the data to the transit driver interface process, so that the driver is aware of the actual schedule deviation. This output shall be set to zero (no deviation) when that condition occurs, even when it has followed a period of deviation from schedule.
4.1.2.2	This process shall generate outputs that enable a transit vehicle schedule deviation to be corrected. The process shall derive its outputs from data received from another process in the Manage Traffic function. The outputs produced by the process shall consist of corrective instructions for output to the transit vehicle driver by a process on-board the vehicle, and preemption requests for traffic signal controllers at road and freeway intersections. The process shall only produce this output when another process has determined that deviation is small, or the transit vehicle is operating in an urban area. In all other conditions, the process shall provide an output that shows that there are no corrective instructions.
4.1.2.3	This process shall provide a schedule correction interface for the transit driver in the transit vehicle. The interface shall provide data to the driver about how far the vehicle is from its schedule and what corrective action the driver must take. The data shall be received by the process from other processes in the Manage Traffic function. The output delivered by the process shall be available in audio or visual form in such way that while alerting the driver to the information it contains, it shall in no way impair the driver's ability to operate the vehicle in a manner that is both safe to its passengers and to other vehicles on the roads and freeways. The process shall maintain the output until new data is received from the other processes.

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4.1.2.4	This process shall provide the interface through which multimodal transportation service providers are informed of a transit vehicle schedule deviation. The output delivered by the process results from input received from another process in the Manage Transit function, and shall relate to the deviation of an individual transit vehicle. The process shall provide the output in a form that enables adjustments to be made to any connecting services being provided by the multimodal supplier so that transit users are not unconvenienced by the deviation of a transit vehicle on one service. A zero (or null) output shall be provided when no deviations are present.
4.1.2.5	This process shall provide the interface through which requests for preemption can be output from a transit vehicle. The output shall be received by the process as a result of data sent from another process in the Manage Transit function. The process shall provide the output in a form that can be used by the controllers at intersections, pedestrian crossings and multimodal crossings on the roads (surface streets) and freeway network served by the Manage Traffic function to provide priority of the transit vehicle. If no data is received from the other process, or it shows that no preemption is needed, the process shall produce no output.
4.1.3	This process shall provide the transit vehicle's current location with a high degree of accuracy. The location shall be computed by this process from data sent by other processes that provides basic vehicle location and on-board vehicle conditions, such as proximity to transit stop, vehicle doors opened or closed, etc. The data shall be output continuously by the process and sent to other processes for their use and for storage.
4.1.4	This process shall manage large deviations of individual transit vehicles, deviations in rural areas, and deviations of large numbers of vehicles. The process shall generate the necessary corrective actions which may involve more than the vehicles concerned and more far reaching action, such as, the introduction of extra vehicles, wide area signal preemption by the Manage Traffic function, the premature termination of some services, etc. All corrective actions generated by this process shall be subject to the approval of the transit fleet manager before being implemented. Confirmation that the requested overall priority has been given by the Manage Traffic function shall be received by the process.
4.1.5	This process shall provide transit vehicle operational data to processes within the Manage Transit function, and on request to the transit fleet manager and the Manage Travel Demand facility in the Manage Traffic function. This process shall also provide transit probe and AVL information to the Manage Traffic function. Transit probe information can be provided by fixed route, flexibly routed, and paratransit services. The data shall be obtained by this process from another process that manages a store of transit vehicle operating data.
4.1.6	This process shall manage the store of transit vehicle operating data. When any new data is received from another process, this process shall load it into the data store. This process shall also retrieve selected data on request from other processes in the Manage Transit function.
4.1.7	This process shall provide the interface through which multimodal transportation service providers are informed of transit vehicle schedule deviations. The output delivered by the process shall result from input received from another process in the Manage Transit function, and shall relate to the deviation of a number of transit vehicles such that the disruption will affect several services, possibly on different routes. The process shall provide the output in a form that enables adjustments to be made to any connecting services being provided by the multimodal supplier so that transit users are not inconvenienced by the deviations. A zero (or null) output shall be provided when no deviations are present.
4.1.8	This process shall provide customized sets of transit vehicle schedule deviations to travelers, the traveler information data archive, and to the media. The process shall only provide data to the media and data archive when prompted by the arrival of new deviation data in the transit_vehicle_operational_data store, which is maintained by another process in the Manage Transit function. The outputs shall be made available following a direct request from the other ITS function, or as part of a subscription process relating to a traveler's transit profile. The process shall obtain the required data from the process that manages the store of transit vehicle operating data. The process shall send kiosk and personal transit deviation requests to the archival process.

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4.1.9	This process shall collect and process vehicle maintenance data available to sensors on-board transit vehicles. When processed, the data shall be sent by this process on request to another process in the Manage Transit function for storage as transit vehicle operating data so that it can subsequently be used for work on future vehicle maintenance.
4.2.1.1	This process shall provide the interface through which processes in the Provide Driver and Traveler Service function can gain access to the Provide Demand Responsive Transit Service facility. The process shall enable the interface to support the receipt of trip requests, their transfer to another process for the actual demand responsive schedule generation, the output of the proposed schedule and their (possible) subsequent confirmation. The process shall store the input and schedule data relating to each request until such time as the request is confirmed or the data in the request is no longer valid, e.g. the time(s) used in the proposed schedule has(ve) passed. The confirmation of a particular schedule shall be sent by the process to another process that will enable the schedule to be implemented.
4.2.1.2	This process shall provide the facility for the calculation of the location and availability of transit vehicles for use in demand responsive transit operations. The process shall base its calculation on the vehicle's current location and on the output from a process that determines vehicle availability from data input to sensors. The output shall be loaded by the process into a store for use by another process.
4.2.1.3	This process shall provide dynamic routing and scheduling of transit vehicles so that a demand responsive transit service can be provided. The generation of the specific route and schedule by the process shall be initiated by a request from the management process. The choice of route and schedule produced by the process shall depend on what other demand responsive transit schedules have been planned, the availability and location of vehicles, and the relevance of any regular transit routes and schedules. The process shall send its output to another process for output to the requesting process, and shall also load it into a data store for use if the schedule is later confirmed.
4.2.1.4	This process shall provide output when a demand responsive transit schedule is confirmed. The outputs shall contain details of the schedule and shall be sent to the transit fleet manager and to processes that provide interfaces to the transit driver, a store of data used by the regular transit routes and schedule generation processes, and the transit driver schedule generation processes. The process shall obtain the data for the outputs from the store of data provided by the schedule generation process.
4.2.1.5	This process shall manage data input to sensor(s) on board a transit vehicle. Data including the vehicle's availability for use in demand responsive transit services shall be provided by this process to other processes within the Manage Transit function.
4.2.1.6	This process shall provide the interface through which a transit driver will be sent instructions about the demand responsive transit schedule that has been confirmed. The process shall send the data in a format that will enable the driver to implement the schedule. The output provided by the process shall be available in audio or visual form in such a way that while alerting the driver to the information it contains, it shall in no way impair the driver's ability to operate the vehicle in a manner that is both safe to its passengers, and to other vehicles on the roads and freeways. The input and output forms shall also include those that are suitable for travelers with physical disabilities.
4.2.2	This process shall provide the interface to the store of current regular transit plans, i.e., routes and schedules and demand responsive transit schedules. The process shall enable the store to be used by the Demand Responsive Transit facility as a source of data about regular transit services when it is generating its schedules. The demand responsive transit schedule data shall be accessible as input to the regular transit route and schedule generation processes.

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4.2.3.1	This process shall generate new transit routes. The process shall use parameters set up by the transit fleet manager, operational data for the current routes and schedules, plus the current routes and digitized map data, as sources of input from which the new routes are generated. The process shall also use the requested input data containing the demand responsive transit routes and schedules. The generation of new routes by the process shall be initiated as a result of data received from the transit fleet manager interface process, with the output being sent to other processes for storage. The output data produced by the process shall include sufficient data for a specialist map data provider to generate maps showing transit routes and stops, either as separate data or as part of the general digitized map data provided to other ITS functions.
4.2.3.2	This process shall generate new transit schedules for use by the regular transit operation. The process shall use parameters set up by the transit fleet manager, operational data for the current routes and schedules, plus the current routes and schedules themselves, as sources of input from which the new schedules are generated. The process shall also use the data containing the demand responsive transit routes and schedules to generate the new schedules. The generation of new schedules by the process shall be initiated as a result of data received from the transit fleet manager interface process or a request for services to a parking lot. The process shall send its output to another process for storage.
4.2.3.3	This process shall obtain transit routes and services data and distribute it to ITS functions that are outside the transit center. The process shall run when a request for data is received from an external source, or when fresh data is received. In the latter case, the data shall only be sent by the process to the multimodal transportation service provider. For data requests that include an origin and a destination, the process shall only provide details of the transit service(s) that link the two points. The details shall only cover those portion(s) of the service(s) that are needed to complete the requested trip and not full details of the services.
4.2.3.4	This process shall provide the interface through which the transit fleet manager controls the generation of new routes and schedules (transit services). The transit fleet manager shall be able to review and update the parameters used by the routes and schedules generation processes and to initiate these processes. This process shall also act as the interface through which the Manage Demand facility in the Manage Traffic function can request changes to the current routes and schedules in its efforts to adjust the modal split of travelers' trips in order to make the most efficient use of the road and highway network served by the local ITS functions. The input and output forms shall include those that are suitable for travelers with physical disabilities.
4.2.3.5	This process shall collect transit operational data and load it into a data store for use by the routes and schedules generation processes. The data shall be provided to this process by other processes in the Manage Transit function and shall enable an accurate picture of how routes and schedules are currently operating in terms of the numbers of vehicles that are available, the numbers of passengers that they are carrying, and the numbers of passengers passing through each roadside facility (transit stop).
4.2.3.6	This process shall obtain transit routes and services data and distribute it internally to other processes in the Manage Transit function. The process shall only provide its outputs when fresh data is received from another process. If this does not happen for a long period of time (days), then the process shall initiate its own request for fresh data.
4.2.3.7	This process shall provide the interface through which transit routes and schedules can be exchanged with other transit centers (Other TRM). This data shall be output when data is received from another (local) process and shall enable coordination between services provided by adjacent transit operations, particularly where they serve the same geographic areas. The process shall also provide routes and schedules to the local process when the data is received from other transit centers.

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4.2.3.9	This process shall provide updates to the store of digitized map data used by the transit route generation process and as the background for displays of transit services requested by the transit fleet manager. The process shall obtain the new data from a specialist data supplier or some other appropriate data source, after receiving an update request from the transit fleet manager interface process within the function. The processes requiring data for use in transit route generation and as the background to displays will read the data from the store loaded by this process.
4.2.4	This process shall obtain transit passenger and deployment data, transit user payment transaction data, transit emergency data, transit security data, maintenance and personnel data, and distribute it to the Manage Archive Data function. The process shall run when a request for data is received from an external source, or when fresh data is received. All inputs to this process are unsolicited, and all outputs are solicited, except that the 'transit_archive_status' is a solicited input.
4.3.1	This process shall monitor the condition of a transit vehicle. It shall use the transit vehicle maintenance specification to analyze brake, drive train, sensors, fuel, steering, tire, processor, communications equipment, and transit vehicle mileage to identify mileage based maintenance, out-of-specification or imminent failure conditions. The data resulting from this analysis shall be loaded by the process into the store of transit vehicle operations data, through the output flow transit vehicle maintenance. This data is then sent to the process that generates transit vehicle maintenance schedules.
4.3.2	This process shall generate transit vehicle maintenance schedules and includes what and when maintenance or repair is to be performed. Transit vehicle availability listings (current and forecast) shall also be generated by the process to support transit vehicle assignment planning. The maintenance and/or repair that is to be performed on the transit vehicle shall be scheduled by the process for a specific month, week, day(s), and hour(s). The availability of the transit vehicle that is also output by the process shall be based upon the transit vehicle maintenance schedule. The process shall load each transit vehicle maintenance schedule that it produces into the store of transit vehicle operations data, through the process that maintains this data store.
4.3.3	This process shall assign transit maintenance personnel to a transit vehicle maintenance schedule. The maintenance schedule shall be received from another process and shall define what and when maintenance repair is to be performed to a specific transit vehicle. The process shall base the personnel assignment upon details about the personnel obtained from the transit fleet manager and held in a local data store. These details shall comprise personnel eligibility, work assignments, preferences and seniority. The process shall also provide these details to the transit fleet manager on request. When a work assignment has been generated, the process shall send it to the transit maintenance personnel and also to the process that monitors and verifies maintenance work activity. The input and output forms shall include those that are suitable for travelers with physical disabilities.
4.3.4	This process shall verify that the transit vehicle maintenance activities were performed correctly and that a time stamped maintenance log for record keeping was generated. The correctness of the maintenance activities shall be judged by the process against the transit vehicle's status, the maintenance personnel's work assignment, and the transit maintenance schedules produced by other processes. The process shall save a time stamped record of all the maintenance activities performed on the vehicle into the transit vehicle maintenance log.
4.3.5	This process shall provide the transit fleet managers with the capability of requesting and receiving transit vehicle maintenance information. The process shall obtain the data for each request from the store of transit vehicle operations data, through the process that manages the data store, and shall produce the output to the transit fleet manager in an easily understood form. The input and output forms shall include those that are suitable for travelers with physical disabilities.

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4.3.6	This process shall provide the transit maintenance personnel with the capability to update transit vehicle maintenance information. The process shall send the data received from the transit maintenance personnel to the transit vehicle operations data store management process for use by other processes.
4.3.7	This process shall manage the store of transit vehicle operations data. It shall be able to load data it receives about vehicle maintenance into the store and provide that data on request to other processes.
4.4.1.1	This process shall manage the security in the transit system by monitoring for potential incidents. Data shall be obtained by the process from a variety of sources and assessed for any security problems. Problems shall be passed by the process to the transit system operator for review and the required action. Information about incidents shall also be sent by this process to another process for output to the media, using interface parameters set up by the transit system operator.
4.4.1.2	This process shall support the management of emergencies that occur in the transit system by processing information received from transit vehicles. The process shall accept inputs from either the transit vehicle driver or a transit user, the latter through such interfaces as panic buttons, alarm switches, etc. The reported emergencies shall be sent to another process for action by the transit system operator and subsequently for output to the media. The process shall also send acknowledgment data to the process providing the interface to the transit driver.
4.4.1.3	This process shall provide an interface for the transit system operator to identify and act upon potential information security problems and emergencies. This information shall be provided by other processes through input data flows. This process shall also provide the capability for the transit system operator to update parameters that control the output of data about the potential security problems to the media. The input and output forms shall include those that are suitable for travelers with physical disabilities.
4.4.1.4	This process shall provide the interface through which information about security problems and emergencies detected within the transit system are distributed directly to the media and other information systems. This process shall construct its output from the data supplied by other processes. This data shall contain parameters that define the way (format, content, etc.) in which the information is output by the process. The input and output forms shall include those that are suitable for travelers with physical disabilities.
4.4.1.5	This process shall provide an interface to the transit vehicle through which the driver can both report an emergency situation and receive an acknowledgment. The process shall provide this interface in such a way that its operation for both inputs and outputs shall be transparent to transit users on board the vehicle and to anyone outside the vehicle, and shall not compromise the safe operation of the vehicle by the driver.
4.4.1.6	This process shall collect data about emergencies that occur on-board transit vehicles for output to the media and the Manage Emergency Services function. These emergencies may be reported by either the transit driver or a transit user, the latter through such interfaces as panic buttons, alarm switches, etc. For output to the media interface process, the data shall be combined with the data in the media interface parameters data store.
4.4.1.7	This process shall monitor the secure area environment. Data shall be obtained by the process from a variety of sources and assessed for any security problems. Problems shall be passed by the process to other processes for review and the required action. Information about incidents shall also be sent by this process to another process for output to the media, using interface parameters set up by the transit system operator. The process shall also provide facilities for the control of video cameras and audio output in the secure area environment.
4.4.1.8	This process shall provide an interface in the Provide Driver and Traveler Services function through which travelers can declare emergencies. The traveler may be at a kiosk or other device, transit stop, transit depot, etc. The input and output forms shall include those that are suitable for travelers with physical disabilities.

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4.4.2	This process shall provide transit fleet managers with an interface through which they can control the coordination data sent to the Manage Emergency Services function following the detection of a security problem or emergency within the transit operations network by other processes. The process shall use data from the store of predefined responses to security problems and emergencies in the outputs that it sends to the Manage Emergency Services function. If no match can be found then the process shall send all the available data to the transit fleet manager for action. The input and output forms shall include those that are suitable for travelers with physical disabilities.
4.4.3	This process shall provide the interface through which the transit fleet manager can enter and review predefined responses to security problems and emergencies that have been detected by other processes within the Manage Transit function. This data shall be stored in a form which can be used by another process to provide coordination data to the Manage Emergency Services function. The input and output forms shall include those that are suitable for travelers with physical disabilities.
4.5.1	This process shall assess the transit driver's performance at previous work assignments. The process shall carry out this activity by 1) utilizing standardized performance evaluation criteria set forth by governmental regulations and transit operating company policies, 2) assessing the transit driver's driving history, and 3) assessing comments from the transit driver's supervisor(s). It shall also use the details of any moving violations or accidents, supervisor comments, government regulations, and company policies. The data shall be sent to this process by the process that provides the interface to a local data store, each time that the store is updated with driver performance data.
4.5.2	This process shall assess the transit driver's availability based on previous work assignments plus health and vacation commitments. The process shall carry out this activity by 1) utilizing standardized transit driver work criteria set forth by governmental regulations and company policies, 2) monitoring the transit driver's health status and vacation status, and 3) monitoring the transit driver's accumulated work hours. The data shall be sent to this process by the process that provides the interface to a local data store, each time that the store is updated with driver availability data.
4.5.3	This process shall assess the transit driver's cost effectiveness when carrying out previous work assignments. The process shall perform this activity by 1) utilizing standard transit driver cost criteria set forth by governmental regulations and company policies, and 2) monitoring the transit driver's hourly wage and accumulated work hours. The data shall be sent to this process by the process that provides the interface to a local data store, each time that the store is updated with driver cost effectiveness data.
4.5.4	This process shall assess the transit driver's eligibility for future work assignments. The process shall carry out this activity by 1) monitoring the transit driver's performance, availability and cost effectiveness, 2) utilizing standardized transit driver eligibility criteria set forth by governmental regulations and company policies, and 3) ensuring that the transit driver has the required experience, education and certifications. The data shall be sent to this process in one of two ways: 1) by the process that provides the interface to a local data store, each time that the store is updated with driver eligibility data, or 2) the data is produced as the result of analysis work carried out by other processes within the Manage Traffic function.
4.5.5	This process shall assign transit drivers to transit schedules. The transit driver's eligibility, route preferences, seniority, and transit vehicle availability shall be used by the process to determine the transit driver's route assignment. The output produced by the process shall be sent to the transit driver in the form of the next work assignment. The input and output forms shall include those that are suitable for travelers with physical disabilities.
4.5.6	This process shall provide the interface through which the transit driver can input data to the store of transit driver information. The interface provided by this process shall enable the transit driver to update personal availability and route assignment information. The input and output forms shall include those that are suitable for travelers with physical disabilities.

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4.5.7	This process shall provide the interface between the transit fleet manager and the store of driver information. The interface provided by the process shall enable the fleet manager to review and update transit driver information. The input and output forms shall include those that are suitable for travelers with physical disabilities.
4.5.8	This process shall provide the read and write interface to the store of transit driver information. The interface enables the contents of the store to be updated with inputs received from the transit driver and transit fleet manager via other processes, as well as, inputs resulting from analysis of driver availability, cost effectiveness, eligibility, and performance carried out by other processes. The process shall also supply data to these processes when the store is updated with information from the transit driver and fleet manager. It shall also supply data to the process that generates driver route assignments when any of the analysis inputs is received.
4.6.1	This process shall detect embarking transit users on-board a transit vehicle and read data from the payment instrument that they are carrying. The process shall provide an image of all transit users which shall be used for violation processing of those who do not have a payment instrument or whose transit fare transaction fails. It shall obtain an image of the required accuracy under all lighting conditions and over the range of speeds with which transit users will pass through the fare collection point on a transit vehicle.
4.6.2	This process shall determine the transit user's travel routing based on the transit vehicle's current location and the user's destination. The process shall support the transit user's routing, enabling it to include travel on the vehicle for all or part of its route and (possibly) transfer to another vehicle on another route. In order to achieve this capability, the process shall have access to the complete range of transit services (routes and schedules) that are available to the transit user. The transit vehicle's location shall be provided by other processes within the Manage Transit function. Details of all transactions with the transit user's payment details removed, shall be sent by this process to the interface process for loading into a data store.
4.6.3	This process shall calculate the transit user's fare based on the origin and destination provided by the user. The process shall calculate the fare using the transit routing, transit fare category, and transit user history components of the ride data, in addition to information provided by the interface process for the transit fares data store. The accumulated data shall be sent by this process to another process for the actual implementation of the fare payment transaction.
4.6.4	This process shall manage the transit user fare payments on-board a transit vehicle. The process shall receive information about the fare that is to be paid and the method of payment adopted by the transit user. It shall always support two modes of operation to complete the back end financial processing: infrastructure interactive, or semi-autonomous batch processing. The interactive method shall be used for individual transactions, such as those in paratransit type operations where value/volume ratios are high. It shall send transit user fare payment data to processes in the Provide Electronic Payment Services function for financial authorization and transaction processing, plus the return of the result for display to the transit user. A failed transaction shall result in the transmission of an image of the transit user to another process. Batch processing shall be used by the process for routes where value/volume ratios are low. It shall be performed using all the same data flows and processes as in the interactive method, except that transaction records are queued in a transaction buffer store which shall be maintained by this process. The accumulated data for the fare transactions shall be sent to the Provide Electronic Payment Services function on command from the transit vehicle driver, or when the transit vehicle has reached a convenient point on its route. The transit vehicle driver shall be notified when batch processing has completed successfully. In either mode of operation, a record of the status of all transit fare processing shall be sent to an interface process for the fare collection storage database.
4.6.5	This process shall provide the fare payment interface for the transit user on-board a transit vehicle. The process shall prompt the transit user for information necessary that has not been provided for the transaction. The result of the transit service ride fare payment plus other services request and payment, shall be reported back to the transit user by the process. The input and output forms shall include those that are suitable for travelers with physical disabilities.

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4.6.6	This process shall provide a database on-board the transit vehicle for use in fare processing. The database shall contain transit fare information from which the fares for all possible trips within the transit operational network can be determined.
4.6.7	This process shall provide passenger loading and fare statistics data to other ITS functions. The process shall send the data automatically at regular periodic intervals using data collected in the store of fare transaction data. This store receives data from the process that interfaces to the user on-board a transit vehicle.
4.6.8	This process shall act as the interface for advanced payment of tolls and parking lot charges from the transit user. Requests for these advanced payments shall be passed to other processes in the Provide Electronic Payment Services function for transaction processing. The process shall ensure that the response to these requests from transit users is returned to the transit vehicle from which it was made.
4.7.1.1	This process shall communicate with the Transit Management Center (TRMC) by providing public transit information at roadside locations. These locations may consist of transit vehicle stops or other locations that provide general public transit information. The process shall enable the roadside unit to obtain information about the transit services on request from the local transit user interface process and to receive data about late running services from other processes within the Manage Transit function. The received data shall be loaded into a local data store for future use. The input and output forms shall include those that are suitable for travelers with physical disabilities.
4.7.1.2	This process shall provide the roadside (transit stop) interface through which transit users receive information about an approaching transit vehicle or one that has already arrived. The process shall output the data to the transit user as soon as it is received and shall load the data into the local store for future use. Output of the data shall be maintained until the vehicle leaves the stop, when the process shall cease output of the data and delete it from the local store. The input and output forms shall include those that are suitable for travelers with physical disabilities.
4.7.2.1	This process shall detect transit users embarking at a roadside transit stop and read data from the payment instrument that they are carrying. The process shall provide an image of all transit users which shall be used for violation processing of those who do not have a payment instrument or whose transit fare transaction fails. It shall obtain an image of the required accuracy under all lighting conditions and over the range of speeds with which transit users will pass through the fare collection point at the roadside, i.e., a transit stop.
4.7.2.2	This process shall determine the transit user's travel routing based on the user's destination and the location of the roadside transit stop from which the route request is being made. The process shall support the transit user's routing enabling it to include travel on all or part of the route(s) operating from the stop and (possibly) transfer to another route. In order for this to be achieved, the process requires access to the complete range of transit services (routes and schedules) that are available to the transit user. Details of all transactions with the transit user's payment details removed, shall be sent by this process to the interface process for loading into the transit roadside fare collection data store.
4.7.2.3	This process shall calculate the transit user's fare based on the origin and destination provided by the user. The process shall calculate the fare using the transit routing, transit fare category, and transit user history components of the ride data together with data provided by the interface process to the database of transit fares. The accumulated data shall be sent by the process to another process for the actual implementation of the fare payment transaction.

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4.7.2.4	This process shall generate the data necessary to enable the financial transaction between the transit user and the transit provider to be completed at the roadside, i.e., at a transit stop. The process shall accept and process current transit passenger fare collection information. The process shall perform the front end transaction between the transit user and the transit system, and use the infrastructure interactive mode of operation to complete the back end processing. This means that the process shall send data about each transaction to processes in the Provide Electronic Payment Services function for the back end financial authorization and transaction processing. The process shall then await the return of the result for display to the transit user before accepting the next transaction. A failed transaction shall result in the transmission of an image of the transit user to another process. A record of the status of all transit fare processing shall be sent to another process for storage in a fare collection database.
4.7.2.5	This process shall provide the interface for the transit user at the roadside, i.e., at a transit stop. The interface shall enable the transit user to specify the required destination of a transit service ride and request other (yellow pages) services. The process shall prompt the transit user for information necessary for the transaction that has not been provided. The result of the transit service ride fare payment plus other services request and payment, shall be reported back to the transit user by the process. The input and output forms shall include those that are suitable for travelers with physical disabilities.
4.7.2.6	This process shall provide a database at the roadside, i.e., a transit stop, for use in fare processing. The database shall contain transit fare information from which the fares for all possible trips within the transit operational network can be determined.
4.7.2.7	This process shall create passenger loading and fare statistics data based upon data collected at the roadside and send this data to the store of transit operations data. The process may send the data at regular periodic intervals, on-demand, or through some other trigger mechanism. The process shall create its outputs using information collected in the store of fare transaction data. This data is received from other processes at the roadside, i.e., at a transit stop.
5.1.4	This process shall enable existing emergency centers to receive emergency calls, determine response requirements to the extent necessary to route the information, and route distress calls and emergency information to predesignated responding agencies and vehicles. All identified emergency information shall be provided by the process in a standard format as required. The process shall also communicate with commercial fleet managers to obtain details of cargo and other vehicle data where this will affect the response of the emergency services, e.g., in the case of a vehicle carrying a HAZMAT load. The current status of all emergency service responses shall be stored by the process in an action log, for access by the communications process.
5.1.5	This process shall manage the store of data that defines the way in which the emergency service resources shall be deployed in response to emergencies. Deployment shall vary by certain criteria, such as, type of emergency, source of information, time of day, location, etc. Parameters to define this allocation shall be loaded into the data store following receipt from the process that provides the emergency services operator interface.
5.3.1	This process shall select the appropriate emergency services and their vehicle(s) to respond to incidents. The process shall determine the type and number of vehicles to be dispatched, and provide the vehicle(s) with information on the type and location of the incident. It shall request data about the vehicles that are available from the interface process to the data store of emergency vehicle status. Once the vehicle determination has been made, the status data shall be changed by the process, and incident data sent to the process responsible for the actual dispatch of the vehicle(s).
5.3.2	This process shall direct selected emergency vehicles and drivers to respond to an incident, receive acknowledgment that they will in fact respond, and provide them with the location and details of the incident that was pre-calculated and sent to this process. If called for, the process shall send details to the Manage Traffic function to request a traffic control preemption be provided for the vehicle(s) if that mode of priority is available and chosen. The data for the emergency vehicle driver shall be sent to the driver interface process.

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5.3.3	This process shall manage information about the location of all emergency vehicles available for dispatch and that have been dispatched, and the ETA for vehicles en route. The process shall send this data to the store of emergency vehicle status data. If the vehicle is on its way to an emergency, as indicated by the received vehicle status, the process shall also send data to processes in the Manage Traffic function that will enable the vehicle to have whatever level and mode of priority is available and granted at traffic signals.
5.3.4	This process shall assess the status of emergency vehicles that are responding to an incident. In making its assessment, the process shall use data from the process managing a store of vehicle status, plus data from the emergency vehicle driver interface process. The process shall send the results of the assessment to the process responsible for managing emergency and emergency response information and update the store of vehicle status.
5.3.6	This process shall maintain a data store of the current status of all emergency vehicles available for dispatch and that have been dispatched. It shall provide data from the store on request from other processes and shall update the contents of the store with new data received from other processes. The process shall output the status of a vehicle to the process responsible for vehicle tracking for as long as it is on its way to an incident, to update ETA estimates and enable local vehicle priority to be given at intersections, if that mode of priority is chosen and granted.
5.3.7	This process shall calculate and assign emergency vehicle routes for incident assistance upon request.
5.4.5	This process shall manage the details of fare collection violations reported by the Manage Transit function that have taken place on-board a transit vehicle. The process shall use the parameters in the store of vehicle fare collection violation (enforcement) data to process and send the information to the correct law enforcement agency. This process shall also maintain the vehicle fare collection enforcement data store, entering all information received from other processes.
5.4.7	This process shall manage the details of fare collection violations reported by the Manage Transit function that have taken place at the roadside, i.e., at a transit stop. The process shall use the parameters in the store of roadside fare collection violation (enforcement) data to process and send the information to the correct law enforcement agency. This process shall also maintain the roadside fare collection enforcement data store, entering all information received from other processes.
6.1.1	This process shall obtain all the information needed to fulfill the traveler's request for a trip. The process shall support the request for trips that require the use of one or more modes of transport, and shall use the preferences and constraints specified by the traveler in the trip request, plus data from the store of trip planning parameters, to select the most appropriate modes. It shall send details of the trip requirements to the specialized processes that provide route information for the different modes of transport. When route data is received back from these processes, this process shall ensure that the whole trip is covered by one coherent route for which all the data such as costs, arrival times, and modal change points are known. The information provided to the traveler by the process shall be sufficient to enable the traveler to understand the routing, modes and cost of the trip. The trip information shall be stored for possible use in subsequent trip confirmation. The process also includes parking lot data. This data is used in transactions requiring electronic payment of parking lot services, as well as for a traveler making a parking lot reservation. This process shall exchange all input and output data from and to the traveler with the appropriate traveler interface process. The traveler shall send parking lot data, traveler trip requests, and traveler current condition requests to the archival process.
6.1.2	This process shall confirm a trip previously requested by a traveler and any financial transactions that this may require. The process shall base the trip confirmation upon information created by the process responsible for trip planning and stored locally. Confirmation details shall be sent to specialized processes (such as those responsible for demand responsive transit, ridesharing, etc.) to make reservations for their services. The response to these reservation requests and any necessary payment transactions shall be sent to the traveler. This process shall exchange all input and output data to and from the traveler via the appropriate traveler interface process. The trip confirmation shall be sent to the archival process.

P-Spec Nbr	Description
6.1.3	This process shall collect data about services that are available to travelers from multimodal service providers. These suppliers shall be those that provide travel services that are not part of regular transit or demand responsive transit operations, e.g. heavy rail, and may not involve surface transportation, e.g. ferry and airline operations. The process shall provide data formatted for use as part of a traveler's multimodal trip, and shall support subsequent confirmation of any portion provided by the Multimodal Service Provider.
6.1.4	This process shall manage the data store containing parameters used by the trip planning processes. These parameters shall govern the way in which multimodal trips are planned by other processes within Provide Trip Planning Services. This process shall accept inputs from the ISP Operator to define or update trip planning parameters. This process shall output these trip planning parameters to the ISP Operator.
6.1.5	This process shall receive all traveler requests, such as requests for traffic and transit information, requests for current conditions such as weather, trip requests, guidance route requests, advisory requests, yellow page information requests, and service confirmations. These requests shall be stored in the service_req_and_confirm_data data store and output to the traveler information data archive. The process shall run when a new request or confirmation is received from an external source.
6.1.6	This process shall accept traveler information service requests and confirmations, parking management information, payment transaction data, rideshare requests, commercial and non-commercial probe data, route guidance data, and origin/destination data, and store it in its local traveler info data archive data store, together with a catalog to describe the data. When requested by the Manage Archive Data function, this information will be sent to that function. The process shall also provide a control interface to the ISP operator, responding with the status received from the requester of the archive. The process shall run when a request for data or a catalog is received from an external source, when a command is received from the ISP Operator, or when fresh data is received.
6.2.1.1	This process shall collect and fuse traffic data that will be used to create broadcast or advisory messages to travelers. The input data for this process shall consist of historical, current, and predicted traffic and planned event data. The process shall extract from the data those elements appropriate for advisory or broadcast messages and load it into the store of traveler_traffic_information_data store. The data can be provided to the process either via direct request from the process or as a result of periodic (unrequested) updates.
6.2.1.2	This process shall provide advisory data to users in vehicles (drivers or transit users) as a result of a request from the driver or transit user. (e.g. This process supports a request/response type of exchange with the user.) The advisory information is extracted from the data stores of traveler traffic and transit information. The process shall have the capability to filter the advisory data, read from the data stores, store so that the output only contains data that is relevant to the current location of the vehicle from which the request was made. When the user requests location specific data, the vehicle's location shall be provided to the process in the request message. Advisory data requests shall be sent to the data archival process.
6.2.1.3	This process shall collect and fuse transit advisory data that will be used to create broadcast or advisory messages to travelers. The process shall extract from the data those elements appropriate for advisory or broadcast messages and load it into the traveler_transit_information_data store. The data can be provided to the process either via direct request from the process or as a result of periodic (unrequested) updates. The process shall fuse all the received data into a coherent set, which is loaded into a traveler_transit_information_data store for access by other processes.
6.2.1.4	This process shall extract advisory data from stores of traveler traffic and transit information at locally determined intervals and send it out to drivers or transit users in vehicles as wide area broadcast messages. The content and rate of these messages shall be based upon parameters from the broadcast_parameters_data store, which is managed by the ISP operator.

P-Spec Nbr	Description
6.2.1.6	This process shall gather transit advisory data and provide it via another process to the transit user on-board a transit vehicle. The interface shall receive requests from the transit user specifying the required destination of a transit service ride and other (yellow pages) type services. The transit user may also request and receive information about the state of traffic on the roadway, as well as transit route and stop data (i.e., traffic and transit advisory data). This process extracts data from the store of traveler transit information upon request for advisory data from the driver or transit user in a vehicle. The process shall filter the data read from the store so that output only contains that which is relevant to the current location of the vehicle from which the request was made. The vehicle's location shall be provided to the process in the request data. The input and output forms shall include those that are suitable for travelers with physical disabilities.
6.2.2	This process shall provide in-vehicle advisory and broadcast data for output to drivers and transit users. The process shall format requests from users for advisory data and output the requests to other processes. The request for advisory data shall allow the user to request only information relevant to the location of the vehicle. The request may be repeated, periodically, or when the vehicle changes location by a distance determined by the implementation. Data broadcast to the driver shall include traffic related data (incidents, link data and in-vehicle signage), as well as data from the vehicle itself. This vehicle data includes vehicle conditions, smart probe data, safety and position warnings, and enhanced vision images. Safety and warning messages shall be prioritized by the process to supersede advisory and broadcast messages. The process shall also support the transfer of reservation requests from the users in vehicles for other services such as yellow pages.
6.2.3	This process shall provide a data input and output interface for a transit user on-board a transit vehicle. The process shall enable traffic and travel advisory information, plus yellow pages information to be requested and output to the transit user. When constructing the outputs the process shall use the data in the store of vehicle display definitions data. In addition to the traveler's request/response for information, broadcast advisories about the imminent arrival of the transit vehicle at the next stop are also displayed for the transit user. The process shall handle all inputs and outputs in such a way that they do not impair the vehicle driver's ability to control the transit vehicle in a manner that is safe to both its occupants, to other road and freeway users, and to pedestrians. The input and output forms shall also include those that are suitable for travelers with physical disabilities.
6.2.5	This process shall provide a user interface for a driver through which traffic and travel advisory information can be obtained. The process shall enable traffic and travel advisory information to be requested and output to the driver, and shall also support the automatic output of wide area broadcast information (including in vehicle signage) to the driver. The process shall support output of safety and vision enhancement information to the user. When constructing all outputs the process shall use the vehicle_display_definitions_data store parameters. One purpose of the vehicle_display_definitions_data store is to provide a translation table for road sign and message templates used for in-vehicle display. Part of the input interface provided by the process shall enable the driver to invoke and cancel automatic control of the vehicle including the use of automated highway system (ahs) lanes. The process shall support inputs from the driver in manual or audio form, and shall provide its outputs in audible or visual forms. Visual output may be either in hardcopy, or as a display. Both types of output shall not impair the driver's ability to control the vehicle in a safe manner.
6.4.1	This process shall accept and screen traveler requests for ride-sharing. These requests shall be sent to the process as a result of trip plan requests received from travelers by other processes. This process shall use eligibility data from a local rideshare_data store, to screen travelers before they are matched with other travelers and to enable ridesharing for all or part of their proposed trips. Traveler rideshare requests and rideshare data from the rideshare_data data store shall be sent to the data archival process.

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6.4.2	This process shall match travelers for ridesharing trips. The process shall attempt to achieve a match by considering some or all of the following: the origin and destination of the traveler's proposed trip, any routing constraints, preferences specified by the traveler, compatibility of this rideshare with rideshares confirmed by other travelers, the requesting traveler's eligibility data, and traffic data obtained on request from the Manage Traffic function. The process shall consider the possible disbenefits to other travelers who will be part of the same rideshare when finding the rideshare best suited to the travelerÆs requirements. The process shall store data about selected rideshares in the rideshare_data store, and shall update the data when confirmation of the rideshare acceptance is received from another process.
6.4.4	This process shall confirm the traveler's rideshare match and initiate a payment transaction where appropriate. The process shall send the payment transaction data for action by a process in the Provide Electronic Payment Services function. The results of this transaction shall be sent by this process to the process providing the overall trip confirmation. Once a rideshare match is confirmed, this data is sent to the rideshare match process where it can be factored in to subsequent matches.
6.5.1	This process shall collect and update data about incidents, road construction, weather, events and yellow pages data. This data shall be obtained by the process from other ITS functions and from outside sources such as the weather service, yellow pages service providers and the media. The process shall load the data into a local store for use by the process that provides yellow pages information and reservations.
6.5.2	This process shall provide information and reservation services obtained from yellow pages service providers. The process shall provide the information and reservation data so that it can easily form part of a traveler's information request or trip planning activities. The process shall be able to request additional yellow pages information if the process cannot find the required data in the tourist_information data store. The process shall send requests for payment to a process in the Provide Electronic Payment Services function for action, and shall send the response back to the process from which the payment request was received. The traveler's yellow pages requests shall be sent to the data archival process.
6.6.1	This process shall manage the creation of multimodal routes (those with one or more modes in them) in response to travelerÆs trip or route requests. It shall support on-line route guidance for travelers using personal devices, route guidance for vehicles, selection of specialized vehicle based routes for other ITS functions, (such as Manage Emergency Services and Manage Commercial Vehicles), and selection of multimodal routes in response to trip planning requests from travelers. The multimodal routes provided by the process shall take account of the traveler's preferences and constraints. Constraints can include the access needs of those with disabilities. Preferences can include minimizing waiting time at modal interchange points, level of traveler security, or minimum cost. Trip requests, traveler route requests, and traveler route acceptances shall be sent to the data archival process.
6.6.2.2	This process shall update the data stores containing information which is used by the another process to calculate vehicle routes. This process shall also provide data about links (speed or travel times), and queues to be broadcast to vehicles (to support autonomous guidance with dynamic link updates). The process shall fuse link and queue data received from Manage Traffic sources with probe data received from vehicles under infrastructure based route guidance, or with probe data obtained from other sources (such as from an electronic toll collection system). The process shall obtain route segment data as requested data or as data received at periodic intervals from other ITS functions. The process shall have the capability to request data about route segments outside its own area by sending a data request to the process that provides the interface with other ISP's. Link addresses, mapped to other ISPs, will be maintained by this process and stored in the link_data_store. Usage of current road networks shall be sent to the data archival process.

P-Spec Nbr	Description
6.6.2.3	This process shall obtain from another ISP current or predicted data for road links that are outside the area served by the local supplier. This area, which may be defined on a geographic or jurisdictional basis, is the portion of the transportation network on which the ISP maintains real time information. Identification of which ISP to contact is based upon a store that maps a link to the ISP which maintains real time information about this link. If there is no map to another ISP in the data store, then the process will return default or static data for the link(s). This process shall also respond to similar requests from other ISPs for real time data on links within the local database.
6.6.2.4	This process shall provide the interface to map update providers, or other appropriate data sources, through which updates of the digitized map data can be obtained. The process shall request new data from the provider on request from the ISP operator interface process. The data received from the supplier shall be loaded into a the map_data_for_route_selection data store by the process in such a way that it can be easily used by the route selection process in determining vehicle routes, trip planning, and on-line vehicle guidance.
6.6.2.6	This process shall calculate route segment travel times from vehicle probe data. The probe data shall be accepted by the process from a variety of sources including toll collection points and vehicles receiving on-line infrastructure based guidance. The process shall be responsible for combining the data obtained from these sources and producing one set of route segment travel times or route segment speeds. The process shall indicate route segments for which no data, or insufficient data, is available (this indication could be by setting the link time or speed to zero). Vehicle guidance probe data shall be sent to the data archival process.
6.6.3	This process shall provide the interface to a map update providers through which to obtain fresh updates of digitized map data used in identification of non-vehicle portions of routes. The process shall request new data from the provider on request from the ISP operator interface process. The data received from the supplier shall be loaded into the map_data_for_general_use data store by the process in such a way that it can be easily used by the route selection process in determining non-vehicle routes for use in on-line traveler guidance and trip planning.
6.6.4	This process shall determine routes that are based on regular transit services. Routes shall be provided by the process to travelers in response to trip planning and on-line personal guidance requests. The data provided by the process shall be different for the two types of requests since trip planning information will not need the detail that guidance data requires. The process shall base routes on the current state of the regular transit services using data obtained from processes in the Manage Transit function. It shall also respond to any preferences and constraints, such as those for travelers with special needs, that are specified in the route request. Data on the current use of transit routes in on-line guidance shall be provided by the process to the Manage Demand function to aid in demand management. This data on current use of the transit routes in on-line guidance is stored in the transit_mode_routes data store.
6.6.5	This process shall determine routes, or portions of routes, not based on use of vehicles or regular transit services. Routes shall be provided by the process for travelers in response to trip planning, on-line personal guidance requests, and for data archival. Data provided by the process will be different for the two types of requests since the data for trip planning will not need the level of detail that guidance data requires. The process shall calculate its routes using digitized map data obtained and updated by another process. It shall make use of the alternative modes, (such as ferries, walking, cycling, etc.) that have been specified in the route request, and shall also take account of any preferences and constraints, (such as those for travelers with special needs). Data on current use of routes in on-line guidance shall be provided by the process to the Manage Demand function.
6.7.1.1	This process shall respond to the input of a request from a driver for action by the emergency services. Input of the request shall be received by the process from the driver via a panic button or some other functionally similar form of input device provided as part of the in-vehicle equipment. When the input is received, the process shall send a message to the communications process, containing the vehicle's current location, its identity and basic vehicle data relevant to its current condition, as well as any other data, such as personal medical history, vehicle orientation, etc., that may be developed in-vehicle by other systems.

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6.7.1.2	This process shall prepare and send an emergency message from a driver to the Manage Emergency Services function. The message shall only be sent by the process in response to data received from another process that monitors driver inputs. Once an emergency message has been sent, the process shall send a message to that effect to another process in the Provide Vehicle Monitoring and Control function for output to the driver. The process shall then await a response from the Manage Emergency Services function, and then send a detailed message to the other process for output to the driver. Output of the emergency message to the Manage Emergency Services function shall be repeated by the process at regular intervals until a response is received.
6.8.1.5	This process shall provide an emergency notification interface for a traveler using a personal portable device. The emergency notification interface shall enable the output of messages generated by a traveler's emergency request to another process.
6.8.2.1	This process shall respond to the input of a request from a traveler for action by the emergency services. Input of the request shall be received by the process from the traveler via a panic button or some other functionally similar form of input device provided as part of the traveler's personal portable device. When the input is received, the process shall send a message to the communications process, containing the traveler's current location and identity.
6.8.2.2	This process shall prepare and send an emergency message from a traveler's personal portable device to the Manage Emergency Services function. The message shall only be sent by the process in response to data received from another process that monitors traveler inputs. Once an emergency message has been sent, the process shall send a message to that effect to another process for output to the traveler. The process shall then await a response from the Manage Emergency Services function, and when received again send a message to the other process for output to the traveler. Output of the emergency message to the Manage Emergency Services function shall be repeated by the process at regular intervals until a response is received.
6.8.3.1	This process shall receive traveler requests from a personal device (portable, or non portable) then provide support for trip planning, traffic, transit and other (yellow pages) services information, trip confirmation, yellow pages services confirmation, and payment requests. The process shall send these requests to the appropriate processes within the Provide Driver and Traveler Services function for further processing to generate responses. The interface to the traveler shall be provided through a separate process, from which input to this process originates.
6.8.3.2	This process shall provide the traveler (using a personal device) with data about all requested trip, traffic, transit, other (yellow pages) services information, confirmation of any requested reservations, and payments made as part of confirmed trip plans. The data shall be sent by the process to an interface process which is responsible for its actual output to the traveler. This data shall include digitized map data to act as the background to the output when the data is shown in a suitable format. This process shall request data from other ITS functions or be sent it as a result of requests from another process.

P-Spec Nbr	Description
6.8.3.3	This process shall provide an interface in a personal device through which travelers can plan and confirm trips, as well as obtain current traffic and transit information. The process shall support trip planning and confirmation of other (yellow pages) services such as lodging, restaurants, theaters, and other tourist activities. The process shall be able to load in the traveler_personal_regular_data store frequently used information such as traveler identity (the owner of the personal device), home and work locations, etc. This will reduce the amount of input needed by the traveler for each trip request. The process shall also carry out input data verification and require input confirmation, with the traveler, before passing the data to other processes. The traveler's payment information and location (when traveler is using a portable device) shall be obtained by this process from other processes. The process shall support inputs from the traveler in both manual and audio form, and shall provide its outputs in audible and visual forms that are consistent with a personal device. This process shall include forms suitable for travelers with hearing and vision physical disabilities. The process shall display data for as long as required by the traveler and must enable viewing of previously output data. When used with a portable device, the process shall provide the traveler the option to filter the data (to be displayed) relevant to the travelers current location.
7.3.1.3	This process shall be responsible for maintaining a log of all the transactions carried out by other processes in the Process Electronic Transit Fare Payment facility. The identity of the payee shall have been removed from the data before it is stored. At periodic intervals the process shall output the accumulated records to the transit fleet manager, the transit system operator and to another process in the Provide Electronic Payment Services function. The process shall also be responsible for sending details of transactions to the financial institution to enable the users to be billed through their credit identities. The input and output forms shall include those that are suitable for travelers with physical disabilities.
7.3.1.4	This process shall be responsible for checking to see if the required transit fare payment has already been made. The process shall determine the existence of an advance payment for the transit fare by comparing the received payment information with that in the store containing the list of advanced payments. If the payment has already been made then the process shall remove the requirement for local billing and remove the record of the advanced payment from the store. Details of each payment transaction shall be sent by the process to another process with the payment information received from the transit user removed.
7.3.4	This process shall be responsible for providing the interface through which payment information can be read from a transit user tag. The process shall support reading this data from transit users at the roadside, e.g., a transit stop, for use in paying the current transit fare and (if required) advanced payments. The process shall support advanced payments for tolls, parking lot charges, and/or transit fares. The process shall collect either the credit identity or the stored credit value data from the tag, and update the stored credit value as a result of the fare and (possibly) advanced charges.
7.3.5	This process shall be responsible for providing the interface through which the payment information can be read from a transit user tag. The process shall support the reading of this data from transit users embarking on-board transit vehicles, for use in paying the current transit fare, and if required, advanced payments. The process shall support advanced payments for tolls, and/or parking lot charges, and/or transit fares. It shall be possible for the process to collect either the credit identity or the stored credit value data from the tag, and to update the stored credit value as a result of the fare and (possibly) advanced charges having been paid.
7.4.1.6	This process shall be responsible for transacting advanced payments required for the confirmation of a trip by a traveler. Payments supported by the process shall comprise those for any tolls, parking lot charges, transit fares, or other (yellow pages) services that need to be paid for the trip to be confirmed. The process shall receive the transaction data from a process in the Provide Driver and Traveler Services function and shall send the data to the financial institution. Tolls, fares and parking lot charges are sent to the Route Traveler Advanced Payment function for processing. The process shall send the response from the financial institution to the requesting process and shall send details of the transaction to another process for entry into the payment_transaction_records data store.

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7.4.1.7	This process shall be responsible for the collection and maintenance of a data store that contains transaction records for payments made for various services provided. The process shall load information into the payment_transaction_records data store for services comprising updates of map databases for drivers and travelers, registration of other (yellow pages) service providers (so that information about what they have to offer is available to travelers and transit users), advanced payment of tolls, parking lot charges, transit fares and other (yellow pages) services that form part of travelers' trips. The data shall be stored by the process with all references to the identity of the payment source, i.e., driver, traveler, commercial vehicle fleet manager, and any other payment information, removed.
7.4.1.8	This process shall be responsible for transacting payments for ridesharing that are required for the confirmation of a traveler's trip. The process shall start the transaction by receiving data from a process in the Provide Driver and Traveler Services function and shall send the data to the appropriate financial institution. The process shall send the response from the financial institution to the requesting process and shall send details of the transaction to another process for entry into a store of transaction records.
7.4.2	This process shall be responsible for collecting data about the prices being charged for tolls, parking lots and transit fares. This process shall accept data sent to it by the other processes when they have updated their data and automatically sent it, or this process shall request a transfer of data from the other processes. The process shall load the data into the price_data_for_services data store from which some or all of it can be read on request from processes in other ITS functions.
7.4.3	This process shall be responsible for receiving a traveler's request for advanced payment (for tolls, parking lot charges, and/or transit fares) and routing it to the appropriate part of the Provide Electronic Payment Services function. The process shall also receive responses to the advanced payment requests and shall return them to the originating process.
7.5.1	This process shall be responsible for providing the interface through which driver credit identities and stored credit may be entered into the ITS from on-board vehicle tags. The types of vehicles from which data is collected shall include private cars or vans, commercial vehicles, and transit vehicles, including those used for demand responsive transit services. This process shall also provide an interface through which the stored credit held by the tag can be debited for the payment of current or advanced tolls, plus advanced parking lot charges, and/or transit fares.
7.5.2	This process shall be responsible for providing the interface through which credit identities and stored credit values may be collected from tags being used by transit users. The process shall support the collection of this data at the roadside (which in this instance is a transit stop). Payments by the transit user for fares, other services, payment of advanced tolls, and/or parking lot charges shall be supported by the process. It shall also provide an interface through which stored credit held by the tag can be debited for the same types of payment.
7.5.3	This process shall be responsible for providing the interface through which credit identity or stored credit may be collected from the tag being used by a traveler with a personal device. The process shall support the collection of this data from any location in which the device (and hence the tag) is being used. It shall provide an interface through which the credit identity can be used for the payment of advanced tolls, parking lot charges, transit fares, display updates, and/or map updates. The process shall also enable the stored credit value on the tag to be used for the same purposes.
7.5.4	This process shall be responsible for providing the interface through which credit identity or stored credit values may be collected from the tags used by commercial fleet managers. The process shall support the use of the tag data to complete payment for the filing of electronic credentials and tax information that will enable a commercial vehicle to be cleared to travel within the geographic area served by a particular jurisdictional authority. This process shall also enable the stored credit value to be debited as an alternative method of payment.

P-Spec Nbr	Description
7.5.5	This process shall be responsible for providing the interface through which credit identities and stored credit values may be collected from payment instruments being used by travelers. The process shall support the collection of data at the roadside (which in this instance is a kiosk) and use this data for payments needed to confirm a traveler's trip. Payments supported by the process shall include those for advanced tolls, parking lot charges, transit fares, and/or other (yellow pages) services. It shall also provide an interface through which the stored credit held by the tag can be debited for the same types of payment.
8.1	This process shall collect data from each major function within ITS and external sources for archive purposes that may not exist within current ITS data sources. This process shall respond to requests from the Manage Archive Data Administrator Interface process to import data or data catalogs. This process shall send requests for data or a catalog of available data to the other functions and terminators, either a subscription for data or a one-time request. This process shall receive meta data along with the data to describe the conditions under which the data was collected or any other information about the operational data. When data is received this process shall perform quality checks such as range validation or reformat the data as necessary to meet the archive schema. This process shall execute methods on the incoming data such as cleansing, summarizations, aggregations, or transformations applied to the data before it is stored in the archive. Any changes made to the data shall be recorded in the meta-data stored in the archive to assist in the reconstruction of the original data if possible. This process shall receive inputs from the Manage Archive Data Administrator Interface that contain the parameters for managing the processing on the data. This process forwards the collected onto the Manage Archive function along with updated meta-data and a record of any methods applied to the incoming data. This process shall also support the notification of the operational source functions of any errors that may be present in the data that could be caused by equipment failures or a transmission error.
8.2	This process shall store the collected and formatted data in a permanent archive data store. This process shall receive the formatted data from the Get Archive Data function accompanied by any updates to the meta data that would describe the formatting operations performed on the data as it was imported. This process shall respond to requests from the administrator interface function to maintain the schema of the archive data, set update frequencies, backup schedules, user authentication schemes, cleansing algorithms. This process shall provide the administrator interface function with status of the data quality in the archive, frequency reports on use of the archive, updates to the measure of the volume of the data and other data archive metrics. This process shall receive inputs from the Coordinate Archives function to provide data and information about the archive schema to other archives. In turn the process shall receive data and schema of other archives to use to build a global schema. The process shall use the global schema to support requests from user systems for data that may be spread across multiple archives. The process shall maintain the access privileges information for the data held in the archive to maintain the security of the archive. The process shall employ such techniques as necessary to maintain the integrity of the data and ensure no data is lost from the archive. The process shall respond to requests for data to support user data products, user analysis, and inputs to government reporting systems. The process shall respond to such request by authenticating the originator of the request and providing the data that is available. The process shall also be capable of providing a sample or catalog of data contained within the archive to support the user requests.
8.4	This process shall coordinate the information exchange between different Manage Archived Data functions represented through the Other Archives terminator. This process shall allow other archives to share data collected by other archive functions to share the data in response to local requests from users systems. This process shall use data collected from different archives to build a set of global schema which the data archive definitions for the local archive plus any archives known to the local archive. This process shall provide the global schema to the local Manage Archive function. This process shall receive the schema of the local archive to share with other archive functions. This process shall provide data to those other archives when requested. This process shall support analysis, data fusion, and data mining of archived information across geographically dispersed archives.

P-Spec Nbr	Description
8.5	This process shall monitor the archive data user systems interface for requests for data from the archive. This process shall support requests from users involved in planning, research, safety, as well as operations of transportation functions. This process shall receive requests for data and catalogs of data that may be contained in the archive. This process shall translate the requests into a format that can be understood by the Manage Archive function to retrieve data from the archive. When data or a catalog of data is received from the archive, this process shall generate the requested data product for the users systems. For archive data requiring financial payment this archive process the financial requests and manages an interface to a Financial Institution.

APPENDIX C

DATA FLOW DESCRIPTIONS

Data Flow Name	Data Flow Description
archive_data	This data store within the Manage Archived Data function contains the collection of data imported into the archive function that has been formatted for the archive schema. This data store is comprised of the data, the meta data to describe the archived data in detail enough to improve the usefulness of the data over time, a catalog and schema of the data held within the archive, and a set of access permissions for the data held within the archive.
cf_on_board_vehicle_data	This data flow is used within the Manage Commercial Vehicle function and contains data collected on-board a commercial vehicle output of which has been requested by the commercial vehicle manager.
cf_request_on_board_vehicle_data	This data flow is used within the Manage Commercial Vehicles function. It contains a request from the commercial vehicle manager for the commercial vehicle to output the on-board data it has collected, plus any general message data from the driver.
confirm_vehicle_fare_ payment	This data flow is sent from the Provide Electronic Payment Services function to the Manage transit function to confirm that transaction processing of the payment of a single transit fare (interactive operation) or of a group of fares (batch mode) from on-board the vehicle has been completed. If the transaction processing was in batch mode, the transit user's tag identity will be set to zero (0), otherwise it will be set to the identity provided in the transaction request.
control_parameters	This data flow is used within the Manage Traffic function to pass data between the Provide Traffic Surveillance and Provide Device Control facilities.
cv_roadside_data_for_vehicle	This data flow is used within the Manage Commercial Vehicle function. It contains data that is being sent from a commercial vehicle roadside checkstation or border crossing facility to the commercial vehicle.
cv_vehicle_data_for_roadside	This data flow is used within the Manage Commercial Vehicle function. It contains data that is being sent from the commercial vehicle to the commercial vehicle roadside checkstation facility.
em_archive_status	This data flow is sent from the Manage Archived Data function to the Emergency Management function. It is the status returned when transit archive data is sent from the Emergency Management function to the Manage Archived Data function.
em_archive_request	This data flow from the Manage Archived Data function contains the request for data collected and stored by the Emergency Management function. The request can be a request for a catalog of the data held by the function or a request for the data itself.
emergency_data_archive	This data store is used to hold data that is to be archived by the Manage Archived Data function. This data includes information, such as, incident characteristics and emergency management response data.
emergency_request_driver_ acknowledge	This data flow is used by the Manage Emergency Services function to acknowledge that the request for emergency services previously sent by the driver has been received and is therefore sent to the Provide Driver and Traveler Services function for output.
emergency_request_driver_ details	This data flow is used by the Provide Driver and Traveler Services function to send data about an emergency declared by a driver to the Manage Emergency Services function.

Data Flow Name	Data Flow Description
emergency_traffic_control_ request	This data flow is sent from the Manage Emergency Services function to the Manage Traffic function. It contains a list of the route segments that have been provided for use by an emergency vehicle, together with the arrival time at each segment. The data will be used by the Manage Traffic function to generate changes to the current traffic management strategy to give the emergency vehicle priority.
emergency_traffic_control_ response	This data flow is sent from the Manage Traffic function to the Manage Emergency Services function. It contains a list of the route segments that have been provided for use by an emergency vehicle and indicates the traffic management strategy that is in effect for these route segments.
emergency_vehicle_ acknowledge	This data flow is used within the Manage Emergency Services function. It contains the acknowledgment of data received by the emergency vehicle.
emergency_vehicle_dispatch_data	This data flow is used within the Manage Emergency Services function. It contains data required to dispatch an emergency vehicle to the scene of an incident.
emergency_vehicle_dispatch_ request	This data flow is used within the Manage Emergency Services function and contains data for the request for an emergency vehicle dispatch. The data flow specifies the information needed to respond to a particular incident.
emergency_ vehicle_dispatch_ response	This data flow provides current enroute status and requests any additional current incident response status.
emergency_vehicle_incident_ details	This data flow is used within the Manage Emergency Services function and contains details of an incident to which a response is required.
emergency_vehicle_ preemptions	This data flow is sent by the Manage Emergency Services function to the Manage Traffic function. It contains the data necessary for an individual emergency services vehicle and the stream of traffic in which the vehicle is traveling to be given preemption (priority) at an indicator controller. This will be at the controller for a particular road junction, pedestrian crossing, or highway entrance ramp. The data is sent directly from the emergency vehicle to the next controller along its route and therefore is not subject to any centralized coordination. Local coordination may be provided if there are links between adjacent controllers.
emergency_vehicle_response_ request	This data flow is used within the Manage Emergency Services function and contains data for the request for an emergency vehicle to be processed by the Select Response Mode function. The data flow specifies the information needed to respond to a particular incident.
emissions_archive_data	This data flow is to the Manage Archive data function from the Manage Traffic function. It contains pollution data collected from sensors allocated at the roadside and from vehicles.
emissions_archive_request	This data flow from Manage Archive Data function contains the request for data collected and stored by Manage Traffic function. The request can be a request for catalog of the data held by the function or a request for the data itself.
Emissions_archive_status	This data flow is sent from the Manage Archived Data function to the Manage Traffic function. It is the status returned when emissions archive data is sent from the Manage Traffic function to the Manage Archived Data function.

Data Flow Name	Data Flow Description
Erms_incidents	This data flow is sent from the Manage Emergency Services function to the Manage Traffic function. It contains data about incidents and the priority requests needed by emergency vehicles.
From_C_and_M	This data flow is sent to the Manage Traffic function. It contains either information about road and highway repairs from the Construction and Maintenance organization or indicator fault clearance data.
From_Commercial_Vehicle	This data flow is sent from a commercial vehicle to the Manage Commercial Vehicles and Provide Vehicle Monitoring and Control functions. It contains data that has been collected on-board a commercial vehicle for processing by sensors before being used within the functions.
From_Commercial_Vehicle_ Driver	This data flow is sent from the commercial vehicle driver to the Manage Commercial Vehicles function and contains data that has been input by a driver acting either as a driver, or acting as a commercial vehicle manager.
From_Commercial_Vehicle_ Manager	This data flow is sent from the commercial vehicle manager to the Manage Commercial Vehicles function and contains data that has been input by a commercial vehicle fleet manager.
From_Event_Promoters	This data flow is sent from the Event Promoters terminator to the Provide Driver and Traveler Services and Manage Traffic functions.
From_Financial_Institution	This data flow is sent from the Financial Institution to the Provide Electronic Payment Services function and contains data about requests for payments that have been successfully made or otherwise.
From_Other_EM	This data flow is sent by the other emergency centers to the Manage Emergency Services function and contains information about incidents that are taking place outside the area of operation serviced by the local function.
From_Payment_Instrument	This data flow is sent from the payment instrument to the Provide Electronic Payment Services function.
From_Traffic	This data flow is sent to the Manage Traffic function. It contains analog data from traffic on roads and highways that can be read by sensors within ITS.
From_Traffic_Operations_Personnel	This data flow is input by traffic operations personnel to various processes in the Manage Traffic function. It is used to request the output of traffic, incident, traffic and travel demand, or pollution data, or to control closed circuit television (cctv) systems, or to provide new parameters for use by processes in the Traffic Incident, Demand and Emissions Management facilities. It also provides information about roadway characteristics (shoulder width, pavement type, speed limit, etc.).
From_Transit_Driver	This data flow is sent to the Manage Transit function. It contains input from a transit vehicle driver.
From_Transit_Fleet_ Manager	This data flow is sent from the transit fleet manager to the Manage Transit function and contains various inputs. Some are initiated by the manager, whilst others result from prompts to input data which is additional to that already received by processes within the function.
From_Emergency_Personnel	This data flow is sent from the emergency personnel to the Manage Emergency Services function.

Data Flow Name	Data Flow Description
From_Environment	This data flow is sent from the environment to the Manage Traffic function. It provides information about the environmental conditions both generally in the area served by ITS and at the roadside. It is mostly analog data that must be converted by sensors to provide data for use by other processes.
From_Media	This data flow is sent from the Media to the Manage Traffic and Provide Driver and Traveler Services function. It provides input of data regarding incidents identified by the Media and traveler information, as well as requests for incident or traffic information.
From_Rail_Operations	This data flow is sent from a railroad operated operations center (or centers) to the ITS Manage Traffic function. It contains information about scheduled and/or planned railroad activity that may be relevant to ITS traffic management (e.g. train schedules through busy corridors, maintenance schedules for railroad owned and maintained grade crossing equipment, etc.). This is typically informational data and is not required for timely operation of grade crossing protection and safety devices. It is however the source of data for use in route planning, alternate route determination, railroad incident notifications, etc.
From_vehicle_characteristics	This data flow is sent from the vehicle characteristics terminator. It represents the presence of a vehicle near a sensor, which allows the sensor to create an output that can be used to identify a particular vehicle and its characteristics, such as the number of wheels, size, pollution parameters, etc., for toll payment and parking lot charging purposes.
From_Wayside_Equipment	This data flow represents information received by HRI from railroad maintained and operated wayside interface equipment (track circuits, gate controllers, local connections to centralized sites via railroad communications networks, etc.). This is assumed to be a real-time, or near real-time interface capable of providing direct communications with (or otherwise detecting) approaching trains.
From_Roadway_ Environment	This data flow is sent from the roadway environment to the Provide Vehicle Monitoring and Control and Manage Traffic functions. It contains analog data about the environment actually around the roadway itself covering such things as emissions, fog, ice, snow, etc.
From_Weather_Service	This data flow consists of data that is provided by the Weather Service terminator and is sent to the Provide Driver and Traveler Services and Manage Traffic functions. The weather service may also provide data to the Manage Archived Data function. The current and predicted weather data items will be organized by geographic area to allow for local variations.
Global_schema	This data flow from the Coordinate Archives function contains the definition of the archives that are managed by similar Manage Archived Data functions that have made the data available to local user systems. The global schema defines the structure of various archive databases, including information such as the definition of objects within a database or how tables of data are related to each other as in a relational database. The global schema would also define the information necessary to locate information spread across geographical boundaries as in a distributed archive model. The global schema is used to support mining and fusion activities of data across multiple archives.
Guidance_data	This data flow is used within the Provide Driver and Traveler Services function to transfer data between the Manage Trip Planning and Ridesharing facility and the Provide Guidance and Trip Planning Services facility.

Data Flow Name	Data Flow Description
Hri_surveillance_data	This data flow provides surveillance information, acquired by HRI at grade crossings, that is relevant to the overall traffic surveillance functions of ITS (e.g. grade crossing vehicle traffic, detected incidents, etc.
incident_command_request	This data flow requests resources, provides commands for relay to other allied response agencies, and includes other requests that reflect local command of an evolving incident response
incident_data_input	This data flow is used within the Manage Traffic function to send processed traffic sensor data and data received from other traffic management centers (TMC's) from the Provide Traffic Surveillance facility to the Manage Incidents facility.
Incident_details	This data flow is sent from the Manage Emergency Services function to the Manage Traffic function and provides information about current incidents.
Incident_details_request	This data flow is used by the Manage Traffic function to request details of incidents from the Manage Emergency Services function.
Incident_response_clear	This data flow is sent from the Manage Traffic function to the Manage Emergency Services function and is an indication that the Manage Traffic function has data indicating that an incident has been cleared.
Incident_response_status	This data flow provides the current status of an incident response indicating site management strategies in effect, incident clearance status, the incident command structure that is in place, and points of contact.
Incident_status_data	This data flow is sent from the Manage Emergency Vehicle function to the Manage Emergency Response function. It provides detailed incident information gathered by emergency personnel at the incident site and contains detailed information which includes the number and extent of injuries, identification of vehicles and people involved, specification of hazardous material, and any other information required to completely and accurately determine the scope and severity of the incident and the required response.
Incident_information	This data flow is sent from the Manage Emergency Services function to the Provide Driver and Traveler Services function and contains information that has been requested about incidents.
Incident_video_for_ emergency_services	This data flow is used within the Manage Traffic function. It contains current video images of incidents requested by the Manage Emergency Services facility.
Local_schema	This data flow from the Manage Archive function contains the definition of the archive managed by the local process. The schema defines the structure of the archive database, including information such as the definition of objects within a database or how tables of data are related to each other as in a relational database.
Other_archive_data_input	This data flow from the Coordinate Archive function to the Manage Archive function contains the data and meta data from other archives. This data is sent based on requests from local user systems to retrieve data that is not located within the local archive. This request for data is to support the activities of mining or fusion of data across multiple archives.

Data Flow Name	Data Flow Description
Other_archive_data_request	This data flow from the Manage Archive function to the Coordinate Archive function contains the request for data that may be located in other archives. This data request is built based on requests from user systems to retrieve data that is not located within the local archive but is known to exist in other archives based on the global schema that is being maintained.
Other_archive_data_request_ input	This data flow from the Coordinate Archive function to the Manage Archive function contains the request from other archives for data that may be located in the local archive. This data request is built based on requests from user systems of other archives to retrieve data that is not located within their local archive. This request for data is to support the activities of mining or fusion of data across multiple archives.
Other_archive_data	This data flow from the Manage Archive function to the Coordinate Archives function contains data drawn from the archive data store that is to be sent to other archives as part of data mining or fusion activities across multiple archives. This data flow may also contain any meta data from the archive necessary to describe the data provided.
paratransit_personal_ schedule	This data flow is sent from the Manage Transit function to the Provide Driver and Traveler Services function.
paratransit_service_ confirmation	This data flow is sent by the Provide Driver and Traveler Services function to the Manage Transit function to confirm that the traveler wants to use the previously identified paratransit service.
paratransit_trip_request	This data flow is sent from the Provide Driver and Traveler Services function to the Manage Transit function to action a trip request using the paratransit operation.
pollution_state_data	This data flow is used within the Manage Traffic function as a means of transferring current pollution data from the Manage Emissions facility to the Manage Demand facility. It contains data about the current levels of pollution obtained from the store of pollution data.
Pollution_state_data_request	This data flow is used within the Manage Traffic function as a means of requesting current pollution data to be sent from the Manage Emissions facility to the Manage Demand facility. It contains request for data about current levels of pollution.
Remote_video_image_control	This data flow is used within the Manage Traffic function. It is a request from the Emergency Management function to control closed circuit televisions(cctv) images of incidents that occurred on roadways.
Request_erms	This data flow is sent from the Manage Traffic function to the Manage Emergency Services function.
Rideshare_information .	This data flow is used within the Provide Driver and Traveler Services function to transfer information about rideshare requests, rideshare routes and travelers, and requests for rideshare as part of a traveler's proposed trip request.
Rideshare_request_and_ confirmation	This data flow is used within the Provide Driver and Traveler Services function to transfer information about rideshare requests.

Data Flow Name	Data Flow Description
Roadside_archive_data	This data flow is sent from the Manage Traffic function to the Manage Archive Data function. It contains the roadside archive data stored in the Manage Traffic function along with the meta data describing the data as collected from field equipment. It consists of sensor data which includes the status of the sensors and detection of sensor faults.
Roadside_archive_control	This data flow from the Manage Archive Data function contains the request for data collected and stored by the Manage Traffic function. The request can be a request for a catalog of the data held by the function or a request for the data itself.
Retrieved_archive_data	This data flow from the Get Archive Data function contains the data from sources within ITS and outside ITS, i.e. terminators. This data includes the updated meta-data to indicate what formatting or other methods may have been applied to the data as it was imported.
Route_data	This data flow is used to transfer data between the Provide Driver and Traveler Services function and the Manage Traffic function. It contains a wide variety of data covering road network use by guided vehicles and requests for current traffic data which can be presented to travelers, as well as a traveler profile for subscription of data.
Sensor_parameters	This data flow is used within the Manage Traffic function to send data between the Provide Device Control and Provide Traffic Surveillance facilities.
To_C_and_M	This data flow is sent to the construction and maintenance terminator from the Manage Traffic function. It either confirms that the request for maintenance work sent in as a planned incident from the terminator has been accepted, or requests changes to the timing to minimize the impact on traffic flows, or contains reports about indicators that are faulty.
To_Commercial_Vehicle	This data flow is sent to a commercial vehicle from the Manage Commercial Vehicles function. It contains a request for data to be provided by the commercial vehicle for use within the function.
To_Commercial_Vehicle_ Driver	This data flow is sent to the commercial vehicle driver from the Manage Commercial Vehicle function and contains responses to requests for information or requests for further data to be input.
To_Commercial_Vehicle_ Manager	This data flow is sent to the commercial fleet manager from the Manage Commercial Vehicles function and contains data to be output to the manager.
To_Emergency_Personnel	This data flow is sent to the emergency personnel from the Manage Emergency Services function.
To_Event_Promoters	This data flow is sent from the Manage Traffic function to the event promoters terminator
To_Financial_Institution	This data flow is sent to the Financial Institution from the Provide Electronic Payment Services function and contains requests for payment to be made for services being requested by travelers or drivers, or details of those involved in bad transaction data.

Data Flow Name	Data Flow Description
To_Media	This data flow is sent by processes within the Manage Traffic, Manage Transit, and Manage Emergency functions to the Media System. It provides output of information on traffic flow conditions, traffic incidents, transit incidents and other emergencies, plus a request for traveler information. The output data can be based upon a specific request from the Media, or as part of a subscription service where information of a predefined type is automatically output to the Media.
To_Other_EM	This data flow is sent to the other emergency centers by the Manage Emergency Services function to advise then of incidents that are taking place in locations that are in the area served by the local function and hence outside their area of operations.
To_Payment_Instrument	This data flow is sent to the payment instrument by the Provide Electronic Payment Services function. It consists of two types of data, that which requests payment for a service fromthe credit stored by the instrument itself, and that which gives notice that payment for the service will be charged to the credit identity provided by the instrument.
To_Traffic_Operations_ Personnel	This data flow is used by various processes within the Manage Traffic function to send data on traffic conditions, weather conditions, incidents, incident responses, traffic and travel demand and pollution data to traffic operations personnel.
To_Transit_Driver	This data flow is sent by the Manage Transit function to the transit driver. It contains information for the transit driver. This information is particular to this type of driver and is not relevant to drivers of other types of vehicle(s).
To_Transit_Fleet_Manager	This data flow is sent from the Manage Transit function and contains output to a transit fleet manager.
To_Wayside_Equipment	This data flow represents information for trains or hi-rail vehicles approaching a specific highway grade crossing and their crews. It is provided by HRI traffic control elements to rail owned and operated wayside interface equipment (train signaling circuits, automatic control interfaces, local connections to centralized sites via railroad communications networks, etc.). This is a time critical flow and requires the most direct communications path available to a train approaching a grade crossing.
Traffic_data_flow	This data flow is sent from the Manage Traffic function to the Provide Driver and Traveler Services function. It contains traffic data either to be provided direct to travelers or for use by the route guidance and route selection processes, or for archival.
Traffic_data_demand_request	This data flow is used within the Manage Traffic function to provide the Manage Demand facility with current, historic and predictive traffic data.
Traffic_data_for_broadcast_ to_personal_devices	This data flow is used to provide broadcast data on the traffic flowing in the road network, plus that which is predicted to flow in the network for output to a traveler's personal device. This subset of the full data will depend on the route segment list included in the request.
Traffic_data_for_emergency_ services	This data flow is used within the Manage Traffic function and contains current traffic information and roadway environmental conditions for the emergency management system.

Data Flow Name	Data Flow Description
Traffic_data_for_personal_devices	This data flow is used to provide data on the traffic flowing in the road network, plus that which is predicted to flow in the network for output to a traveler's personal device. This subset of the full data will depend on the route segment list included in the request.
Traffic_data_for_transit	This data flow contains information about environmental conditions, current incidents on the road, traffic flow state, and air quality data.
Traffic_management_archive_data	This data flow is sent from the Manage Traffic function to the Manage Archive Data function. It is used to provide data on the traffic flowing in the road network, which includes current, predicted, and historical data. It also provides data on video images and operational data.
Traffic_management_archive_request	This data flow from the Manage Archived Data function contains the request for data collected and stored by the Manage Traffic function. The request can be a request for a catalog of the data held by the function or a request for the data itself.
Traffic_management_archive_status	This data flow is sent from the Manage Archived Data function to the Manage Traffic function. It is the status returned when traffic archive data is sent from the Manage Traffic function to the Manage Archived Data function.
Traffic_surveillance_data	This data flow represents highway traffic management surveillance information that is relevant to local ITS railroad grade crossing traffic management (e.g. stalled vehicles within crossings, crossing signal malfunctions, unusual traffic, detected incidents, etc.).
Transit_archive_data	This data flow from Manage Transit to Manage Archive Data contains the archive data stored in the Manage Transit function along with the meta data describing the data as collected from field equipment. This data can include a catalog of the data held by the function. This data flow is made up of transit passenger operational data, transit deployment data, transit user payment data, transit emergency data, transit security data, maintenance and personnel data.
Transit_archive_data_request	This data flow from the Manage Archive Data function to the Manage Transit function contains the request for the data held by the Manage Transit function. The request for data may include the description of the data required or a time frame over which the requested information may be available.
Transit_archive_status	This data flow is sent from the Manage Archived Data function to the Manage Transit function. It is the status returned when transit archive data is sent from the Manage Transit function to the Manage Archived Data function.
Transit_conditions_guidance_request	This data flow is sent from the Provide Driver and Traveler Services function to the Manage Transit function. It is used to request details of the current state of transit vehicle operations for use in the preparation of data for on-line driver and traveler guidance.
Transit_conditions_advisories_request	This data flow is sent from the Provide Driver and Traveler Services function to the Manage Transit function. It is used to request details of the current state of transit vehicle operations for use in the preparation of data for driver and traveler advisories.
Transit_deviations_for_personal_devices	This data flow contains current transit service deviations for a particular route. This data will be output to a traveler's personal device.

Data Flow Name	Data Flow Description
Transit_deviations_for_ broadcast_to_personal_ devices	This data flow contains current transit service deviations for a particular route. This data will be broadcast to a traveler's personal device.
Transit_fare_data	This data flow is used within the Provide Electronic Payment Services function and contains details of the fares being currently charged for transit services.
Transit_fare_data_request	This data flow is used within the Provide Electronic Payment Services function. It contains a request for the current transit fare price data to be provided from the store that is being used to calculate transit fares.
Transit_fare_details	This data flow is sent from the Provide Electronic Payment Services function to the Manage Traffic function and contains details of the fares being currently charged for transit services.
Transit_fare_request	This data flow is sent from the Manage Traffic function to the Provide Electronic Payment Services function and contains a request for the current prices being charged for transit fares.
Transit_fare_transactions	This data flow is used by processes in the Manage Transit function and contains records of transit fare payment transactions.
Transit_inputs	This data flow is sent from the Manage Transit function to the Manage Traffic function and contains information about the operation of transit vehicles, requests for preemption at signalized intersections and the response to requests for changes in transit services that have been made to help redistribute traveler demand.
Transit_probe_data	This data flow contains the location of the transit vehicle on each part of its route, i.e., each transit route segment. This data will be used along with other probe data to calculate the link speed or travel time. Transit probe information can be provided by fixed route, flexibly routed, and para-transit services.
Transit_roadway_priority_ given	This data flow is sent from the Manage Traffic function to the Manage Transit function. It contains confirmation that the overall priority requested for one or more transit vehicles throughout the road and freeway network served by the function has been given.
transit_incident_coordination_dat a	This data flow is sent from the Manage Emergency Services function to the Manage Transit function and contains information needed to deal with a transit related incident.
Transit_coordination_data	This data flow is sent from the Manage Transit function to the Manage Emergency Services function. It is used to provide data on the way in which the response to a transit incident should be coordinated.
Transit_incident_details	This data flow is sent from the Manage Transit function to the Manage Emergency Services function and contains details of an incident in the transit operations network.
Transit_emergency_data	This data flow is sent from the Manage Transit function to the Manage Emergency Services function and contains details of an emergency on-board a transit vehicle.

Data Flow Name	Data Flow Description
Transit_running_data_for_ advisories	This data flow is used within the Provide Driver and Traveler Services function. It contains data on the current state of transit operations for use in driver and transit user advisory output messages. The messages will only contain data that is relevant to the vehicle's current location.
Transit_running_data_for_ guidance	This data flow is sent from the Manage Transit function to the Provide Driver and Traveler Services function. It is used to provide data on the current state of transit operation for use in preparing driver and traveler on-line guidance data
transit_services_demand_ request	This data flow is sent from the Manage Traffic function to the Manage Transit function. It is a request for supply of details of the transit services and will be used in the preparation of demand forecasts by the Manage Demand facility.
Transit_services_for_demand	This data flow is sent from the Manage Transit function to the Manage Traffic function. It contains a complete set of all the transit routes and the services that run upon them, including timings, etc. that are provided by the transit fleet from which the data was requested, for use in the calculation of demand forecasts by the Manage Demand facility.
Transit_services_for_eta	This data flow is used within the Manage Transit function. It is sent to the Operate Transit Vehicles facility for use in the calculation of transit vehicle estimated times of arrival (eta) at transit stops. It only contains details of the schedule for the transit route that is currently being operated by the vehicle.
Transit_services_for_ corrections	This data flow is used within the Manage Transit function. It is sent to the Operate Transit Vehicles facility for use in the calculation of corrections to transit vehicle routes and schedules to restore a service to normal operation. It contains a complete set of all the transit routes and the services that run upon them, including timings, etc. that are provided by the transit fleet from which the data was requested.
Transit_services_travelers_ request	This data flow is used within the Manage Transit function to request the details of the current transit services for a transit user at the roadside. The transit user will have to provide the origin and destination so that the receiving process can work out for which transit route(s) data will be provided.
Transit_user_advanced_ payment_on_vehicle	This data flow is sent from the Manage Transit function to the Provide Electronic Payment Services function. It contains the cost of advanced payments that must be deducted from the credit currently stored on the payment instrument being used by a transit user on-board a transit vehicle. These advanced payments may cover tolls, and/or parking lot charges, and/or transit fares.
Transit_user_vehicle_credit_ identity	This data flow is sent from the Provide Electronic Payments Services function to the Manage Transit function and contains the credit identity of a transit user on-board a transit vehicle, or a stored credit value. Either data item is obtained by a process within the Provide Electronic Payment Services function as data input from the payment instrument terminator
transit_updates	This data flow is sent from the Manage Traffic function to the Manage Transit function and contains traffic data for use in transit operations, requests for information on transit services, or requests for changes to transit services to try and re-distribute traveler demand.
Transit_vehicle_arrival_time	This data flow is used within the Manage Transit function. It contains the estimated time of arrival of a transit vehicle at a stop plus the route and service number on which it is operating.

Data Flow Name	Data Flow Description
Transit_vehicle_availability	This data flow is used within the Manage Transit function and contains details of a transit vehicle's availability for work.
Transit_vehicle_eta_for_ advisory	This data flow is used as an interface between the Manage Transit and Provide Driver and Traveler Information functions. It contains the estimated time of arrival of a transit vehicle at the end of a transit route segment, which is usually a stop, plus the route and service number on which it is operating.
Transit_vehicle_location	This data flow is used within the Manage Transit function to provide the exact location of the transit vehicle.
Transit_vehicle_fare_data	This data flow is sent by the Provide Electronic Payment Services function to the Manage Transit function and contains details of the fares being currently charged for regular transit services. It is for use in calculating fares that are to be paid by transit users on-board a transit vehicle
transit_vehicle_passenger_ data	This data flow is used within the Manage Transit function and contains the number of passengers carried by a transit vehicle while in service. It is derived from on-board vehicle fare collection data and may be used for calculating future transit schedules.
Transit_vehicle_roadway_ preemptions	This data flow is sent from the Manage Transit function to the Manage Traffic function and contains data necessary for an individual transit vehicle to be given preemption (priority) at indicator controllers. This will be at the controller for a particular road junction, pedestrian crossing, or highway entrance ramp. The data is sent directly from the transit vehicle to the next controller along its route and therefore is not subject to any centralized coordination. Local coordination may be provided if there are links between adjacent controllers.
Transit_vehicle_user_data	This data flow is used within the Manage Transit function and contains data about a transit vehicle for automatic output to transit users at transit stops. The data is output at the transit stop as the vehicle approaches and contains information about the vehicle such as the route number.
Traveler_traffic_profile	This data flow contains a traveler's personal profile for obtaining traffic information. This profile is submitted one time and then used to generate future personalized trip information. This profile supports a subscription type of information dissemination to the traveler.
Trip_planning_data	This data flow is used within the Provide Driver and Traveler Services function to transfer data between the Provide Guidance and Trip Planning Services facility and the Manage Trip Planning and Ridesharing facility, as well as provide route information to the data archive.
Unusual_congestion	This data flow is used within the Manage Traffic function and identifies places in the road network at which unusual congestion has been detected.
Vehicle_location_for_ emergencies	This data flow is used within the Provide Driver and Traveler Services function. It contains the vehicle's location as computed from data input to sensors controlled by the processes that determines vehicle location. This is a high precision data flow that enables the location of the vehicle to be pin-pointed to a high degree of accuracy and is used to provide the destination for the emergency services when they respond to an emergency call-out message generated on-board a vehicle by its driver.

Data Flow Name	Data Flow Description
vehicle_location_for_transit	This data flow is sent from the Provide Driver and Traveler Services function to the Manage transit function. It contains the vehicle's location as computed from data input to sensors controlled by the processes that determine vehicle location. This is a low precision data flow that will be refined using data obtained from on-board the transit vehicle.
vehicle_pollution_alert	This data flow is used by the Manage Traffic function as a means of transferring current vehicle pollution data from the Manage Emissions facility to the Manage Emergency Services function to enable enforcement of air quality standards. It contains data about the current levels of pollution being output by a vehicle.
vehicle_status_details_for_ emissions	This data flow is sent from the Provide Vehicle Control and Monitoring function to the Manage Traffic function. It contains the operational status of the vehicle which is important because the levels of pollution vary according to how long the vehicle has been running, i.e. how warm is the engine, and what it is actually doing, e.g. is it stationary, or pulling away from a stop.
weather_service_information	This data flow consists of weather information that is provided by the Provide Driver and Traveler Services and Manage Traffic functions and is sent to the Provide Traffic Operations Personnel Traffic Data Interface.
weather_service_information_req uest	This data flow requests weather information from the Provide Driver and Traveler Services and Manage Traffic functions. The data requested will provide weather conditions for the Provide Traffic Operations Personnel Traffic Data Interface.
wide_area_pollution_data	This data flow is used within the Manage Traffic function as a means of transferring current pollution data from the Manage Emis sions facility to the Provide Traffic Surveillance facility. It contains data about the current levels of pollution obtained from the store of pollution data in the area covered by the Traffic Management Center

APPENDIX D

THURSTON REGION MARKET PACKAGE DESCRIPTIONS

Market Package	Description
Traffic and Transportation Management Market Packages	
Network Surveillance (ATMS01)	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 operated by WSDOT's Tacoma TOC. The derived data can be used locally such as when traffic detectors are connected directly to a signal control system or remotely (e.g., when a CCTV system sends data back to the Tacoma TOC). The data generated by this market package enables traffic managers to monitor traffic and road conditions, identify and verify incidents, detect faults in indicator operations, and collect census data for traffic strategy development and long range planning. The collected data can also be analyzed and made available to users and the Information Service Provider Subsystem.
Probe Surveillance (ATMS02)	This market package provides an alternative approach for surveillance of the roadway network. The implementation path supported by this market package includes the wide-area wireless communications between the vehicle (could be a personal vehicle or a county maintenance crew) and Information Service Provider (could be the Thurston County Roads and Maintenance, and the Tacoma TOC) used to communicate current vehicle location and status. The market package enables traffic managers to monitor road conditions, identify incidents, analyze and reduce the collected data, and make it available to users and private information providers. It requires one of the communications options identified above, roadside beacons and wire-line communications for the short range communications option, data reduction software, and utilizes wire-line links between the Traffic Management Subsystem and Information Service Provider Subsystem to share the collected information.
Surface Street Control (ATMS03)	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 in the Thurston region. A range of traffic signal control systems are represented by this market package ranging from static pre-timed control systems to fully traffic responsive systems that dynamically adjust control plans and strategies based on current traffic conditions and priority requests. Implementing centers in this market package include the local streets and signal systems that are operated by Thurston County and the regional cities of Olympia, Lacey and Tumwater along with some signals that are maintained and operated by WSDOT. This market package is generally an intra-jurisdictional package that does not rely on real-time communications between separate control systems to achieve area-wide traffic signal coordination. Systems that achieve coordination across jurisdictions by using a common time base or other strategies that do not require real time coordination would be represented by this package. This market package is consistent with typical urban traffic signal control systems.
Freeway Control (ATMS04)	This market package provides the communications and roadside equipment to support ramp control, lane controls, and interchange control for freeways mainly operated by WSDOT. Coordination and integration of ramp meters are included as part of this market package. This package is consistent with typical urban traffic freeway control systems. This package incorporates the instrumentation included in the Network Surveillance Market Package to support freeway monitoring and adaptive strategies as an option. This market package also includes the capability to utilize surveillance information for detection of incidents operated by the Tacoma TOC.

Market Package	Description
Traffic Information Dissemination (ATMS06)	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 operated by WSDOT. This package provides a tool that can be used to notify drivers of incidents by using portable DMS operated and maintained by Thurston County at selected roadway locations to provide information to travelers to take alternate routes and make better travel decisions. This package also covers the equipment and interfaces that provide traffic information from the Tacoma TOC to the media (for instance via a direct tie-in between a traffic management center and radio or television station computer systems), transit management center, emergency management center, and information service provider.
Regional Traffic Control (ATMS 07)	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 the WSDOT traffic management centers, Thurston county, adjoining counties of Pierce and Lewis, and all the regional cities to support a regional control strategy. The nature of optimization and extent of information and control sharing is determined through working arrangements between the stakeholders and jurisdictions in the Thurston region. This package relies principally on roadside instrumentation supported by the Surface Street Control and Freeway Control Market Packages and adds hardware, software, and wire line communications capabilities to implement traffic management strategies that 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.
Incident Management (ATMS 08)	This market package manages both predicted and unexpected incidents so that the impact to the transportation network and traveler safety is minimized. Requisite incident detection capabilities are included in the freeway control market package and through the regional coordination with other traffic management and emergency management centers, weather service entities, and event promoters supported by this market package. Information from these diverse sources are collected and correlated by this market package to detect and verify incidents and implement an appropriate response. In the Thurston Region, the day-to-day operations of incident management, including detection, response and clearance will be performed by the Thurston County E911 Call Center, Washington State Patrol and the Local Police and Fire. In the case of exceptional incident management, which includes situational conditions like earthquakes, the Thurston County EOC takes over emergency management operations of incident management. This market package provides Traffic Management Subsystem equipment that supports traffic operations personnel in developing an appropriate response in coordination with emergency management and other incident response personnel to confirmed incidents. The response may include traffic control strategy modifications and presentation of information to affected travelers using the Traffic Information Dissemination market package. The same equipment assists the operator by monitoring incident status as the response unfolds. The coordination with emergency management might be through a CAD system like the Thurston County E911 System or through other communication with emergency field personnel. The coordination can also extend to tow trucks and other field service personnel.

Market Package	Description
Traffic Forecast and Demand Management (ATMS 09)	This market package includes advanced algorithms, processing, and mass storage capabilities that support historical evaluation, real-time assessment, and forecast of the roadway network performance managed by WSDOT. This includes the prediction of travel demand patterns to support better link travel time forecasts. The source data would come from the WSDOT TMCs as well as other traffic management centers like the Thurston County Roads and regional city traffic departments. In addition to short-term forecasts, this market package provides longer range forecasts that can be used in transportation planning that can be useful to the Thurston Regional Planning Council (TRPC) and other MPOs in the region. This market package provides data that supports the implementation of TDM programs, and policies managing both traffic and the environment.
Emissions Monitoring and Management (ATMS11)	This market package monitors individual vehicle emissions and provides general air quality monitoring using distributed sensors to collect the data. The collected information is transmitted to the emissions management subsystem for processing. The Thurston Urban Region has been designated by the Environmental Protection Agency (EPA) as a PM10 non-containment area and TRPC is very involved in air-quality modeling and emissions projects to maintain the air quality standards in the county. Both individual detection and identification of vehicles that exceed emissions standards and general area-wide monitoring of air quality are supported by this market package. For area wide monitoring, this market package measures air quality, identifies sectors that are non-compliant with air quality standards, and collects, stores and reports supporting statistical data. For point emissions monitoring, this market package measures tail pipe emissions and identifies vehicles that exceed emissions standards. The gathered information can be used to implement environmentally sensitive TDM programs, policies, and regulations.
Virtual TMC and Smart Probe Data (ATMS 12)	This market package provides for special requirements of rural road systems. Instead of a central TMC, the traffic management is distributed over a very wide area (e.g., a whole state or collection of states). Each locality has the capability of accessing available information for assessment of road conditions. The package uses vehicles like the Thurston county snow and maintenance as smart probes that are capable of measuring road conditions and providing this information to the roadway for relay to the Traffic Management Subsystem, in this case the Thurston County.
Standard Railroad Grade Crossing (ATMS 13)	This market package manages roadway traffic at highway-rail intersections (HRIs) where operational requirements do not dictate more advanced features (e.g., where rail operational speeds are less than 80 miles per hour). Both passive (e.g., the crossbuck sign) and active warning systems (e.g., flashing lights and gates) are supported. (Note that passive systems exercise only the single interface between the roadway subsystem and the driver in the architecture definition.) These traditional HRI warning systems may also be augmented with other standard traffic management devices. The warning systems are activated on notification by interfaced wayside equipment of an approaching train. The equipment at the HRI may also be interconnected with adjacent state, county or city signalized intersections so that local control can be adapted to highway-rail intersection activities (e.g., temporary alteration of upstream signal timing patterns).

Market Package	Description
Advanced Railroad Grade Crossing (ATMS 14)	This market package manages roadway traffic at highway-rail intersections (HRIs) where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour—such as the operation of the ***Talgo*** passenger service on the High Speed Ground Transportation (HSGT) corridor paralleling I-5 in Washington and Oregon). This market package includes all capabilities from the Standard Railroad Grade Crossing Market Package and augments these with additional safety features to mitigate the operational risks associated with higher rail speeds. The active warning systems supported by this market package include positive barrier systems that preclude entrance into the highway-rail intersection when the barriers are activated. Like the Standard Package, the HRI equipment is activated on notification by wayside interface equipment which detects, or communicates with the approaching train. In this market package, additional information about the arriving train is also provided by the wayside interface equipment so that the train's direction of travel, its estimated time of arrival, and the estimated duration of closure may be derived. This enhanced information may be conveyed to the driver prior to, or in context with, warning system activation. This market package also includes additional detection capabilities which enable it to detect an entrapped or otherwise immobilized vehicle within the HRI and provide an immediate notification to highway and railroad officials.
Railroad Operations Coordination (ATMS 15)	This market package provides an additional level of strategic coordination between rail operations and traffic management centers. Rail operations coordination provides for the integration of train schedules, maintenance schedules, and any other forecasted events that will result in highway-rail intersection (HRI) closures. This information is used to develop forecast HRI closure times and durations which may be used in advanced traffic control strategies or to enhance the quality of traveler information.
Road Weather Information System (ATMS 18)	This market package monitors current and forecast road and weather conditions using a combination of weather service information and data collected from environmental sensors deployed on and about the roadway. WSDOT currently operates and maintains several Road Weather Information Systems (RWIS) in the state and in Thurston County. The collected road weather information is monitored and analyzed to detect and forecast environmental hazards such as icy road conditions, dense fog, and approaching severe weather fronts. This information can be used to effectively deploy road maintenance resources, issue general traveler advisories, and support traffic information dissemination to travelers through several broadcast media like message signs, highway advisory radio and through the ***rWeather*** website.
Public Transportation Management Market Packages	
Transit Vehicle Tracking (APTS1)	This market package provides for an Automated Vehicle Location System to track Intercity transit vehicle's real time schedule adherence and updates the transit system's schedule in real-time. Vehicle position may be determined either by the vehicle (e.g., through GPS) and relayed to the infrastructure or may be determined directly by the communications infrastructure. A two-way wireless communication link (e.g., Advanced Radio Communication System) with Intercity Transit is used for relaying vehicle position and control measures. Intercity Transit can process this information, update the transit schedule and make real-time schedule information available to the Puget Sound Traveler Information System via a wire-line link.

Market Package	Description
Transit Fixed Route Operations (APTS2)	This market package performs automatic driver assignment and monitoring, as well as vehicle routing and scheduling for Intercity Transit fixed-route services. This service uses the existing AVL database as a source for current schedule performance data, and is implemented through data processing and information display at Intercity Transit center. This data is exchanged using the existing wire-line link to the information service provider, like the Puget Sound Regional Traveler Information System, where it is integrated with that from other transportation modes to provide the public with integrated and personalized dynamic schedules.
Demand Response Transit Operations (APTS3)	This market package performs automatic driver assignment and monitoring as well as vehicle routing and scheduling for demand response transit services provided by Intercity Transit and special needs transportation services. This package uses the existing AVL database to monitor current status of the transit fleet and supports allocation of these fleet resources to service incoming requests for transit service while also considering traffic conditions. Intercity Transit center provides the necessary data processing and information display to assist the transit operator in making optimal use of the transit fleet. The Information Service Provider Subsystem may either be operated by transit management center or be independently owned and operated by a separate service provider. In the first scenario, the traveler makes a direct request to a specific para-transit service. In the second scenario, a third party service provider, like the Area for Coordinated Council for Transportation (ACCT) determines which para-transit service is a viable means of satisfying a traveler request and uses wire-line communications to make a reservation for the traveler.
Transit Passenger and Fare Management (APTS4)	This market package allows for the management of passenger loading and fare payments onboard Intercity transit vehicles using electronic means (e.g., automatic passenger counter and fare card). 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 onboard the transit vehicle to allow fare payment. Data is processed, stored, and displayed on the transit vehicle and communicated as needed to the Intercity transit center using wireless infrastructure.
Transit Security (APTS5)	This market package provides for the physical security of transit passengers. An onboard security system is deployed to perform surveillance and warn of potentially hazardous situations. Public areas (e.g. stops, park and ride lots, stations) are also monitored. Information is communicated to the Intercity transit center using the existing or emerging wireless (vehicle to center) or wire-line (area to center) infrastructure. Security related information is also transmitted to the Thurston County E911 Call Center or the Local Police when an emergency is identified that requires an external response.
Transit Maintenance (APTS6)	This market package supports automatic maintenance scheduling and monitoring. Onboard condition sensors monitor critical system status and transmit critical status information to the Intercity transit center. Hardware and software in the transit center processes these data and schedules maintenance activities.

Market Package	Description
Multi-Modal Coordination (APTS7)	This market package establishes two-way communications between the regional transit agencies of Intercity Transit and Pierce Transit, and traffic agencies like Thurston County and Tacoma TOC, to improve service coordination. Inter-modal 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. More limited local coordination between the transit vehicle and the individual city arterial intersection for signal priority is also supported by this package.
Transit Traveler Information (APTS8)	This market package provides Intercity transit users at transit stops and onboard 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 (computerized Telephone Information System) are also represented by this market package.
Electronic Payment Market Package	
Electronic Fee/Payment Collection (ATMS10)	This market package provides means for electronic fee collections and payment services for Intercity transit and other transportation systems like the special needs transportation services. Dedicated short range communication between the roadway equipment and the vehicle is required as well as wireline interfaces between transit agencies and the financial infrastructure that supports fee collection.
Traveler Services Market Packages	
Broadcast Traveler Information (ATIS1)	This market package provides the user with a basic set of ATIS services; its objective is early acceptance. It involves the collection of traffic conditions, advisories, and general public transportation and includes the real-time dissemination of this information over a wide area through existing infrastructures and low cost user equipment (e.g., FM sub-carrier, cellular data broadcast) and through commercial media broadcast. Different from the market package ATMS6--Traffic Information Dissemination -- that provides the more basic HAR and DMS information capabilities, ATIS1 provides the more sophisticated digital broadcast service. Successful deployment of this market package relies on availability of real-time transportation data from the Tacoma TOC on the roadway conditions in the surrounding area and dissemination of this information through an efficient mechanism like the established Puget Sound regional traveler information system. However, wireless services such as FM sub-carrier broadcast and cellular data broadcast generally require public/private partnerships.

Market Package	Description
Interactive Traveler Information (ATIS2)	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. The traveler can obtain current information regarding traffic conditions, transit services, and ride share/ride match information. These services are likely to be provided by the Puget Sound Regional Traveler Information System for travelers in the Thurston region. A range of two-way wide-area wireless and wire-line communications systems may be used to support the required digital communications between traveler and the information service provider. A variety of interactive devices may be used by the traveler to access information prior to a trip or en-route; including phone, Personal Digital Assistant, and a personal computer. Successful deployment of this market package relies on availability of real-time transportation data from the Tacoma TOC and other regional counties and cities.
Freight Mobility Market Packages	
Fleet Administration (CVO1)	This market package keeps track of vehicle location, itineraries, and fuel usage at the Fleet and Freight Management Subsystem using a cell based or satellite data link and the pre-existing wireless infrastructure. The vehicle has a processor to interface to its sensor (e.g., fuel gauge) and to the cellular data link. The Fleet and Freight Management Subsystem can provide the vehicle with dispatch instructions, and can process and respond to requests for assistance and general information from the vehicle via the cellular data link. The market package also provides the Fleet Manager, WSDOT Commercial Vehicle Operations, with connectivity to intermodal transportation providers using the existing wire-line infrastructure.
Electronic Clearance (CVO3)	This market package provides for automated clearance at roadside check facilities. The roadside check facility communicates with Washington State Patrol CVO sites over wire-line to retrieve infrastructure snapshots of critical carrier, vehicle, and driver data to be used to sort passing vehicles. This package allows a good driver/vehicle/carrier to pass roadside facilities at highway speeds using transponders and dedicated short range communications to the roadside. The roadside check facility may be equipped with AVI, weighing sensors, transponder read/write devices, and computer workstation processing hardware, software, and databases.
CV Administrative Processes (CVO4)	This market package provides for electronic application, processing, fee collection, issuance, and distribution of CVO credential and tax filing. Through this process, carriers, drivers, and vehicles may be enrolled in the electronic clearance program provided by a separate market package which allows commercial vehicles to be screened at mainline speeds at commercial vehicle check points operated by Washington State Patrol. Through this enrollment process, current profile databases are maintained in the Commercial Vehicle Administration Subsystem and snapshots of this database are made available to the commercial vehicle check facilities at the roadside to support the electronic clearance process.

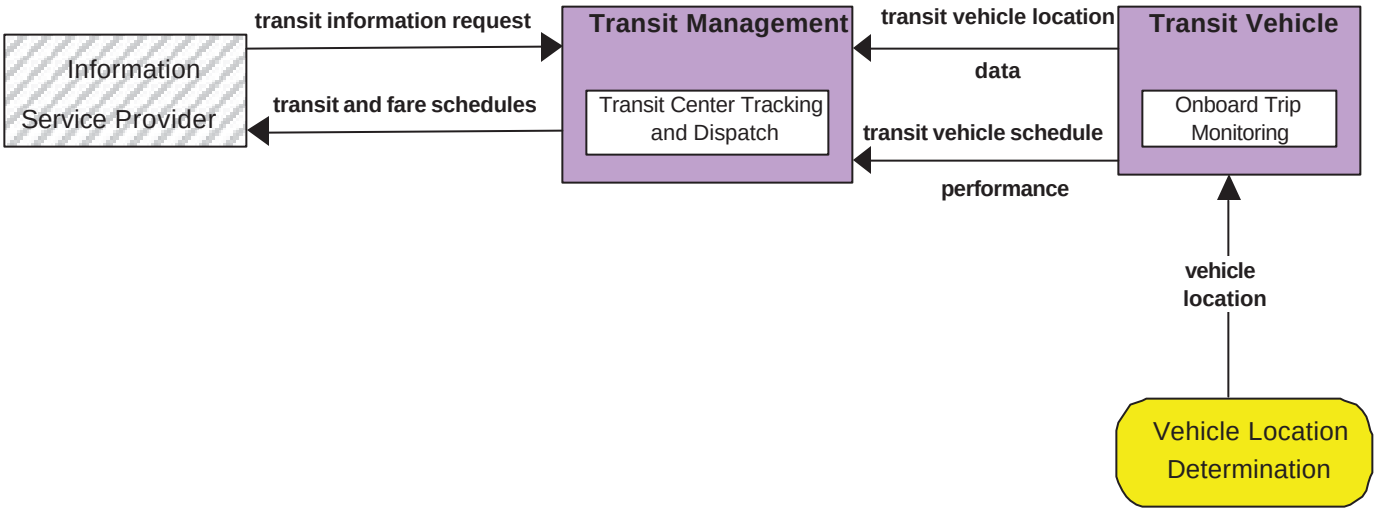
Market Package	Description
CVO Fleet Maintenance (CVO9)	This market package supports maintenance of CVO fleet vehicles through close interface with on-board monitoring equipment and AVLS capabilities with in the Fleet and Freight Management Subsystem operated by Washington State Patrol in coordination with WSDOT Commercial Vehicle Division. Records of vehicle mileage, repairs, and safety violations are maintained to assure safe vehicles on the highway.
Emergency Management Market Packages	
Emergency Response (EM1)	This market package provides the computer-aided dispatch systems, emergency vehicle equipment, and wireless communications that enable safe and rapid deployment of appropriate resources to an emergency. Coordination between the Thurston County E911 Call Center, Washington State Patrol, and the local police and fire supports emergency notification and coordinated response between agencies. Existing wide area wireless communications would be utilized between these agencies and their Emergency Vehicles to enable an incident command system and provide support at the emergency location. The emergency centers in the Thurston area would include hardware and software for tracking the emergency vehicles.
Emergency Routing (EM2)	This market package supports dynamic routing of Thurston County emergency vehicles and coordination with the Washington State Patrol for special priority on the selected route(s). In this market package, the Information Service Provider Subsystem would typically be integrated with the Emergency Management Subsystem in a public safety communications center. The Emergency Vehicle would also optionally be equipped with dedicated short range communications for local signal preemption.
Mayday Support (EM3)	This package allows the user (driver or non-driver) to initiate a request for emergency assistance and enables the Thurston County E911 Call Center to locate the user and determine the appropriate response. The request from the traveler needing assistance may be manually initiated or automated and linked to vehicle sensors. The data is sent to the Emergency Management subsystem using wide area wireless communications with voice as an option. Providing user location implies either a location technology within the user device or location determination within the communications infrastructure.
Information Storage and Management Market Packages	
ITS Data Mart (AD1)	This market package provides a focused archive that houses data collected and owned by Thurston County, WSDOT, and other regional cities. 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. It provides the basic data quality, data privacy, and meta-data management common to all ITS archives and provides general query and report access to archive data users.

Market Package	Description
ITS Data Warehouse (AD2)	This market package includes all the data collection and management capabilities provided by the ITS Data Mart, managed by the individual counties, cities and WSDOT, and adds the functionality and interface definitions that allow collection of data from Thurston County, regional cities, Thurston County Emergency Services, and Intercity Transit. It performs the additional transformations and provides the additional meta-data management features that are necessary so that all this data can be managed in a single repository with consistent formats. The potential for large volumes of varied data suggests additional on-line analysis and data mining features that are also included in this market package in addition to the basic query and reporting user access features offered by the ITS Data Mart.
ITS Virtual Data Warehouse (AD3)	This market package provides the same broad access to multi-modal, multidimensional data from varied data sources as in the ITS Data Warehouse Market Package, but provides this access using enhanced interoperability between physically distributed ITS archives that are each locally managed. Requests for data that are satisfied by access to a single repository in the ITS Data Warehouse Market Package are parsed by the local archive and dynamically translated to requests to remote archives which relay the data necessary to satisfy the request.

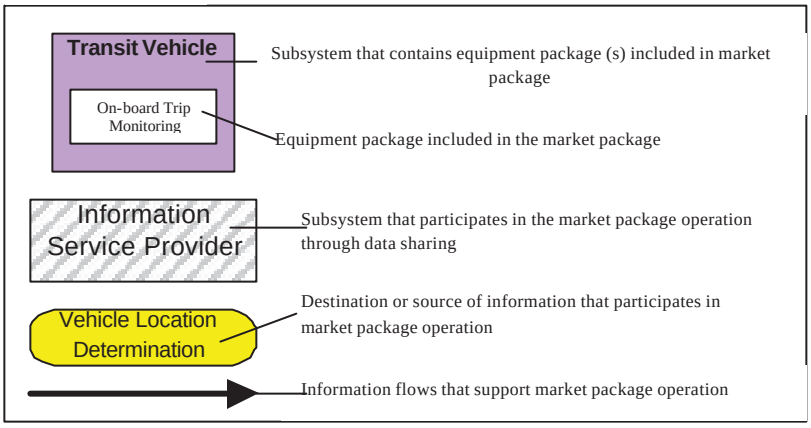
APPENDIX E

THURSTON REGION MARKET PACKAGE DIAGRAMS

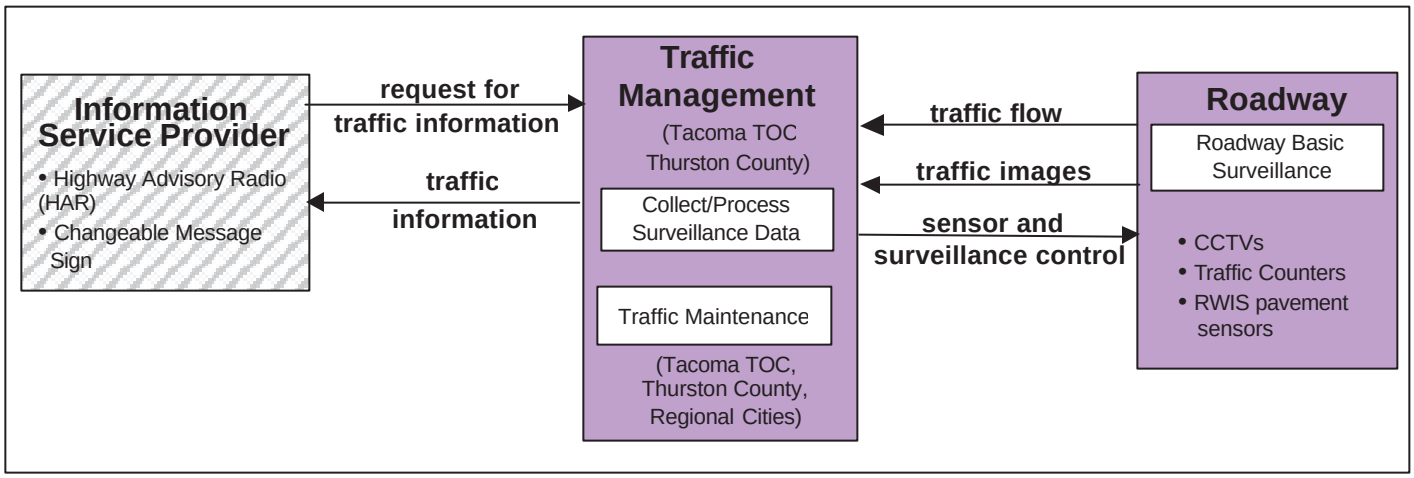
AN EXAMPLE OF A TYPICAL MARKET PACKAGE DIAGRAM AND ITS COMPONENTS



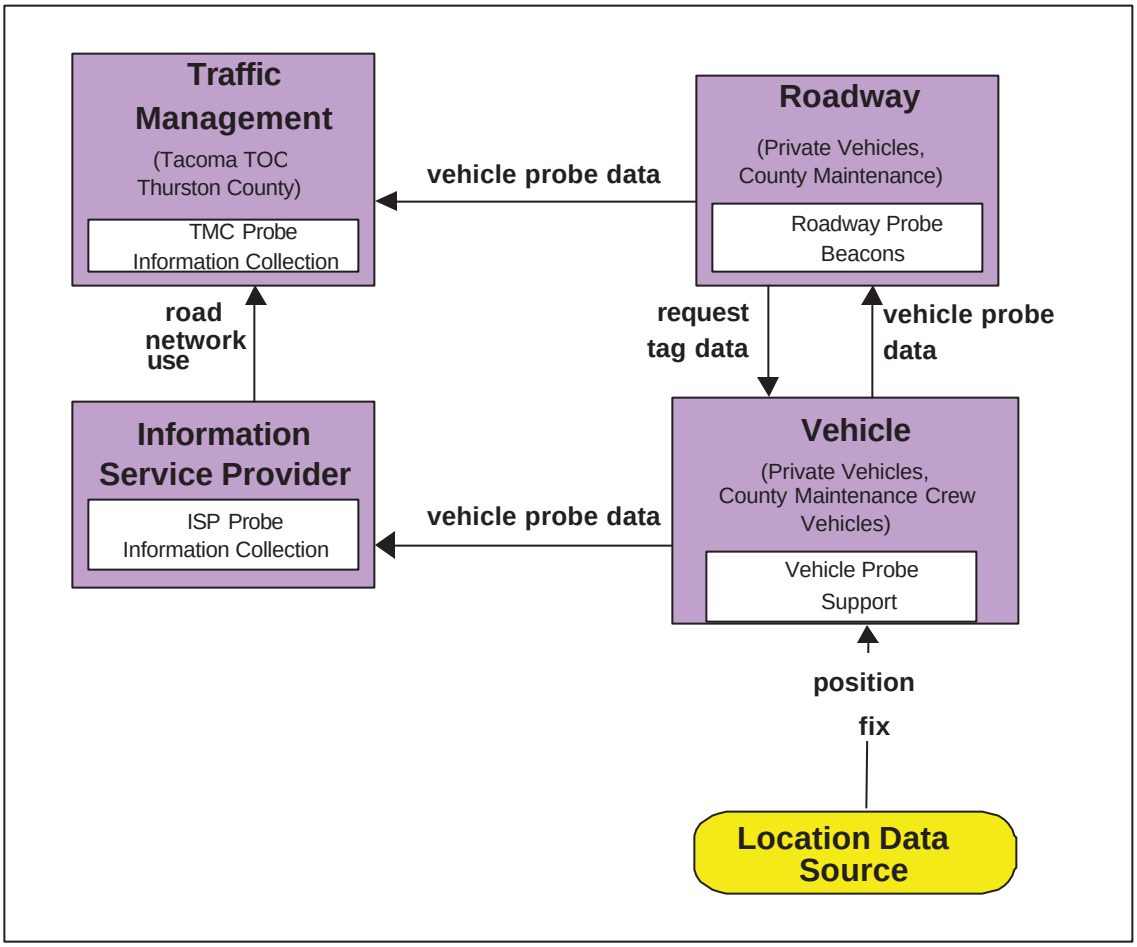
LEGEND



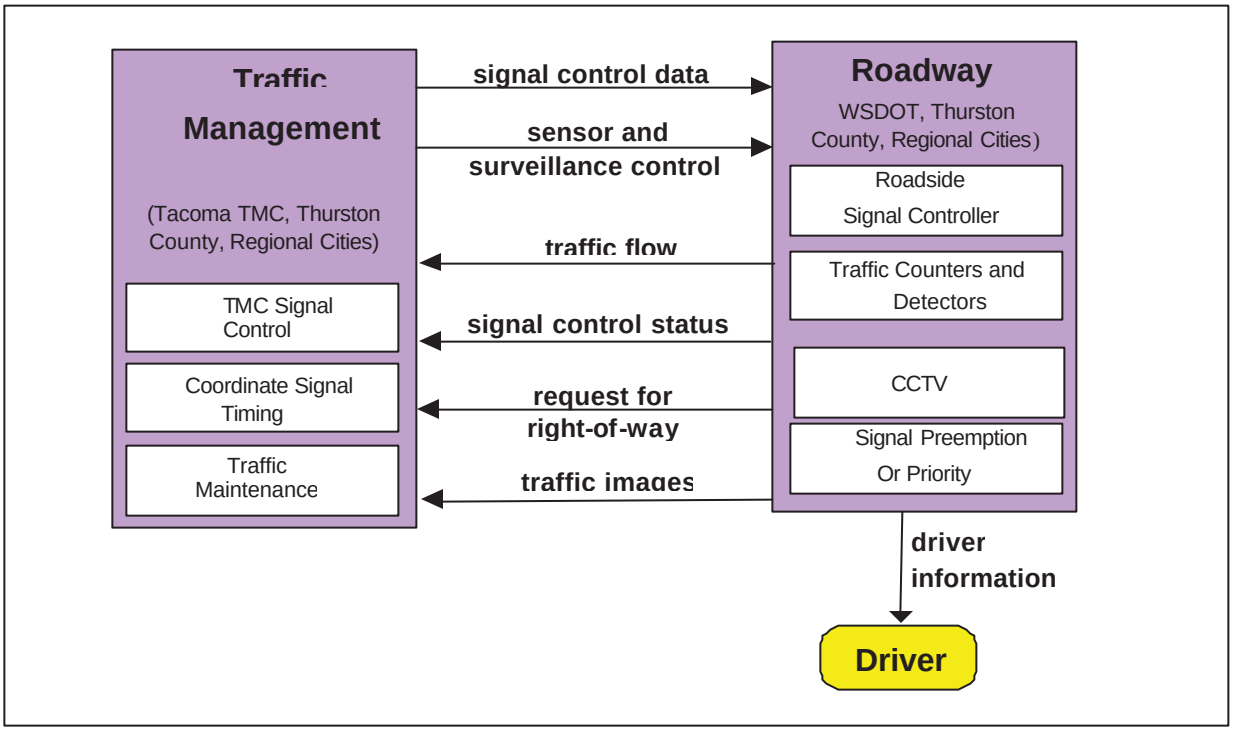
ATMS01: NETWORK SURVEILLANCE



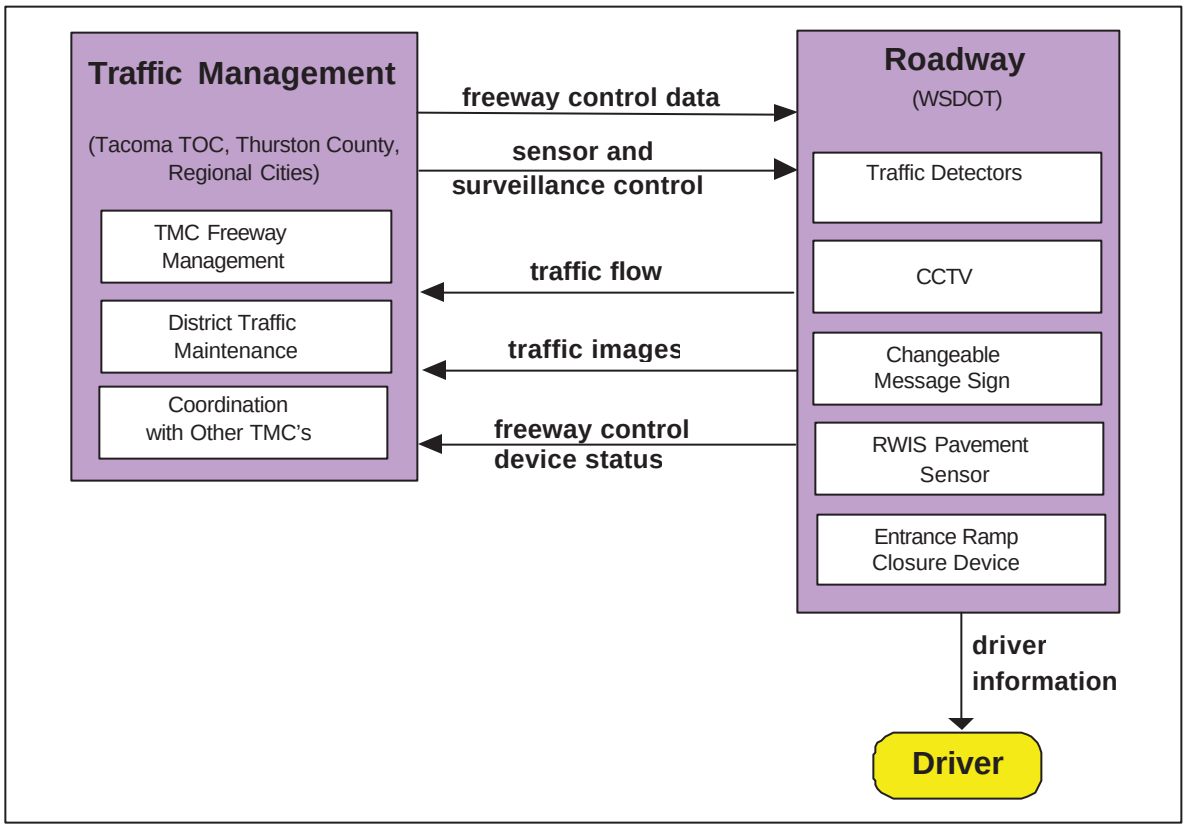
ATMS02: PROBE SURVEILLANCE



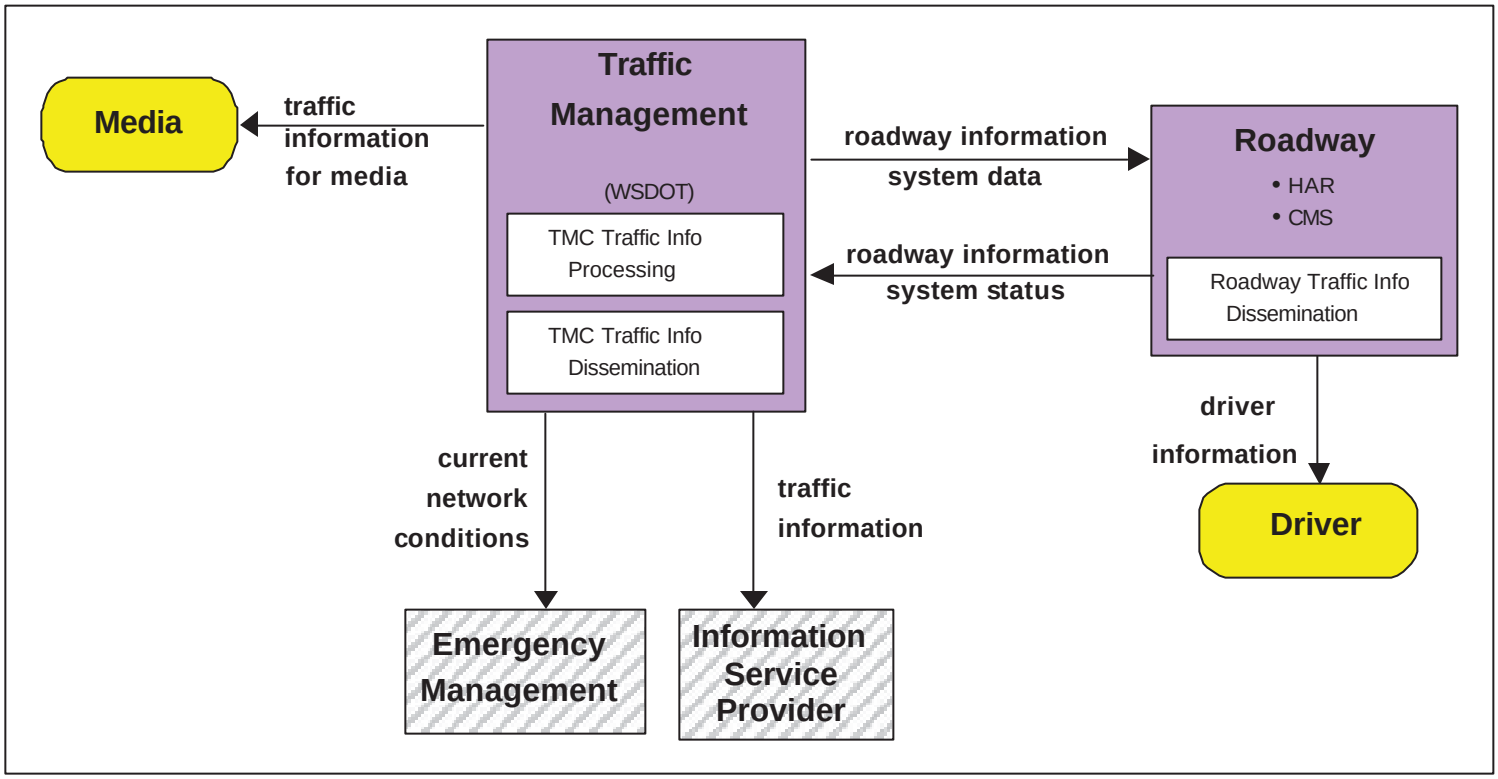
ATMS03: SURFACE STREET CONTROL



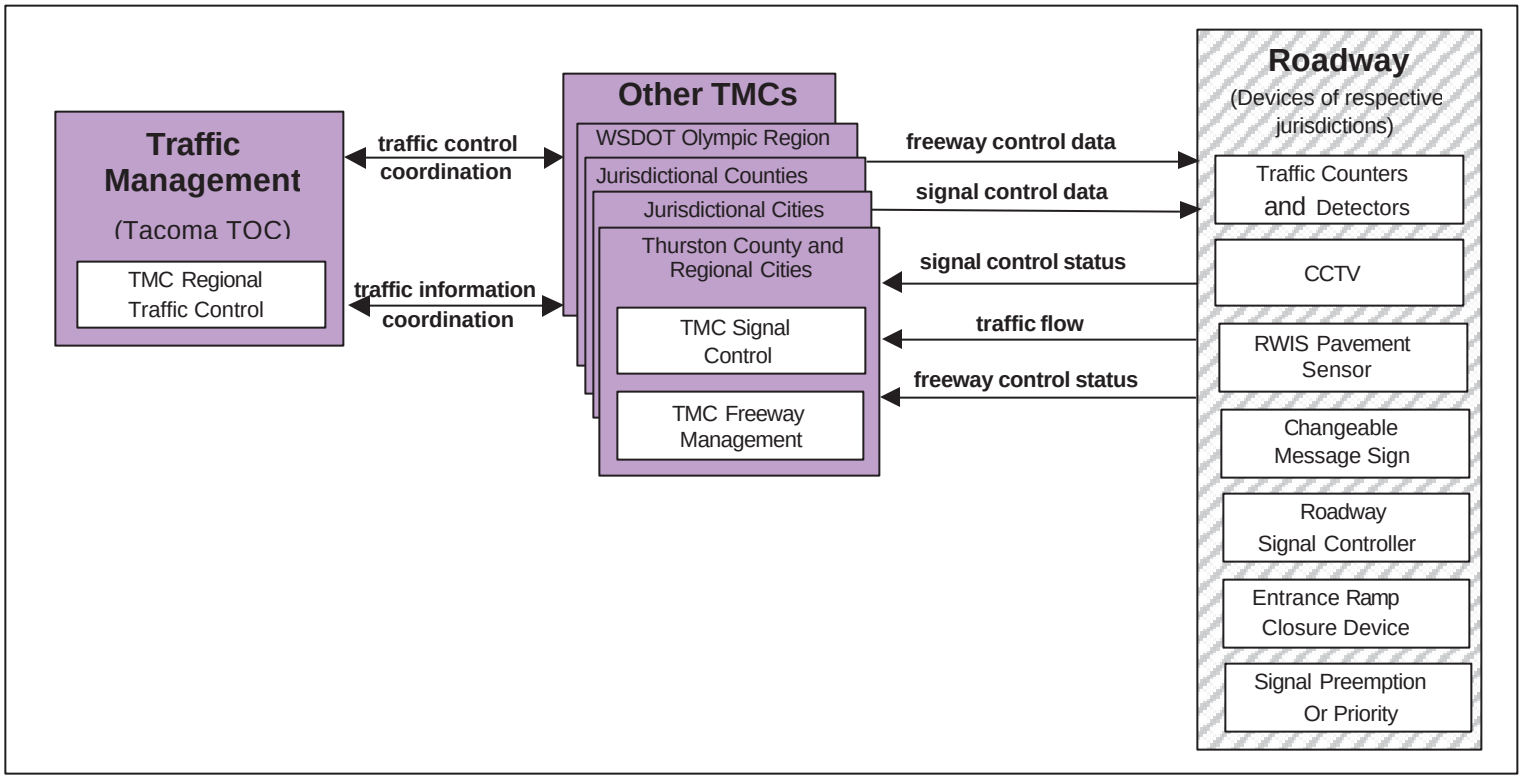
ATMS04: FREEWAY CONTROL



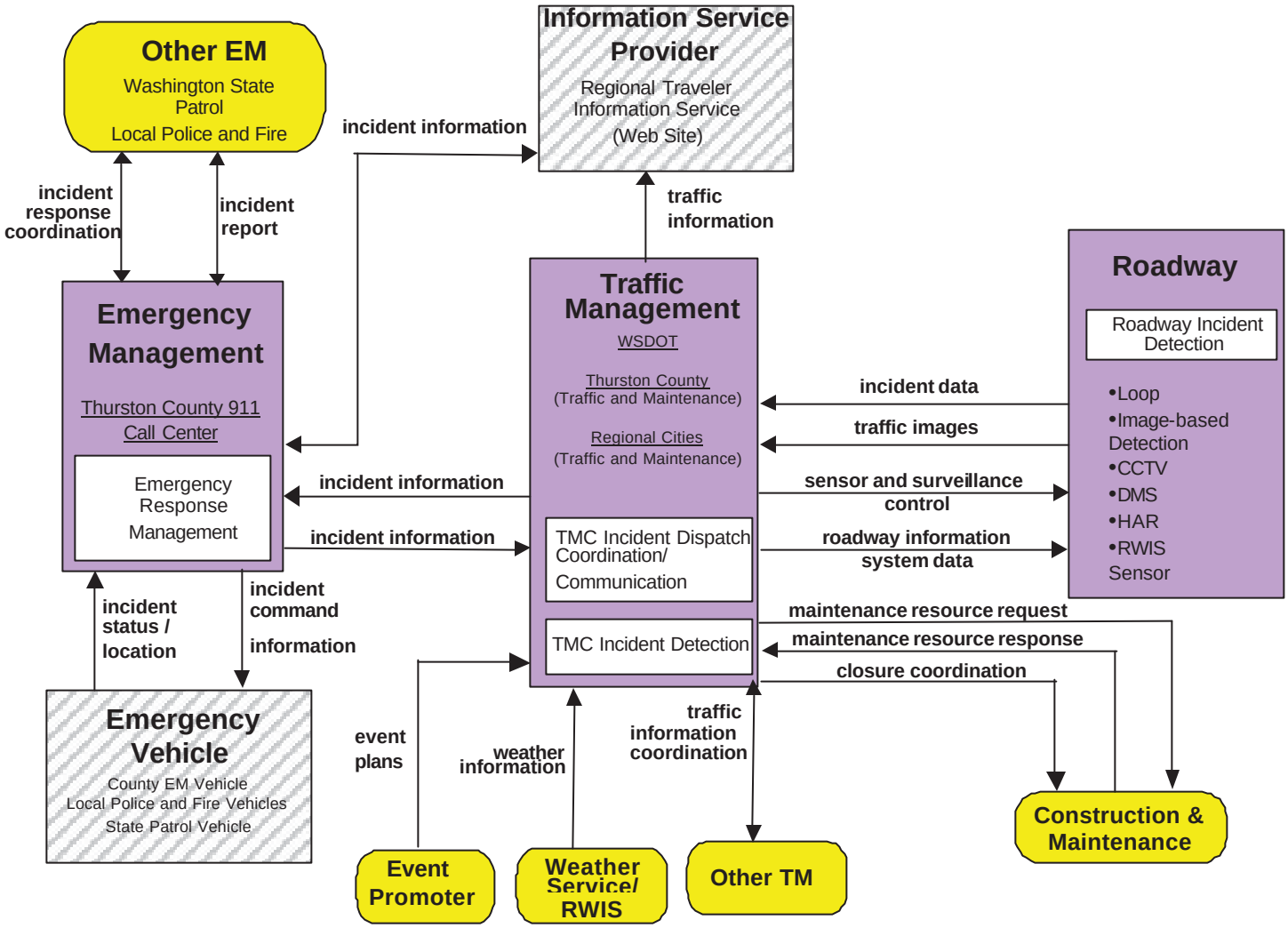
ATMS06: TRAFFIC INFORMATION DISSEMINATION



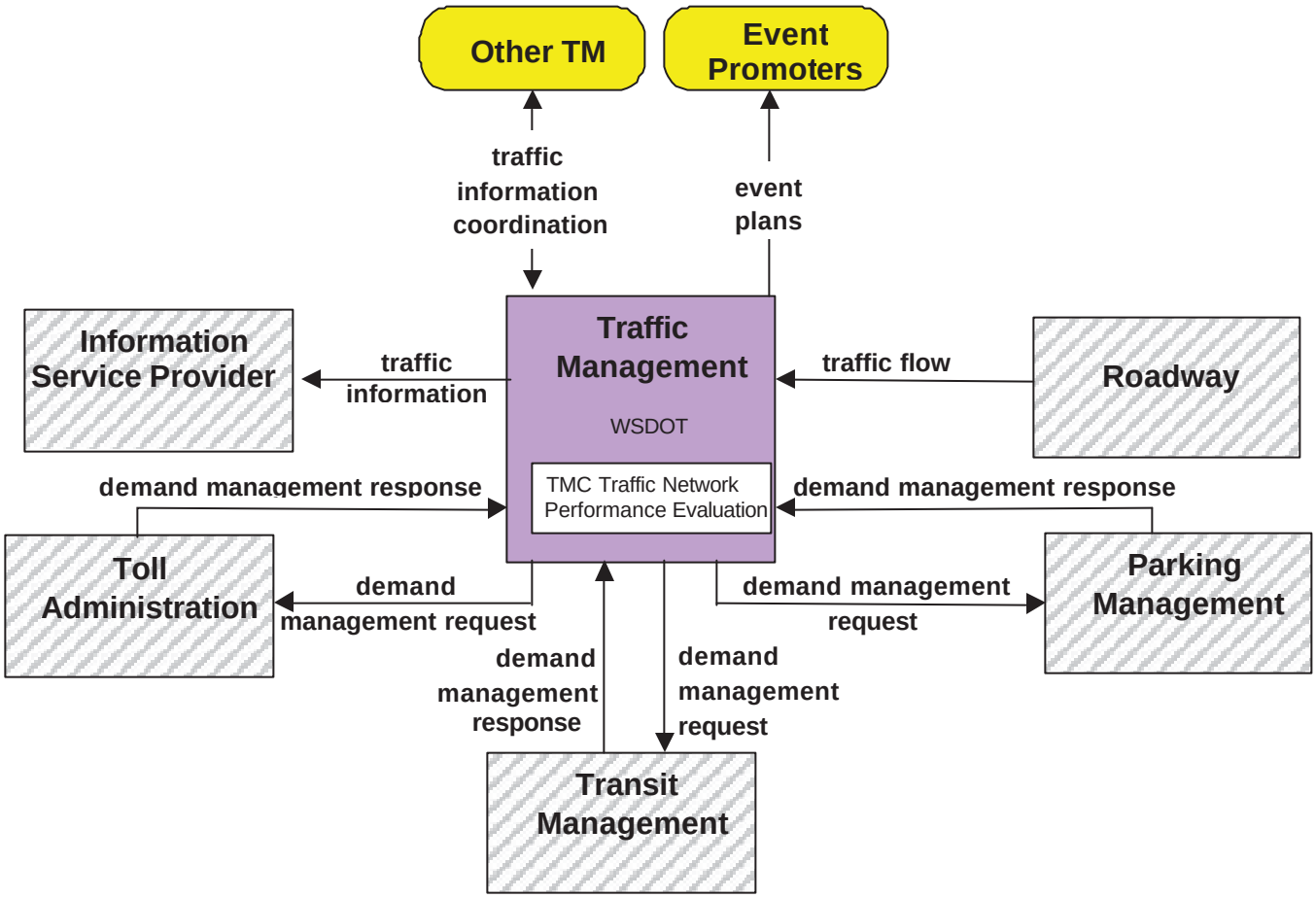
ATMS07: REGIONAL TRAFFIC CONTROL



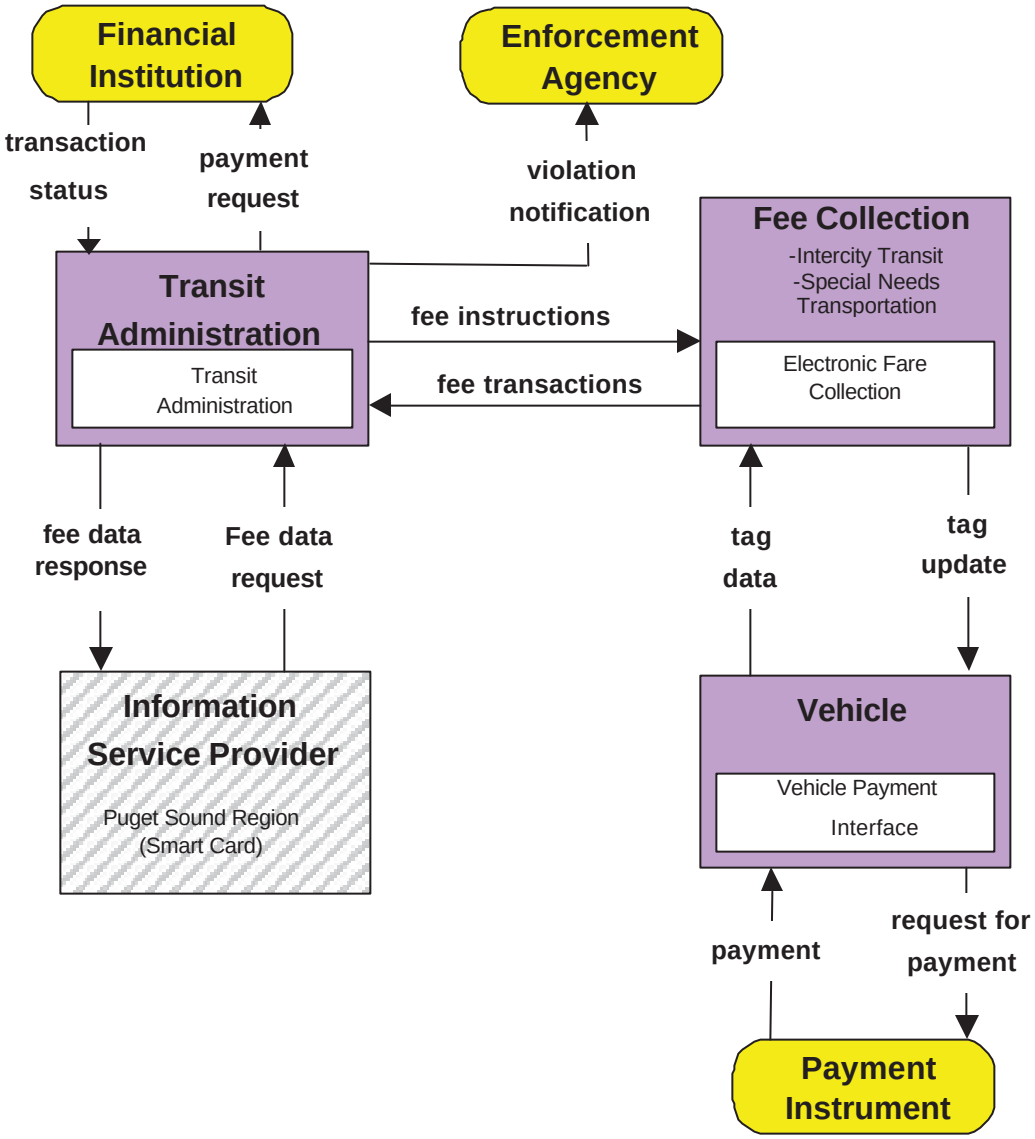
ATMS08: INCIDENT MANAGEMENT



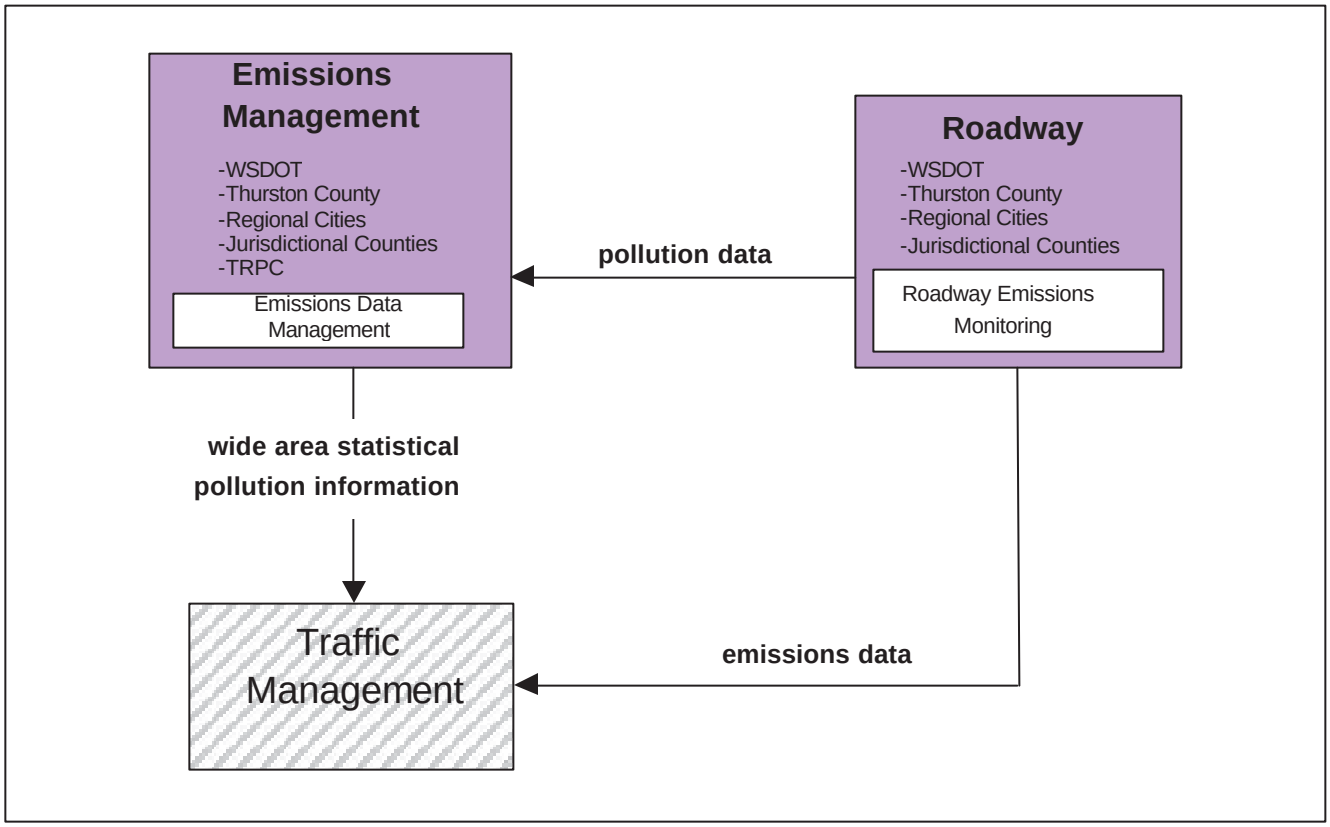
ATMS09: TRAFFIC FORECAST AND DEMAND MANAGEMENT



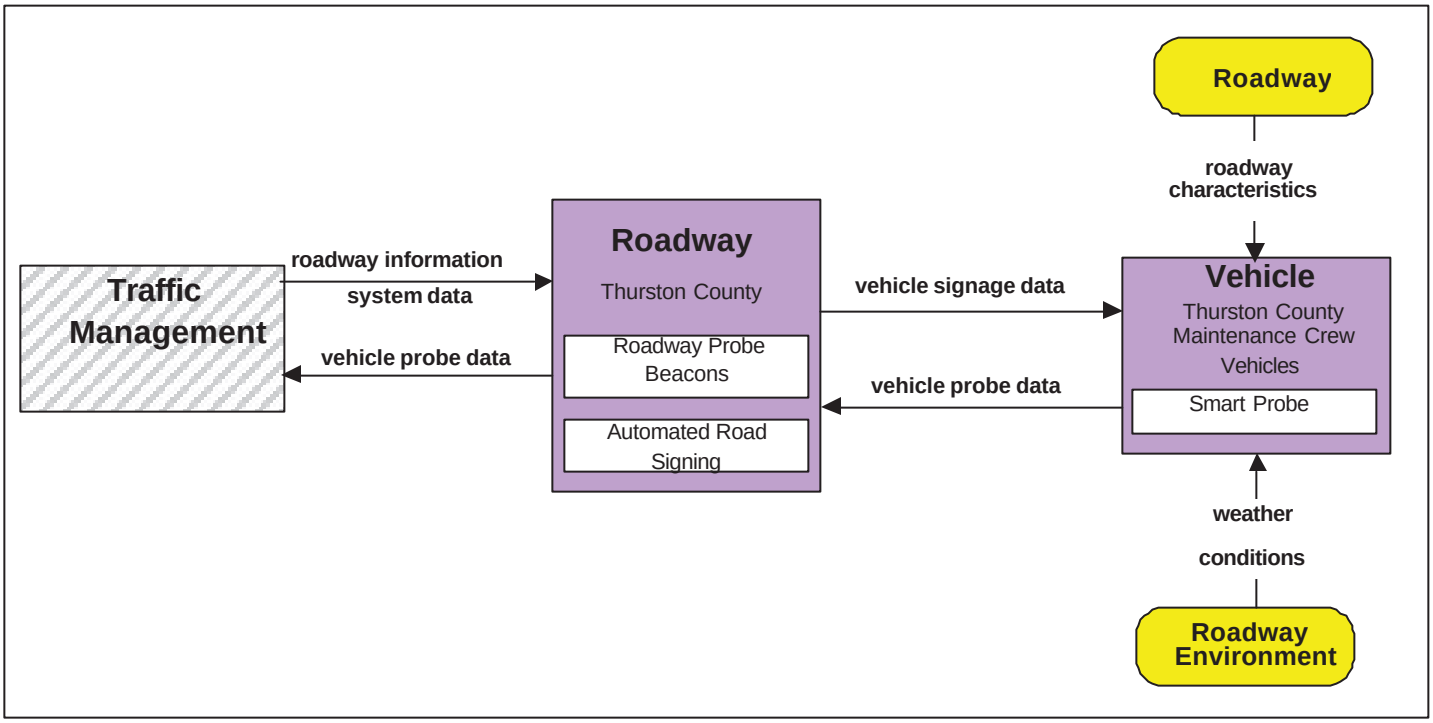
ATMS10: ELECTRONIC PAYMENT/FEE COLLECTION



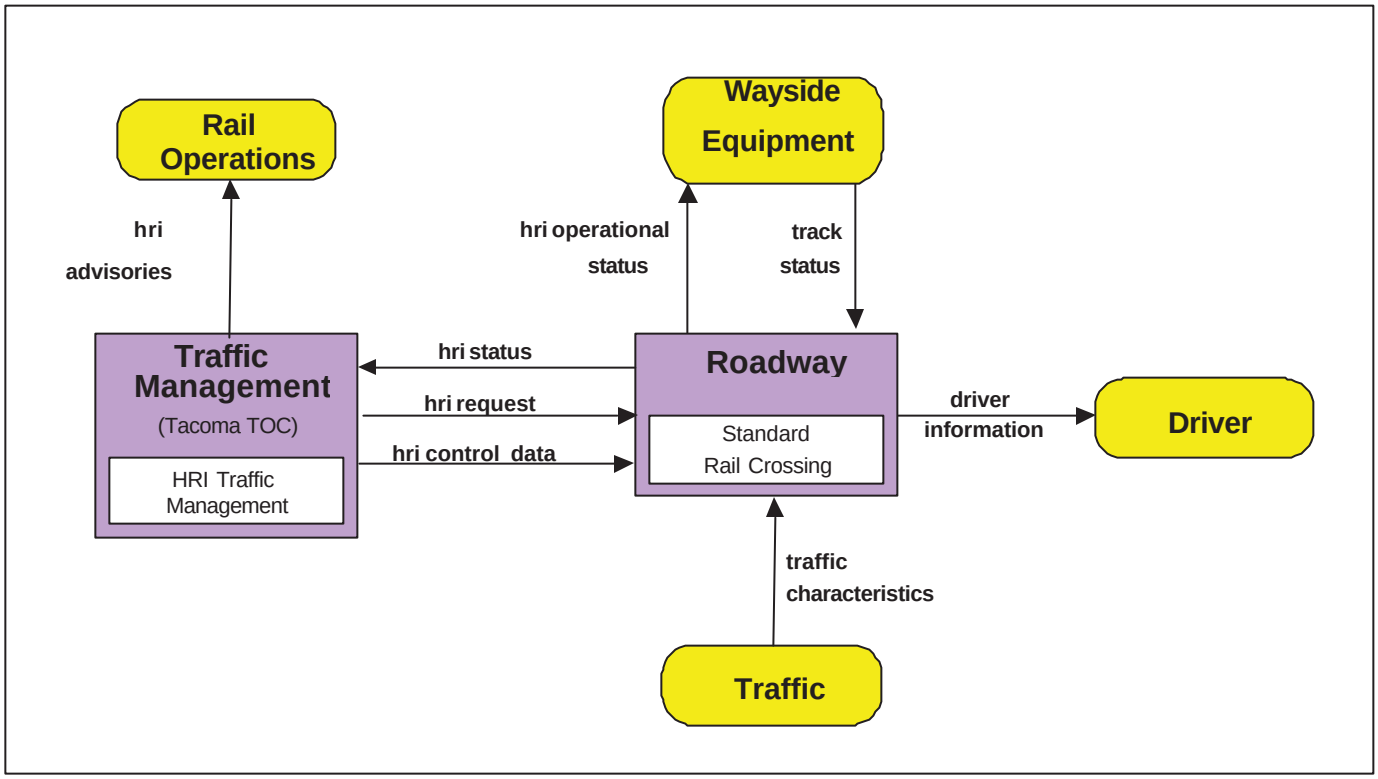
ATMS11: EMISSIONS MONITORING AND MANAGEMENT



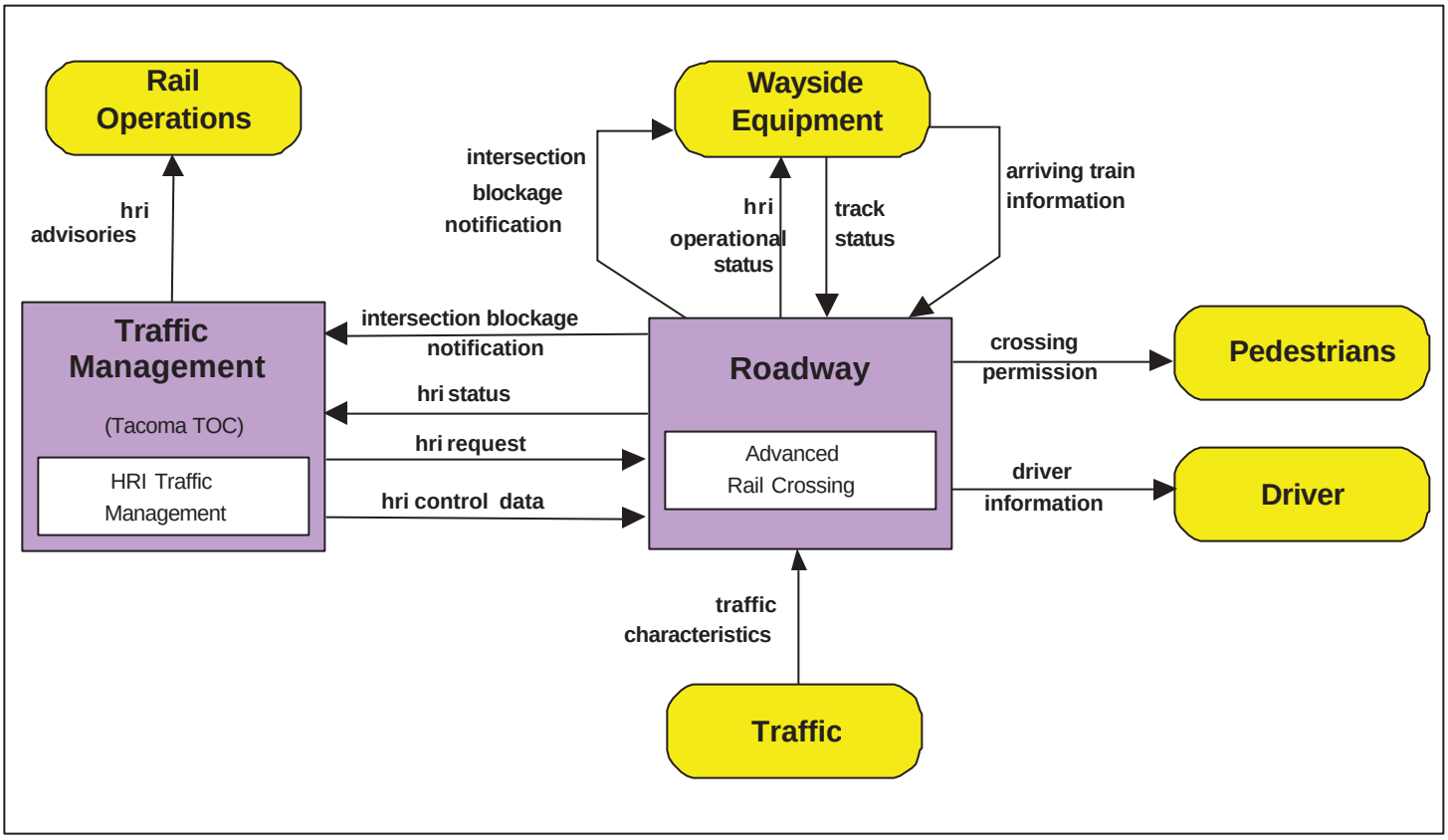
ATMS12: VIRTUAL TMC AND SMART PROBE DATA



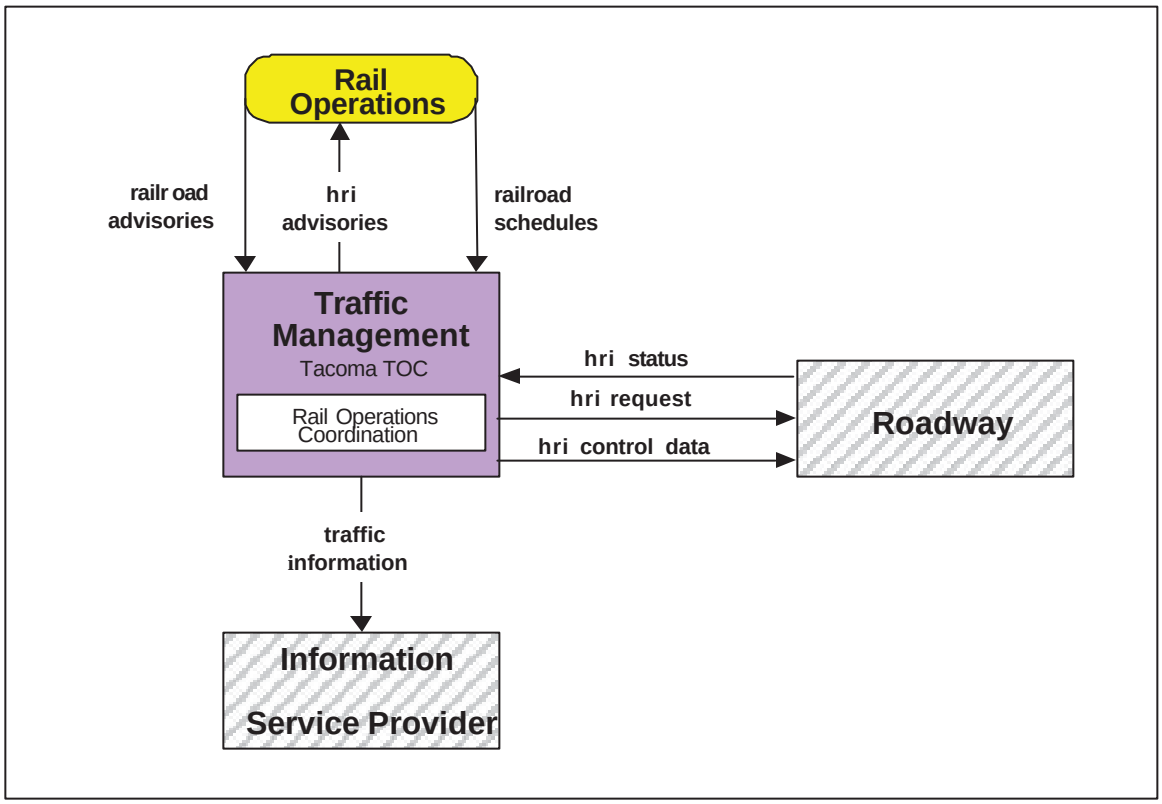
ATMS13: STANDARD RALROAD CROSSING



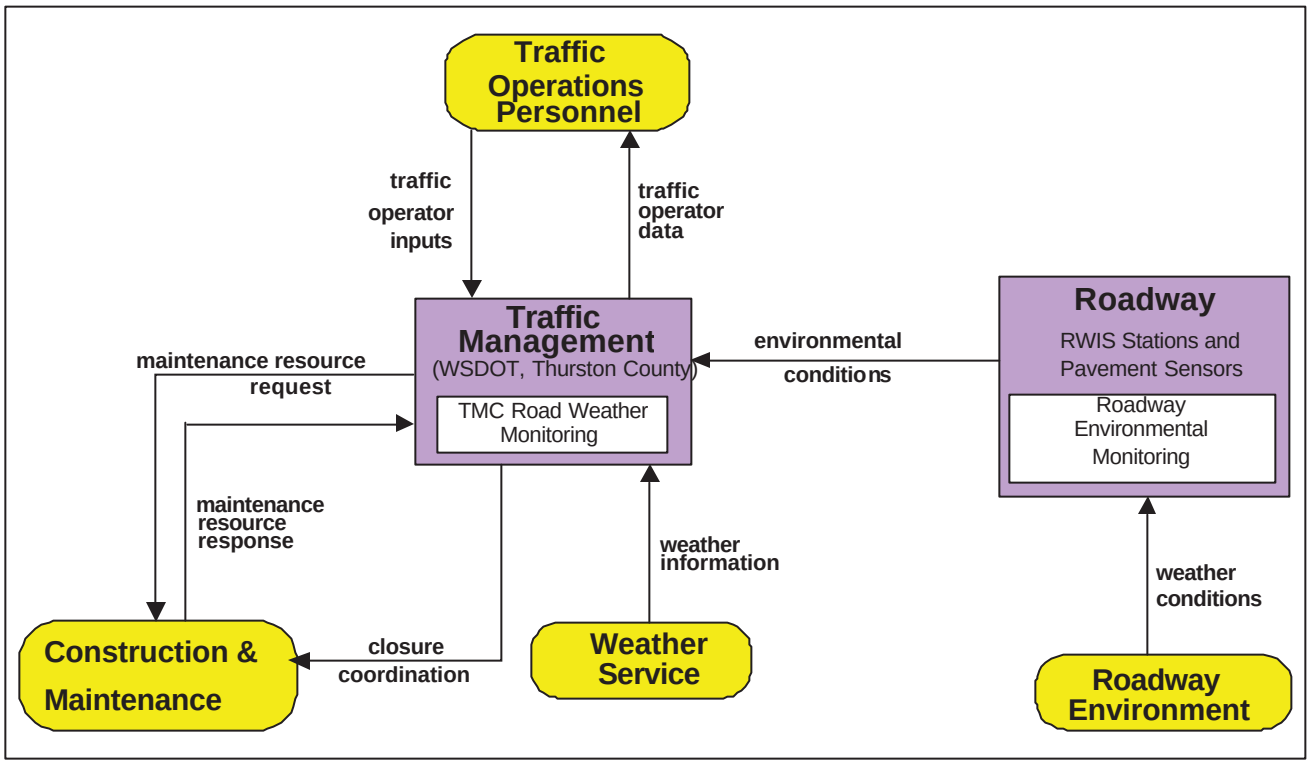
ATMS14: ADVANCED RAILROAD CROSSING



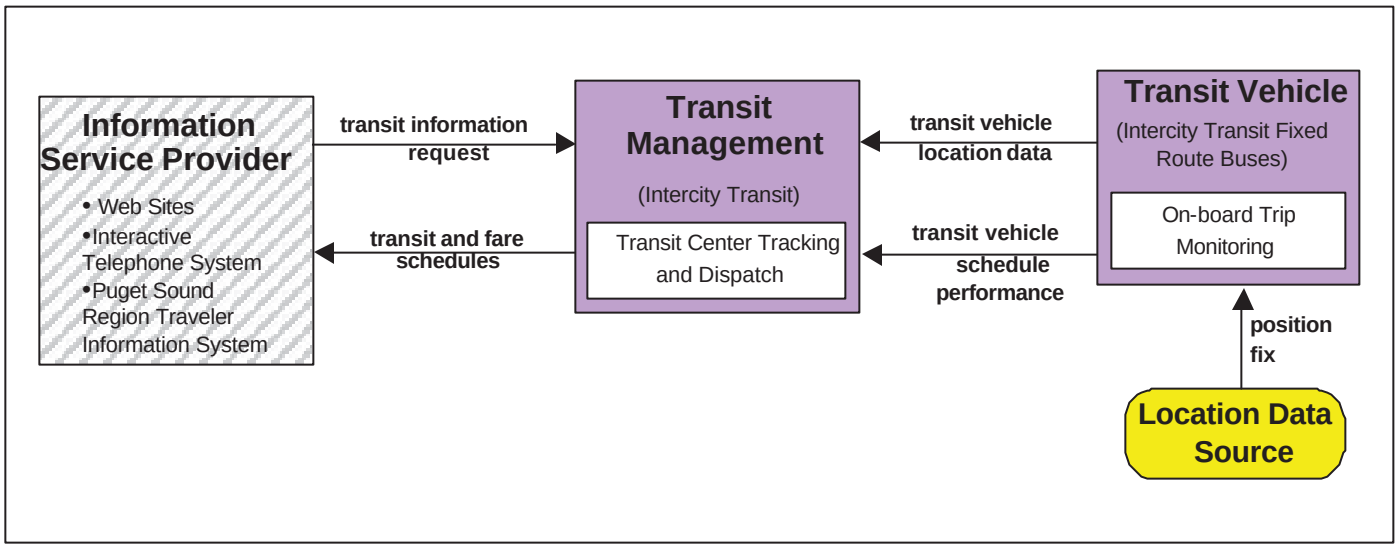
ATMS15: RAILROADS OPERATIONS COORDINATION



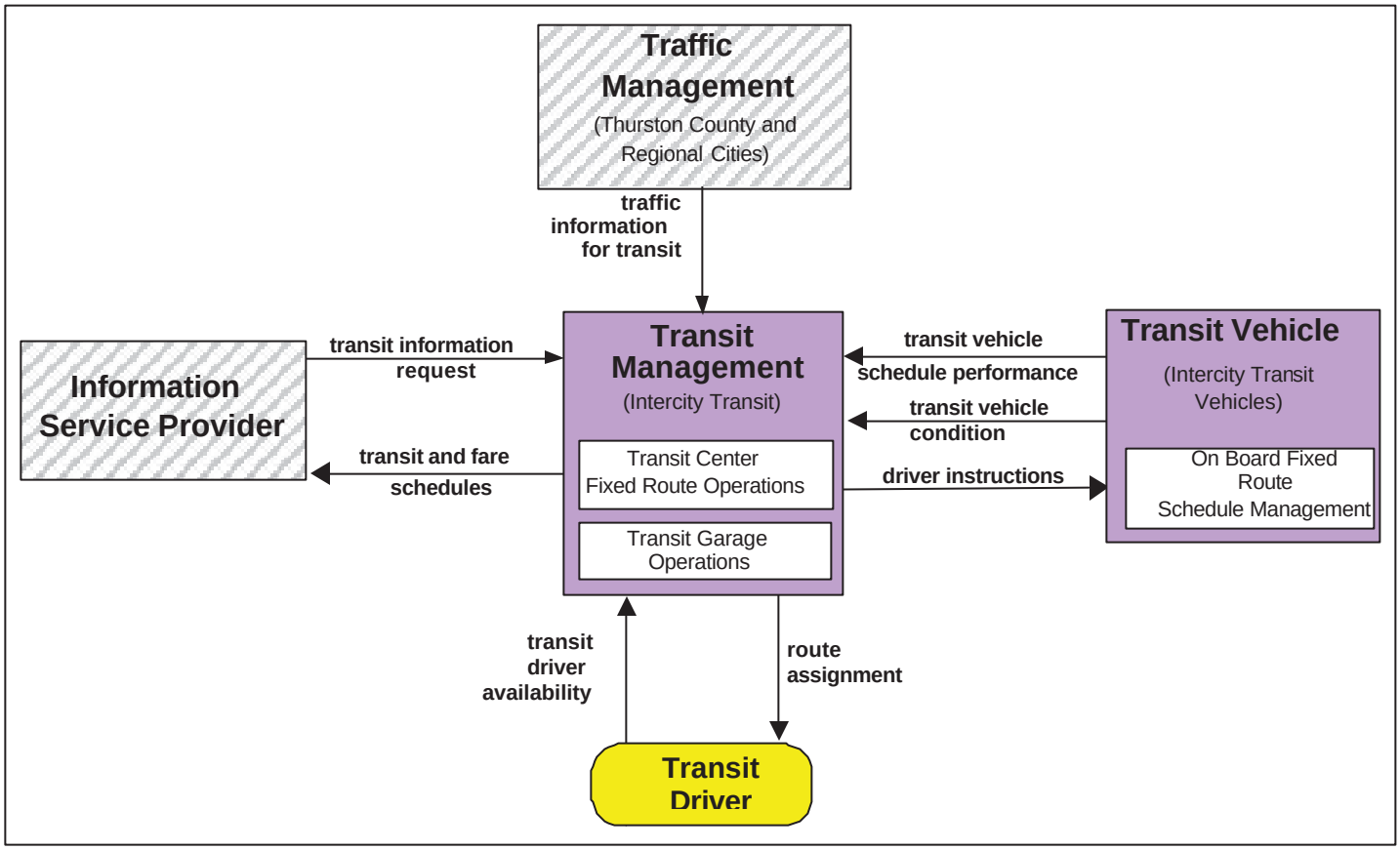
ATMS18: ROAD WEATHER INFORMATION SYSTEM



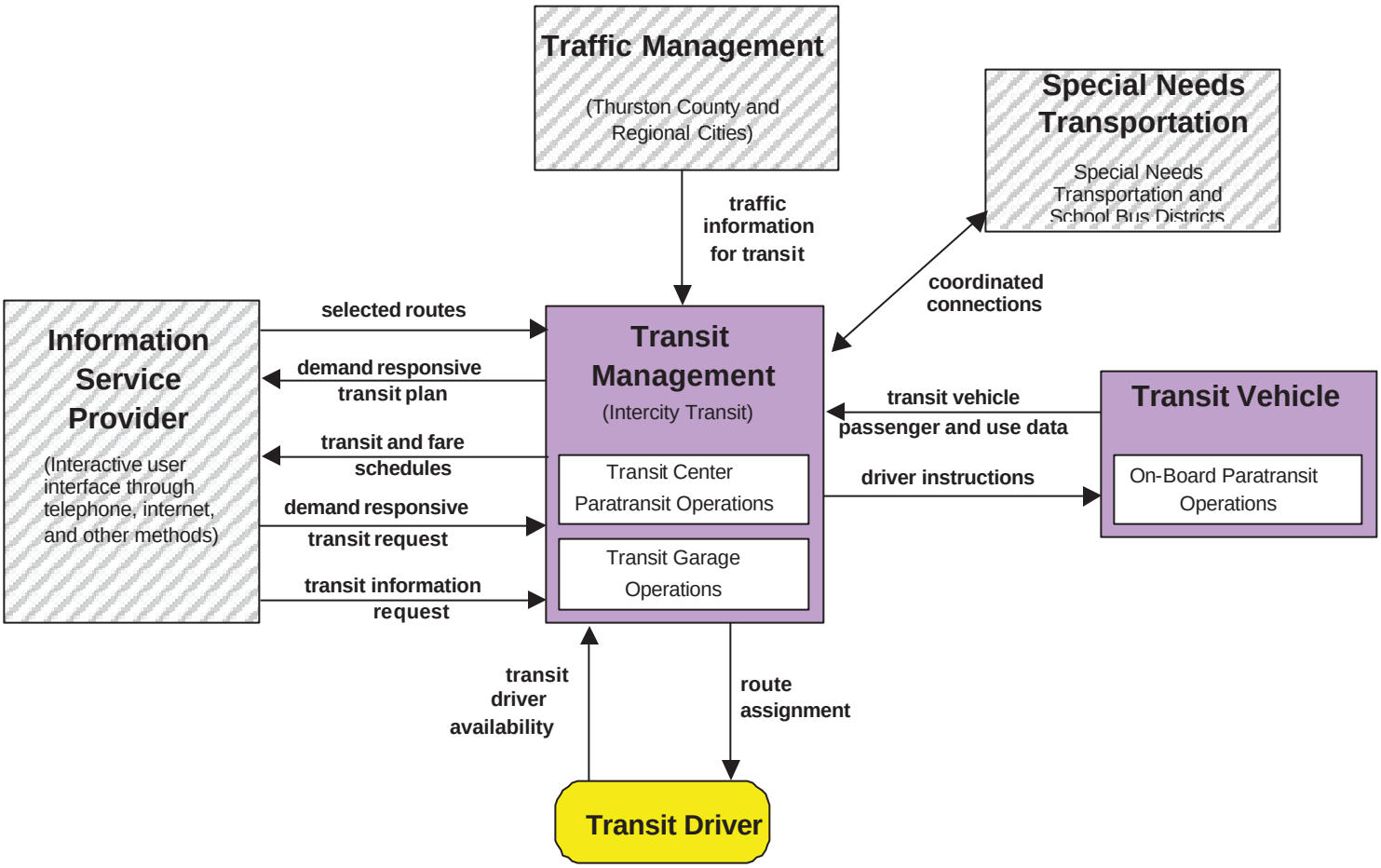
APTS01: TRANSIT VEHICLE TRACKING



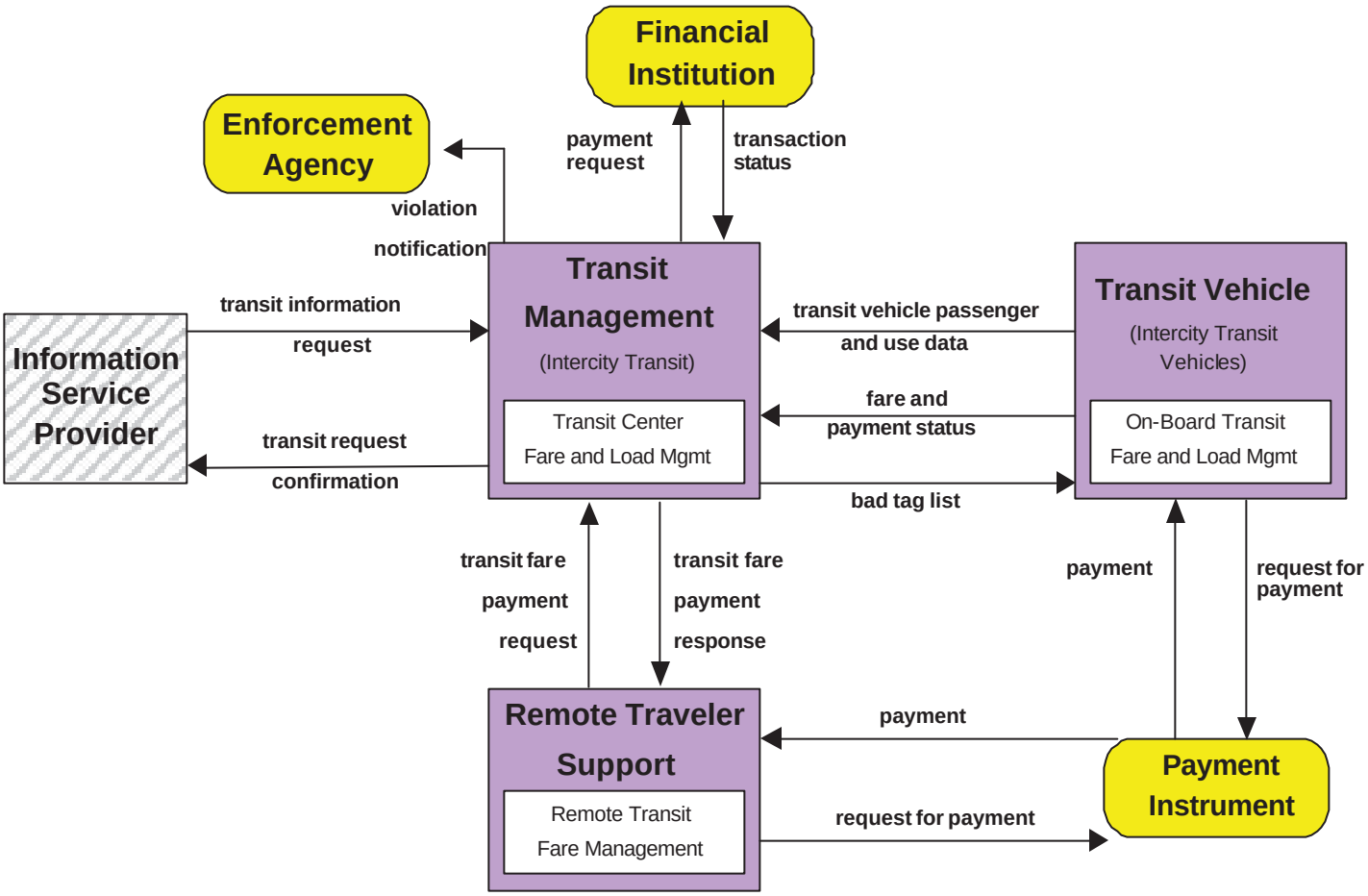
APTS02: TRANSIT FIXED ROUTE OPERATIONS



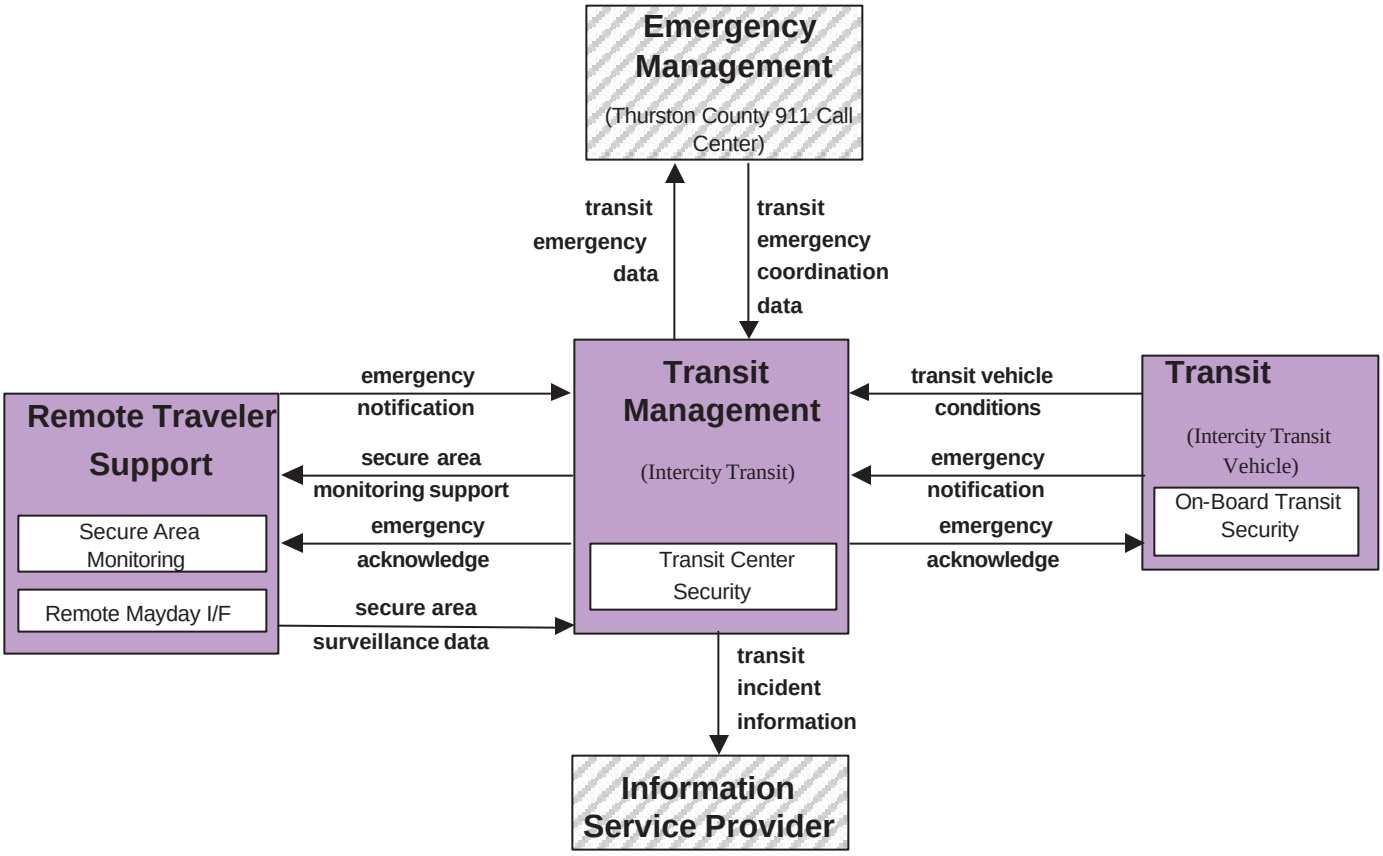
APTS03: DEMAND RESPONSIVE TRANSIT OPERATIONS



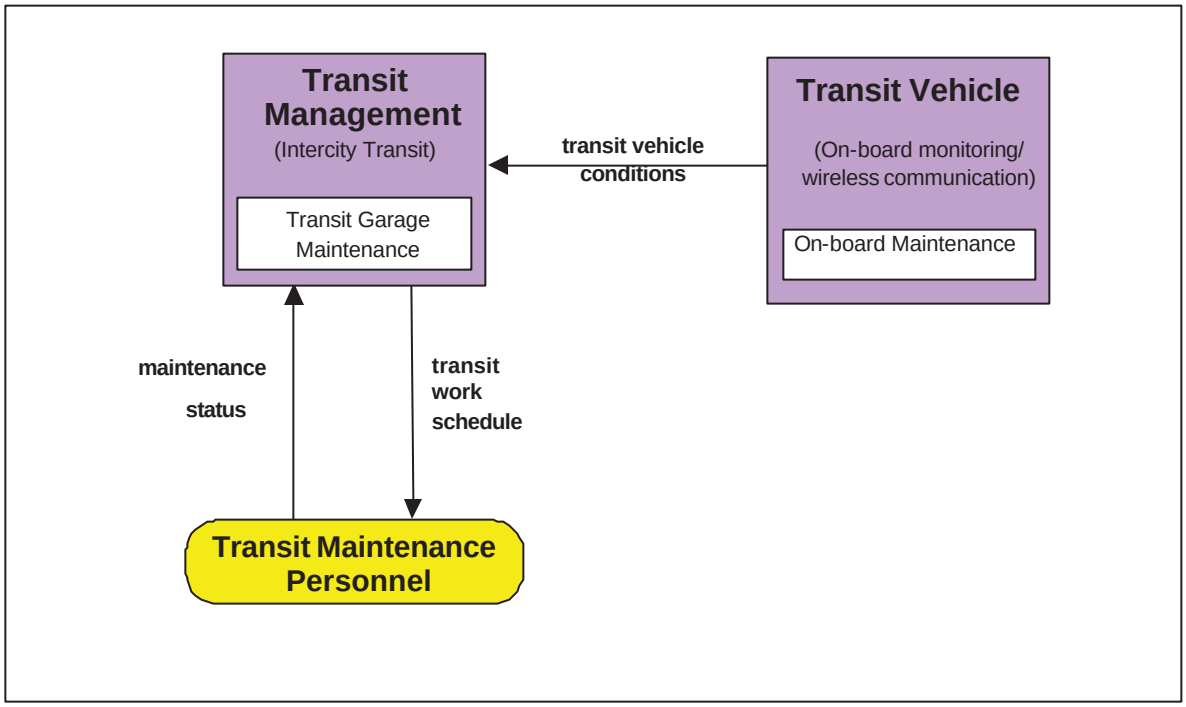
APTS04: TRANSIT PASSENGER AND FARE MANAGEMENT



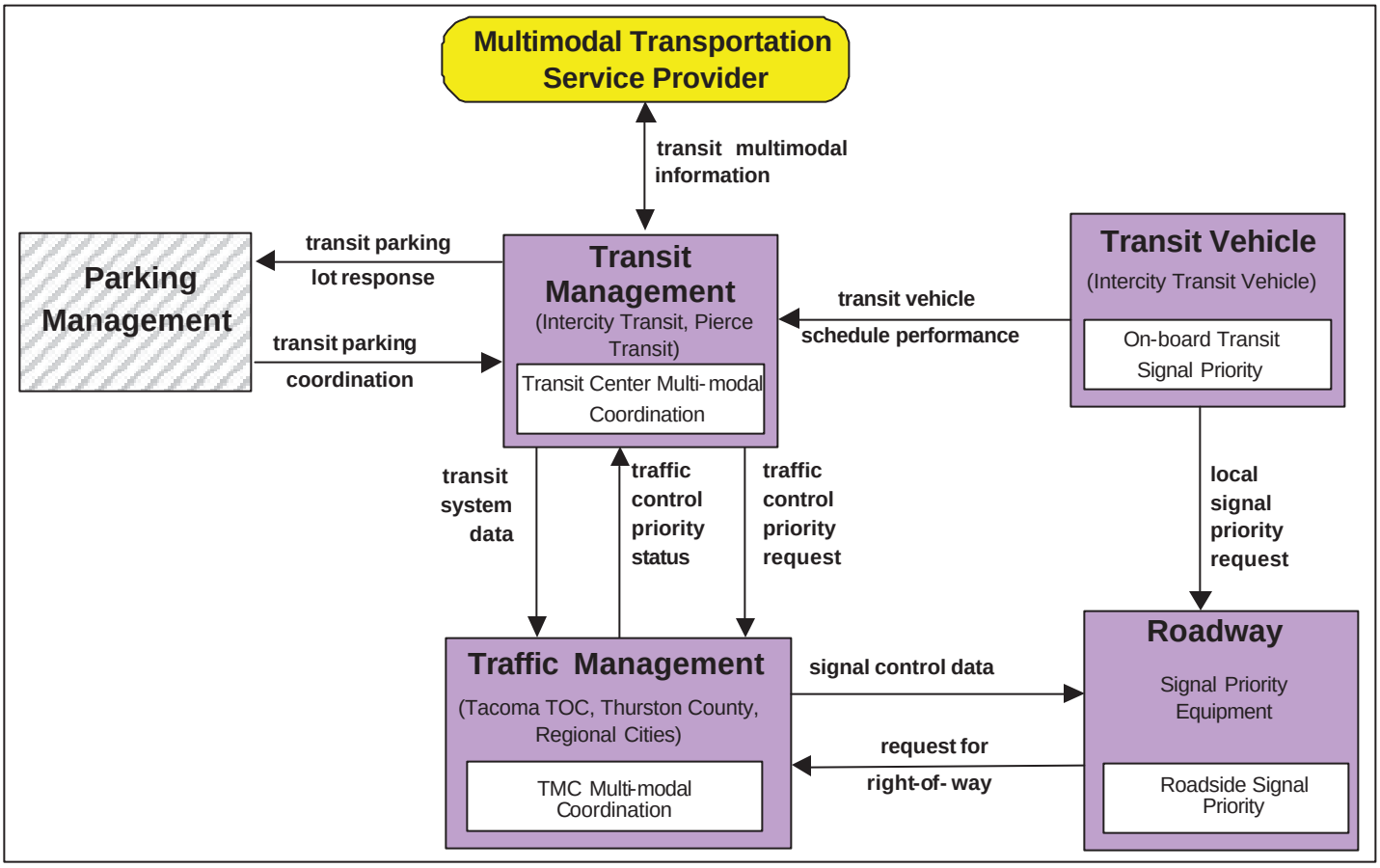
APTS05: TRANSIT SECURITY



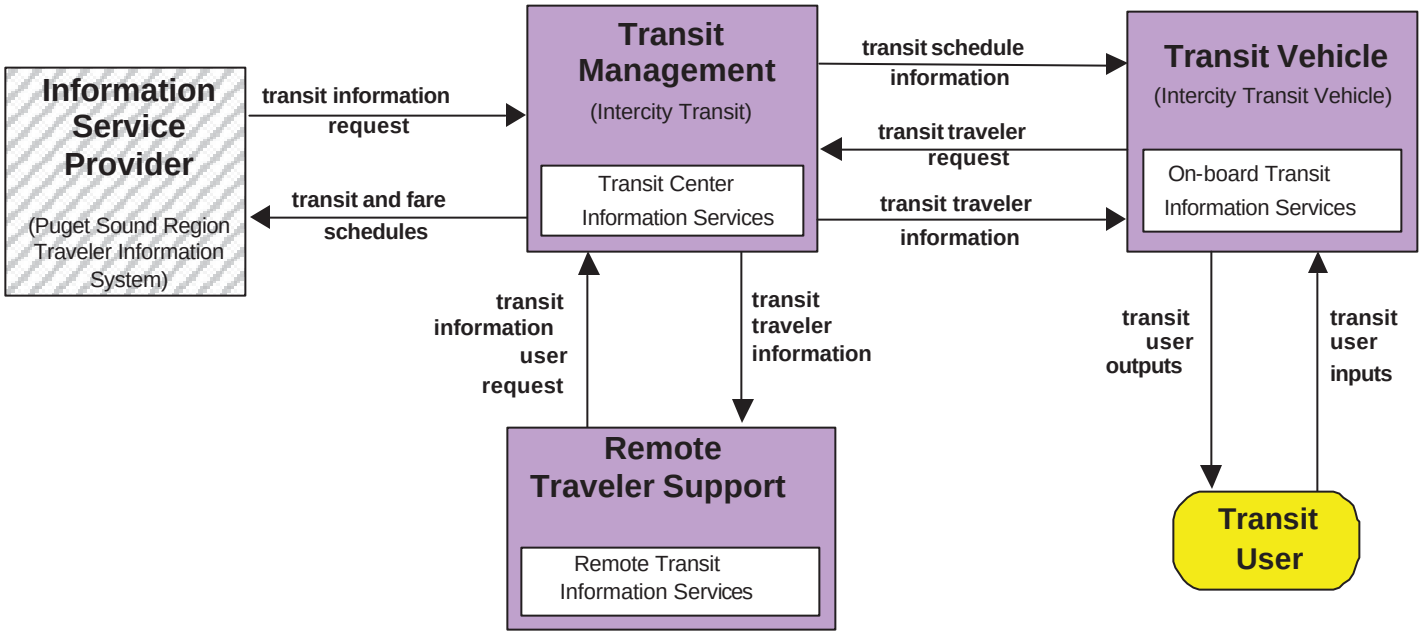
APTS06: TRANSIT MAINTENANCE



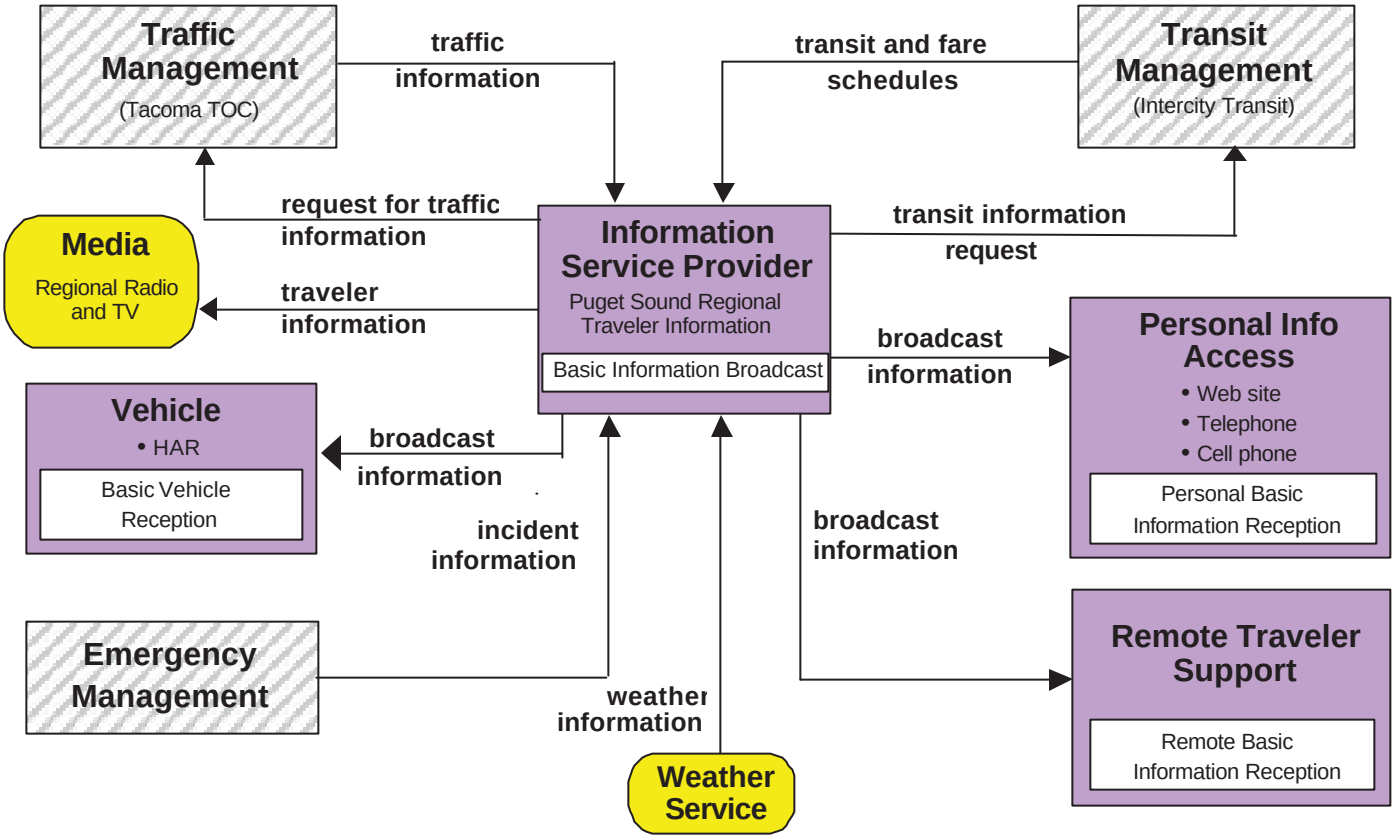
APTS07: MULTI-MODAL COORDINATION



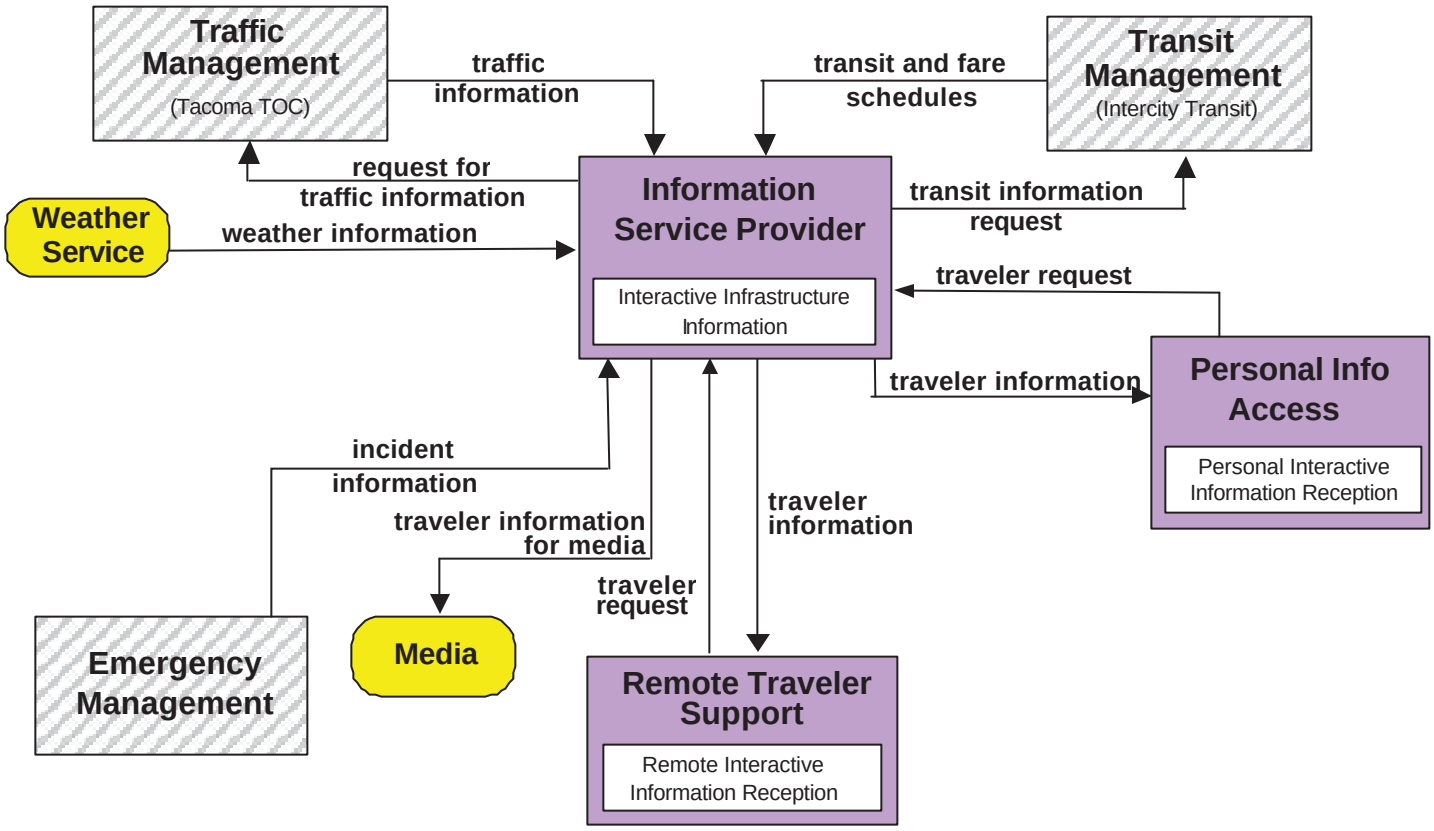
APTS08: TRANSIT TRAVELER INFORMATION



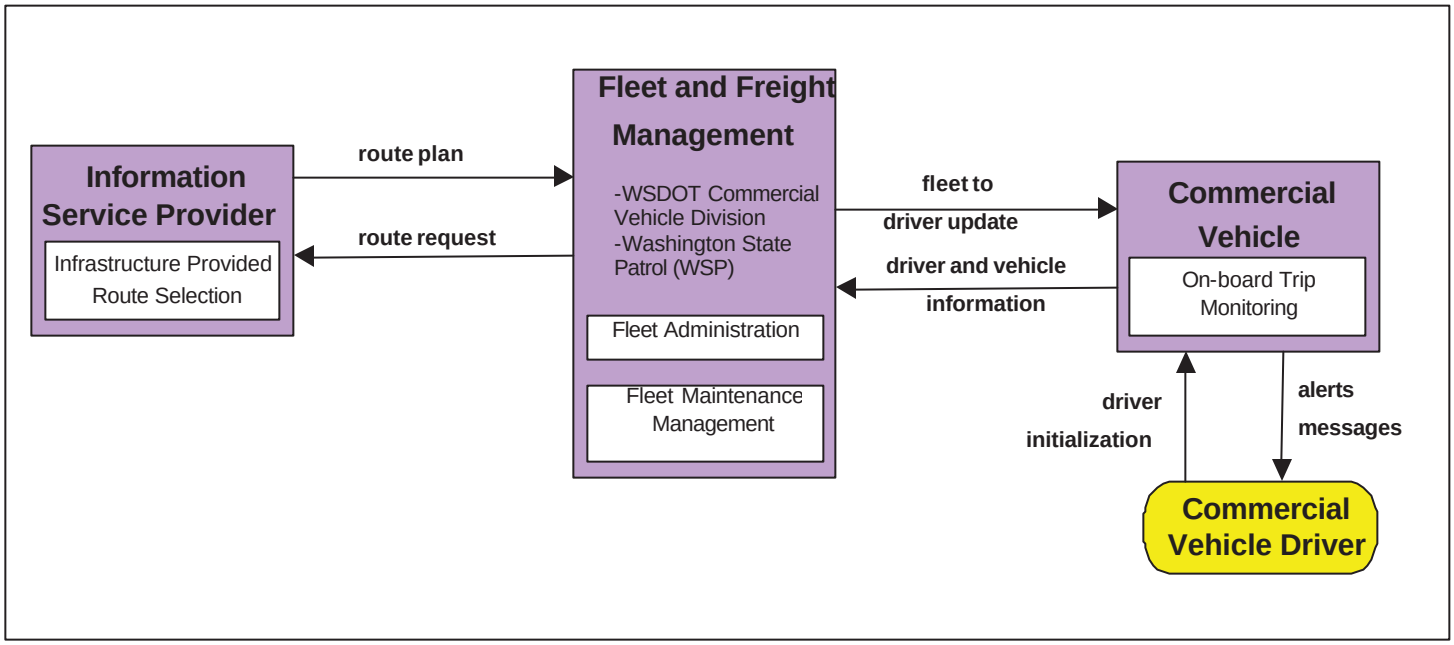
ATIS1: BROADCAST TRAVELER INFORMATION



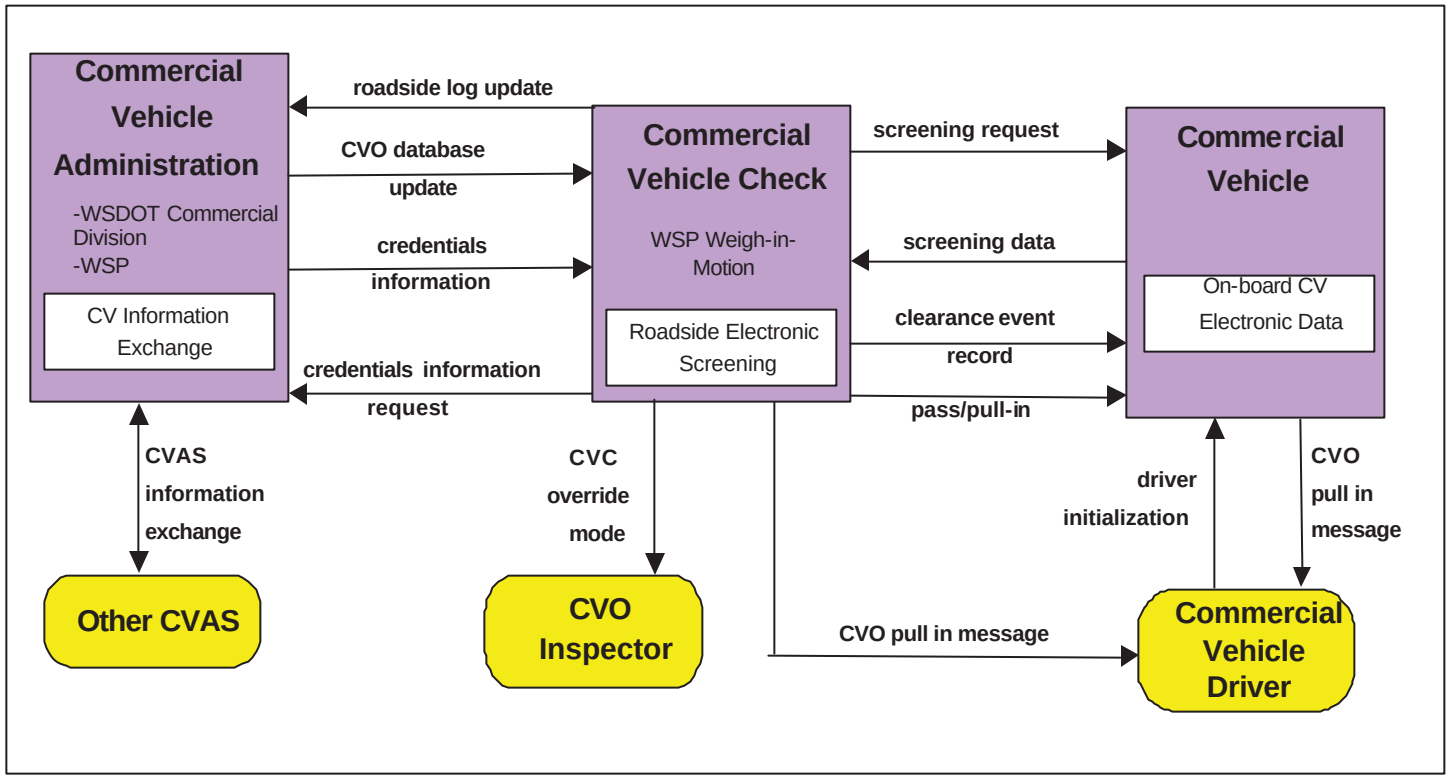
ATIS2: INTERACTIVE TRAVELER INFORMATION



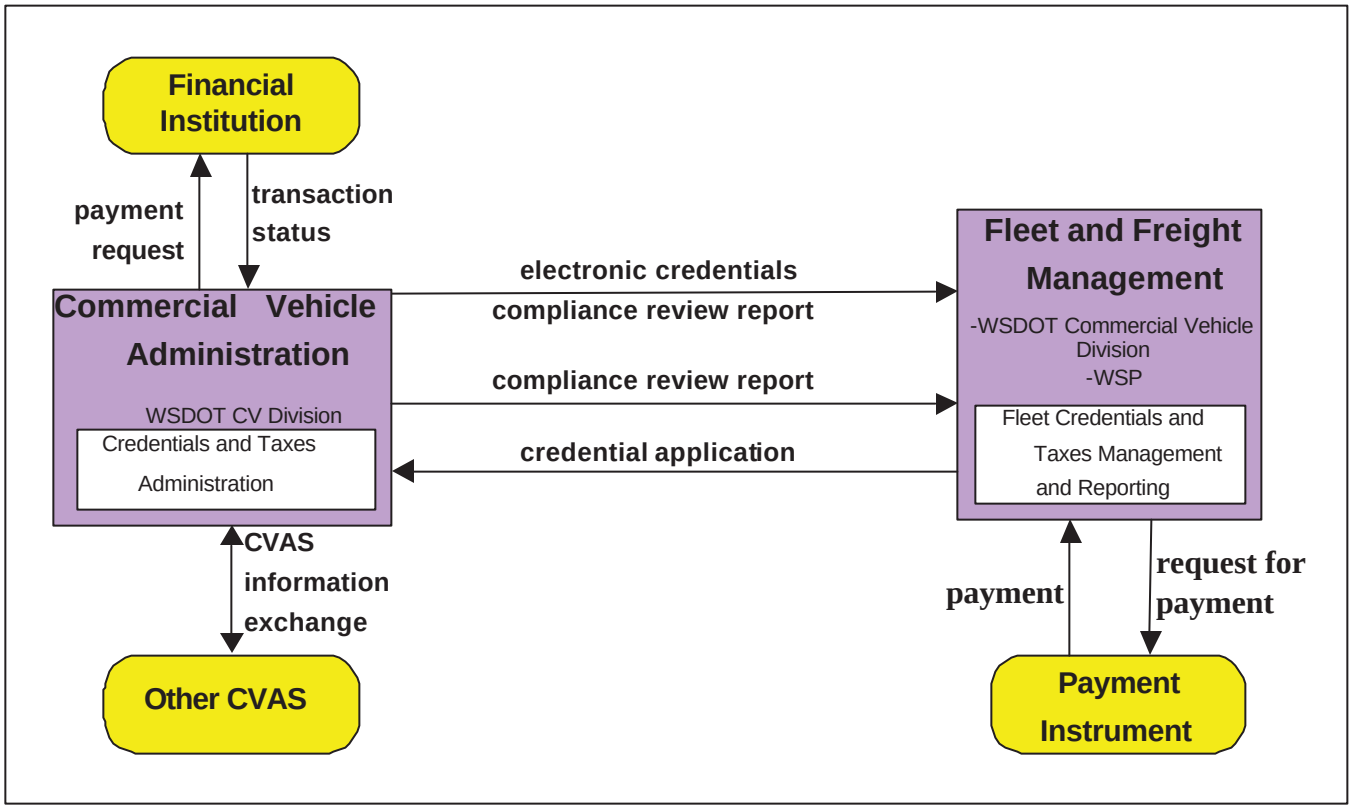
CVO1: FLEET ADMINISTRATION



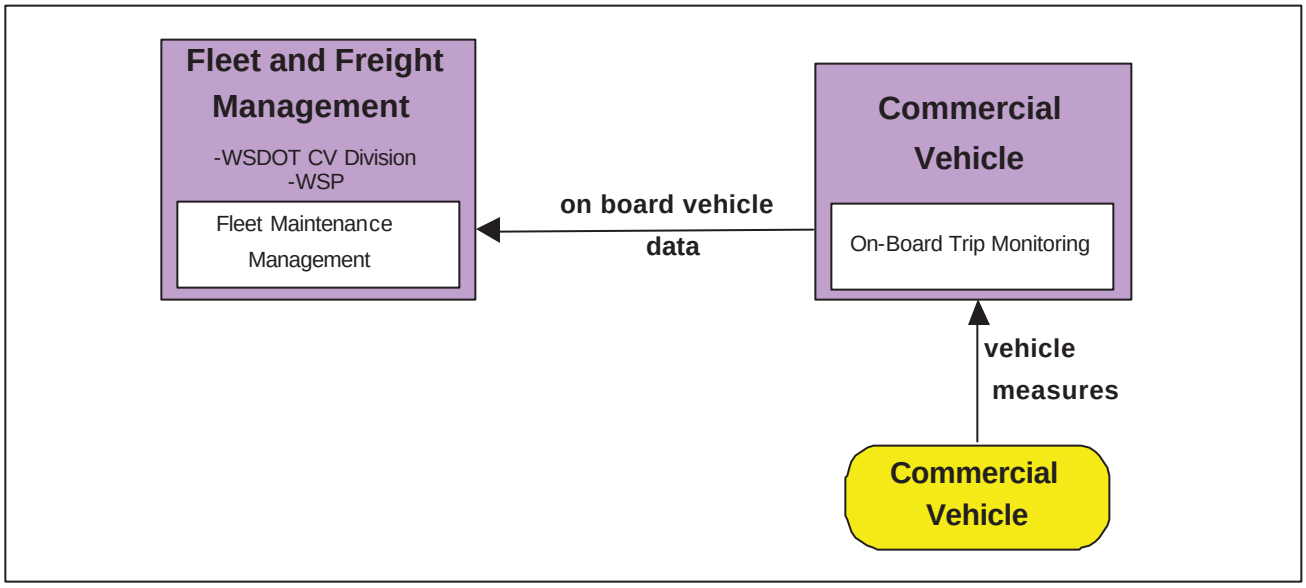
CVO3: ELECTRONIC CLEARANCE



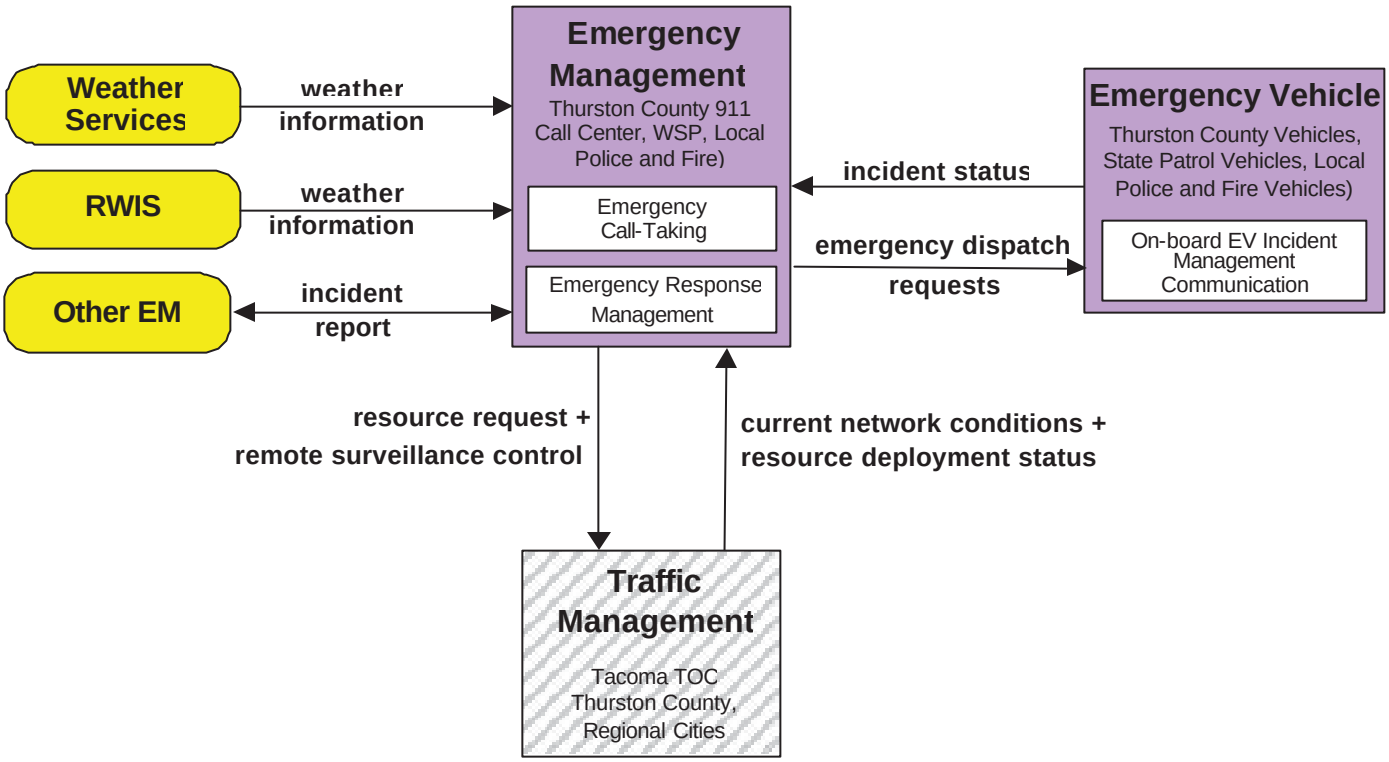
CVO4: CV ADMINISTRATIVE PROCESSES



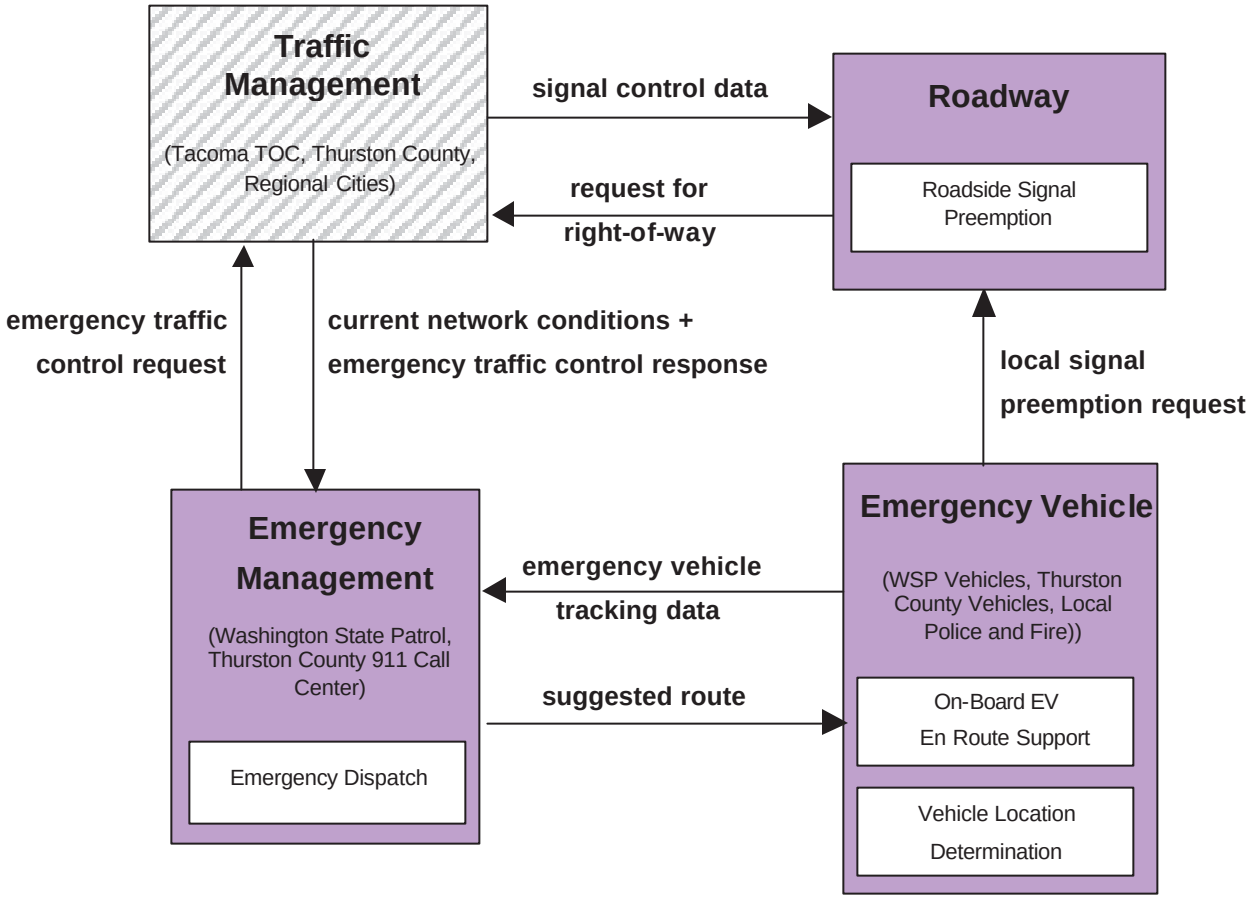
CVO9: CVO FLEET MAINTENANCE



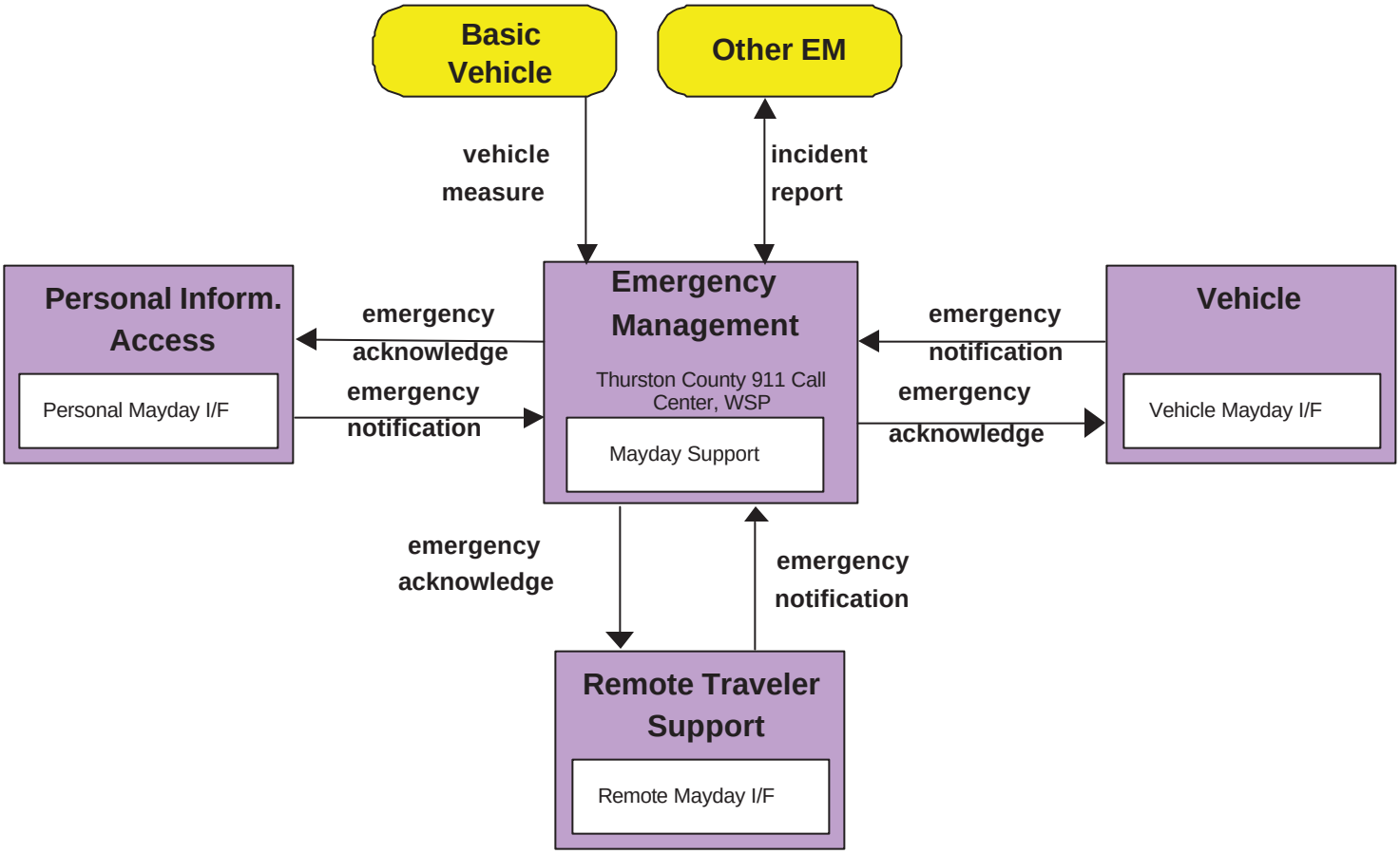
EM1: EMERGENCY RESPONSE



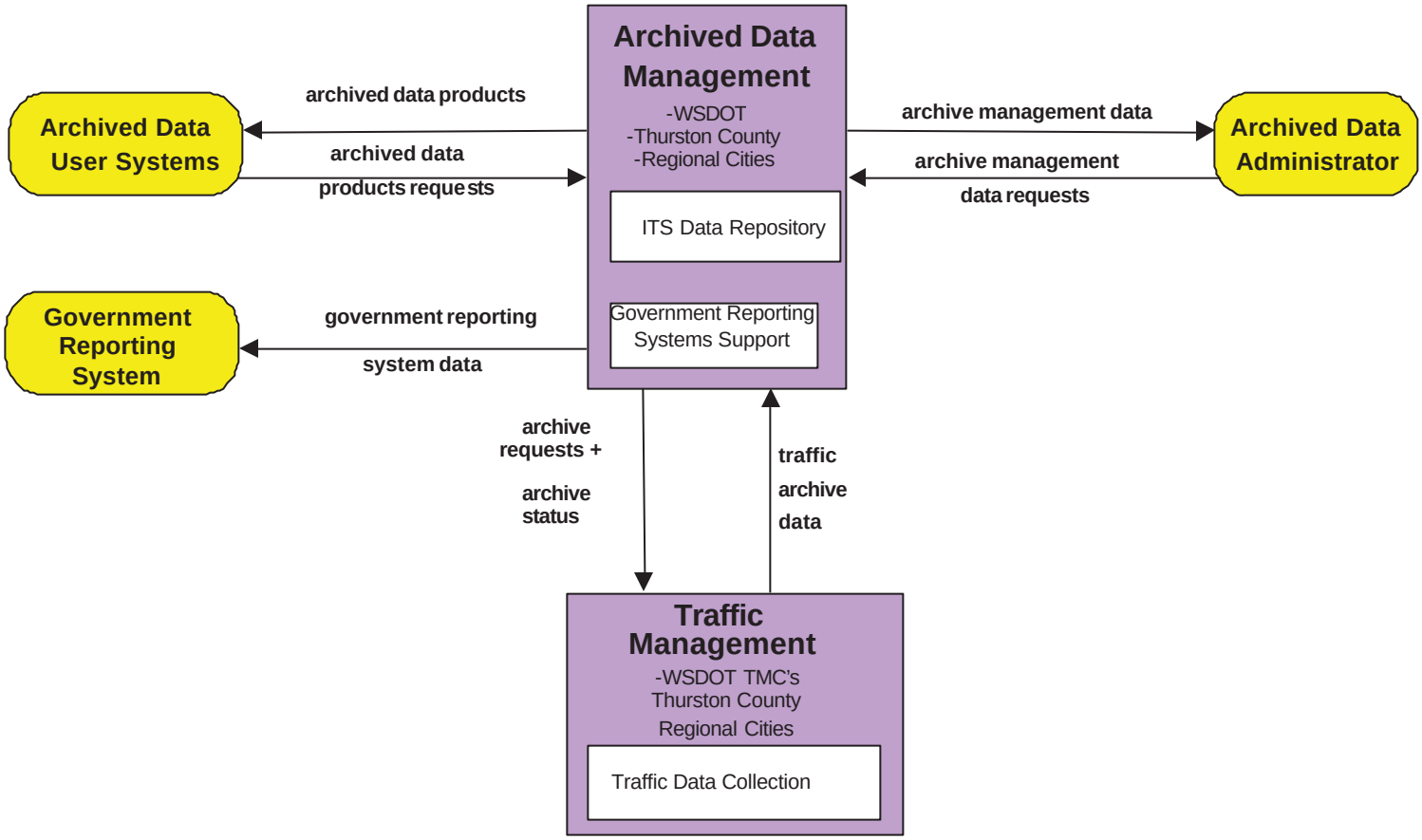
EM2: EMERGENCY ROUTING



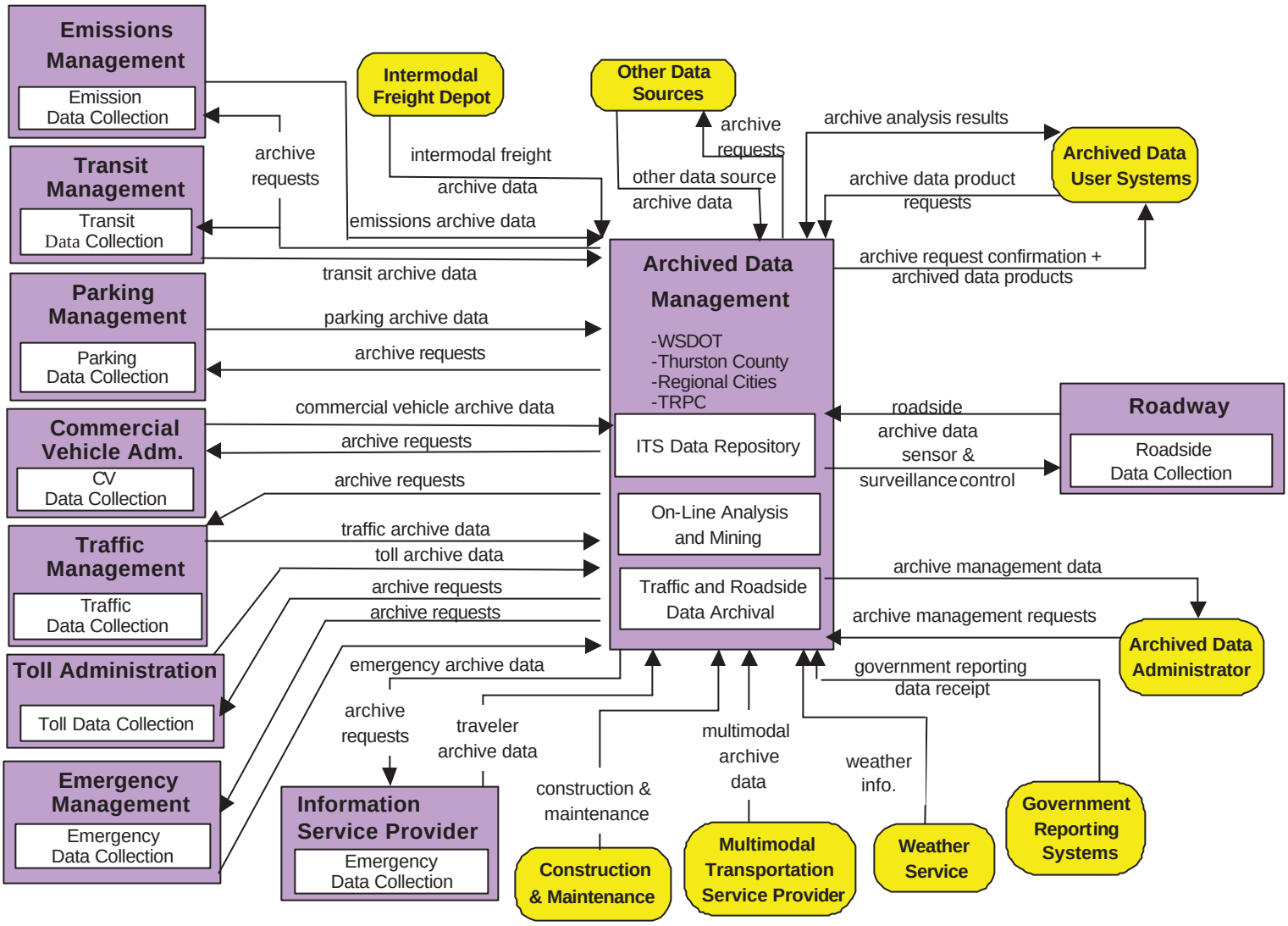
EM3: MAYDAY SUPPORT



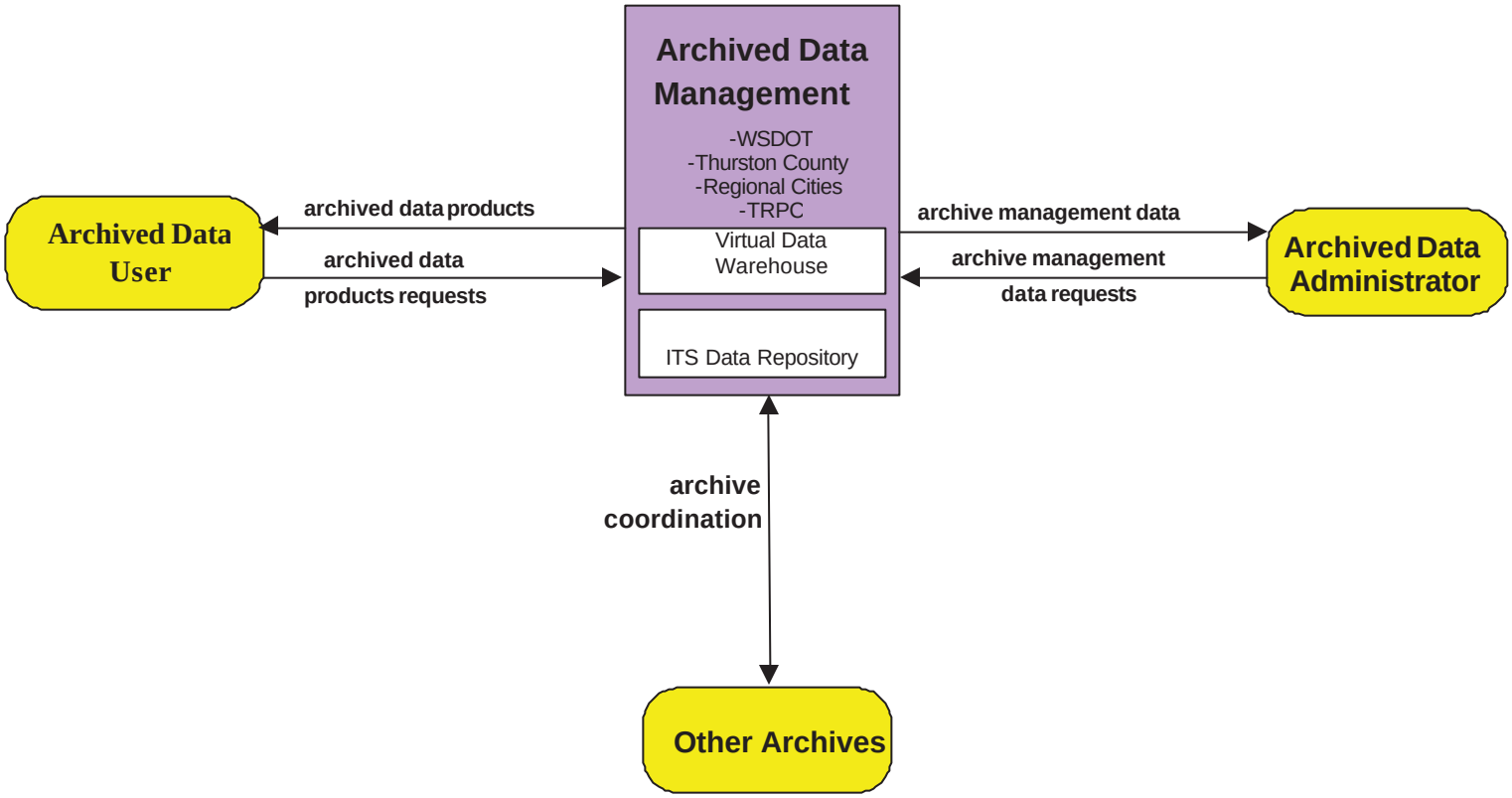
AD1: ITS DATA MART



AD2: ITS DATA WAREHOUSE



AD3: ITS VIRTUAL DATA WAREHOUSE



APPENDIX F

THURSTON REGION EQUIPMENT PACKAGE DESCRIPTIONS AND ASSOCIATED PROCESS SPECIFICATIONS (P-SPECS)

Thurston Region Equipment Package	Description	Associated P-Specs
ITS Data Repository	This equipment package collects data and data catalogs from one or more data sources and stores the data in a focused repository that is suited to a particular set of ITS data users. This equipment package includes capabilities for performing quality checks on the incoming data, error notification, and archive to archive coordination. This equipment package supports a broad range of implementations, ranging from simple data marts that collect a focused set of data and serve a particular user community to large-scale data warehouses that collect, integrate, and summarize transportation data from multiple sources and serve a broad array of users within a region.	8.1, 8.2, 8.5
Traffic and Roadside Data Archival	This equipment package collects and archives traffic, roadway, and environmental information for use in off-line planning, research, and analysis. The equipment package controls and collects information directly from equipment at the roadside, reflecting the deployment of traffic detectors that are used primarily for traffic monitoring and planning purposes rather than for traffic management.	8.9
Virtual Data Warehouse Service	This equipment package provides capabilities to access "in-place" data from geographically dispersed archives and coordinate information exchange with a local data warehouse. While many of the functions performed by this equipment package are similar to the functions inherent in other archived data management subsystem equipment packages (e.g. data management, fusion, analysis) this equipment package also provides the specialized publishing, directory services, and transaction management functions associated with coordinating remote archives. In addition, this equipment package performs functions on an as-needed basis, thereby negating the need to maintain the comprehensive set of data from the remote archives in the local data warehouse.	8.4
Credentials and Taxes Administration	This Equipment package provides administrative capabilities for commercial vehicle operations including database management and administrator-to-roadside and administrator-to-administrator interfaces. For example, this Equipment package would manage the electronic credentials database for a state, perform reconciliation of mileage and fuel taxes (possibly post trip), and interface with roadsides performing credential checks. This equipment package communicates with similar packages in other CVAS locations to exchange credentials database information. Example locations would be state agency or regional offices that are involved with commercial vehicle operations.	2.5.2, 2.5.7
CV Data Collection	This equipment package collects and stores commercial vehicle information that is collected in the course of Commercial Vehicle Administration Subsystem operations. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.	2.5.9
CV Information Exchange	This equipment package supports the exchange of safety and credentials data among jurisdiction. The package also supports the exchange of safety and credentials data between agencies (for example, an administrative center and the roadside check facilities) within a single jurisdiction. Data are collected from multiple authoritative sources and packaged into snapshots (top-level summary and critical status information) and profiles (detailed and historical data).	2.5.6

Thurston Region Equipment Package	Description	Associated P-Specs
Roadside Electronic Screening	This Equipment package provides the Commercial Vehicle Check Subsystem the capabilities for two-way communication with approaching properly equipped commercial vehicles at mainline speeds, reading tags for automated vehicle identification and credential checking. There will be a capability to appropriately screen all vehicles, not just those that are equipped. This Equipment package shall be able to process the data from the commercial vehicles along with accessed database information to determine whether a pull-in message is needed or to generate random pull-in messages with provisions for facility operators and enforcement officials to have manual override capabilities. Support shall be provided to both interstate and intrastate carriers.	2.3.1, 2.3.4, 2.3.5
On-board CV Electronic Data	This Equipment package provides the Commercial Vehicle Subsystem the capability for two-way data exchange between the vehicle and the roadside facility with the transmission of information such as status of driver, vehicle, and carrier IDs and cargo information. The driver, vehicle and carrier are identified via the tag so that actual weight from roadside mainline weigh-in-motion may be checked. This includes only the equipment on the commercial vehicle including a processor/tag for identification, especially a HAZMAT identification. The actual reading and processing required for the credential checking and weigh-in-motion will be performed by the roadside.	2.2.3, 2.3.7, 2.4.3, 2.4.4, 2.4.6, 2.6.2, 2.6.3, 2.6.4, 2.6.5
On-board Trip Monitoring	This Equipment package provides the capabilities to support fleet management with automatic vehicle location and automated mileage and fuel reporting and auditing. This package may also record other special events resulting from communication with roadside equipment. This includes only the equipment on board the vehicle to support this function including the vehicle location devices such as GPS equipment, communication interfaces, a processor to record trip length, and the sensors/actuators/interfaces necessary to record mileage and fuel usage.	2.1.5, 2.2.2, 2.2.4, 2.4.1, 2.4.3, 2.4.5
Emergency Call-Taking	This Equipment package supports the emergency call-taker, collecting available information about the caller and the reported emergency, and forwarding this information to other equipment packages that formulate and manage the emergency response. This equipment package receives 9-1-1, 7-digit local access, and motorist call-box calls and interfaces to other agencies to assist in the verification and assessment of the emergency and to forward the emergency information to the appropriate response agency.	5.1.1, 5.1.3, 5.2
Emergency Data Collection	This equipment package collects and stores emergency information that is collected in the course of operations by the Emergency Management Subsystem. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.	5.6
Emergency Dispatch	This Equipment package supports efficient dispatch of emergency vehicles. It tracks emergency vehicles, dispatches these vehicles to an incident, and provides safe and efficient routes based on real-time traffic information.	5.2, 5.3.2, 5.3.6, 5.3.7, 5.5
Emergency Response Management	This Equipment package develops and stores emergency response plans and manages overall coordinated response to emergencies. It tracks the availability of resources and assists in the appropriate allocation of these resources for a particular emergency response. This Equipment package provides coordination between multiple allied agencies before and during emergencies to implement emergency response plans and track progress through the incident. It provides vital communications linkages which provide real-time information to emergency response personnel in the field.	5.1.2, 5.1.3, 5.1.4, 5.1.5, 5.2, 5.3.1, 5.3.4, 5.5

Thurston Region Equipment Package	Description	Associated P-Specs
Mayday Support	This Equipment package receives Mayday messages, determines an appropriate response, and either uses internal resources or contacts a local agency to provide that response. The nature of the emergency is determined based on the information in the mayday message as well as other inputs. This package effectively serves as an interface between automated mobile mayday systems and the local public safety answering point for messages which require a public safety response.	5.1.1, 5.1.2, 5.1.3, 5.1.6, 5.2
Emissions Data Collection	This equipment package collects and stores air quality and emissions management information that is collected in the course of Emissions Management Subsystem operations. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.	1.5.9
Emissions Data Management	This Equipment package assimilates and stores air quality measures and roadside collected emissions data. General air quality measures are distributed as general traveler information and also may be used for in demand management programs. Collected roadside emissions are analyzed and used to detect, identify, and notify concerned parties regarding vehicles that exceed emissions standards.	1.5.1, 1.5.2, 1.5.3, 1.5.4, 1.5.7, 1.5.8
On-board EV En-route Support	This Equipment package provides capabilities that support safe and expedient arrival on the incident scene. This package provides dispatch and routing information, tracks the vehicle, and preempt signals via short range communication directly with traffic control equipment at the roadside.	5.3.3, 5.3.5
On-board EV Incident Management Communication	This Equipment package provides a direct interface between the emergency vehicle and incident management personnel.	5.3.5
Fleet Administration	This Equipment package provides route plan information from the FMS to the TMS for network performance evaluation. It also provides for vehicle tracking, dispatch, and reporting to the fleet management center personnel.	2.1.2, 2.1.4, 2.1.6, 2.61
Fleet Maintenance Management	This Equipment package provides the capability to use vehicle mileage data to automatically generate preventative maintenance schedules for each specific vehicle by utilizing vehicle tracking data from the prerequisite tracking Equipment package. In addition, capability to automatically ensure that proper service personnel are provided information for maintenance activities and to record and verify that maintenance work was performed shall be provided.	2.1.6
Fleet Credentials and Taxes Management and Reporting	This Equipment package provides the Fleet and Freight Management Subsystem the capabilities to purchase credentials and file trip reports electronically by the fleet managers, to perform automated enrollment at the roadside facilities, and electronically manage the credentials checking by the roadside commercial vehicle inspectors. The electronic purchase shall be performed in accordance with developing standards such that a single integrated system for electronic payments might develop ensuring that deployment across multiple agency political boundaries is performed without degradation. Inherent to credential management shall be the management of the vehicles, with a prerequisite of the vehicle tracking software from the Fleet Administration Equipment package.	2.1.1, 2.1.3, 2.2.1, 7.5.4

Thurston Region Equipment Package	Description	Associated P-Specs
Basic Information Broadcast	This Equipment package provides the capabilities to collect, process, store, bill, and disseminate traveler information including traveler, transit, ridematching, traffic, and parking information. The traveler information shall include maintaining a database of local area services available to travelers with up-to-the-minute information and providing an interactive connectivity between, sponsors, and providers of services. The transit information shall include the latest available information on transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence. The traffic information shall include latest available information on traffic and highway conditions, and current situation information in real-time including incidents, road construction, recommended routes, current speeds on specific routes, current parking conditions in key areas, schedules for any current or soon to start events, and current weather situations. This Equipment package shall also provide users with real-time travel related information while they are traveling, and disseminate to assist the travelers in making decisions about transfers and modification of trips. These capabilities shall be provided using equipment such as a fixed facility with a communications system such as a data Subcarrier multiplexing device.	1.1.4.5, 1.1.4.6, 4.1.8, 6.1.1, 6.2.1.1, 6.2.1.3, 6.2.1.4, 6.2.1.5, 6.5.1, 7.4.2
Interactive Information Reception	This Equipment package shall have as prerequisite the capabilities of the Basic Information Broadcast Equipment package. This Equipment package augments the Basic Information Broadcast Equipment package by providing the capabilities for interactive traveler information.	1.1.4.5, 1.1.4.6, 4.1.8, 6.1.1, 6.1.2, 6.1.3, 6.1.4, 6.2.1.2, 6.5.1, 6.6.1, 6.6.2.3, 6.6.2.4, 6.6.4, 6.6.5, 7.1.6, 7.2.6, 7.3.2, 7.4.1.6, 7.4.2, 7.4.3
Personal Basic Information Reception	This Equipment package shall provide the capability for travelers to interface with the ISP Subsystem Basic Information Broadcast Equipment package and receive formatted traffic advisories including accurate traveling information concerning available travel options and their availability, and congestion information from their Personal Information Access Subsystem to include their homes, place of work, major trip generation sites, personal portable devices, and over multiple types of electronic media such as facsimile machines, portable AM/FM radios, and a pager processor.	6.8.3.2, 6.8.3.3
Personal Interactive Information Reception	This Equipment package shall provide the capability for travelers to interface with the ISP Subsystem Infrastructure Equipment packages including the Interactive Infrastructure Information Equipment package, and the Infrastructure Provided Route Selection, Yellow Pages and Reservation, and Dynamic Ridesharing Equipment packages. These capabilities shall be provided using the Personal Information Access Subsystem equipment such as cellular telephone, interactive TV, Personal Computer, and pager with alpha display using communication medium and equipment such as two-way radio, CATV, and wireless data transceivers.	6.8.3.1, 6.8.3.2, 6.8.3.3, 7.5.3
Personal Location Determination	This equipment package determines current location information and provides this information to other equipment packages that use the location information to provide various ITS services.	6.8.1.3

Thurston Region Equipment Package	Description	Associated P-Specs
Personal Mayday Interface	This Equipment package shall provide the capability to initiate a distress signal and cancel a prior issued manual request for help using the Personal Information Access Subsystem. This capability shall be provided using equipment such as a processor to automatically dial the Emergency Management Subsystem and provide location.	6.8.1.5, 6.8.2.1, 6.8.2.2
Roadside Signal Priority	This Equipment package shall provide the capability to receive vehicle signal priority requests and control roadside signals accordingly.	1.2.7.1, 1.2.7.3
Advanced Rail Crossing	This equipment package manages highway traffic at highway-rail intersections (HRIs) where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). It includes all capabilities from the Standard Rail Crossing equipment package and augments these with additional safety features. The active warning systems supported by this market package includes positive barrier systems which preclude entrance into the intersection when the barriers are activated. Like the Standard package, the HRI equipment is activated on notification by wayside interface equipment which detects, or communicates with the approaching train. In this equipment package, additional information about the arriving train is also provided by the wayside interface equipment so that the train's direction of travel, its estimated time of arrival, and the estimated duration of closure may be derived. This enhanced information may be conveyed to the driver prior to, or in context with, warning system activation. This equipment package also includes detection capabilities which enable it to detect an entrapped or otherwise immobilized vehicle within the HRI and provide an immediate notification to the wayside interface equipment and traffic management.	1.1.1.1, 1.6.1.1, 1.6.1.2.4, 1.6.1.4.3, 1.6.1.5, 1.6.1.6.1, 1.6.1.6.2, 1.6.3.1, 1.6.3.2, 1.6.3.3, 1.6.5.1
Roadside Data Collection	This equipment package collects traffic, road, and environmental conditions information for use in transportation planning, research, and other off-line applications where data quality and completeness take precedence over real-time performance. This equipment package includes the sensors, supporting roadside infrastructure, and communications equipment that collects and transfers information to a center for archival.	1.1.1.4
Roadway Basic Surveillance	This Equipment package provides the capabilities to monitor traffic flow in major intersections and on main highways for urban areas and to monitor road conditions using fixed equipment such as loop detectors and wireline communication.	1.1.1.1, 1.3.1.3
Roadway Emissions Monitoring	This Equipment package monitors emissions and general air quality and communicates the collected information back to the emissions management subsystem where it can be monitored, analyzed, and used. This equipment package supports point monitoring of individual vehicle emissions as well as general monitoring of standard air quality measures.	1.5.5, 1.5.6
Roadway Environmental Monitoring	This Equipment package measures environmental conditions and communicates the collected information back to a center where it can be monitored and analyzed. A broad array of general weather and road surface information may be collected. Weather conditions that may be measured include temperature, wind, humidity, precipitation, and visibility. Surface and sub-surface sensors can measure road surface temperature, moisture, icing, salinity, and other measures. Air quality monitoring can include point monitoring of individual vehicles as well as general monitoring of standard air quality measures.	1.1.1.3

Thurston Region Equipment Package	Description	Associated P-Specs
Roadway Freeway Control	Ramp meters, CMS and other freeway control effects which will control traffic on freeways.	1.1.1.1, 1.2.7.2, 1.2.7.5
Roadway Incident Detection	This Equipment package provides incident detection capability to reside at the roadside. For example, advanced CCTV's with built-in incident detection algorithms would allow the actual detection function to be roadside rather than transmitting images to a center for visual or automated detection.	1.1.1.1
Roadway Probe Beacons	This Equipment package monitors traffic and road conditions by collecting information from passing vehicles that are equipped with a transponder or other short range communications device. The probe data collected by this equipment package may include link travel times, average speeds, road conditions, and any other data that can be measured and communicated by passing vehicles. This equipment package consists of roadside equipment that communicates with passing vehicles using dedicated short range communications, collects the information provided by the vehicles, and forwards this information back to the Traffic Management Subsystem.	1.1.6
Roadway Signal Controls	This Equipment package provides the capabilities to control traffic signals at major intersections and on main highways for urban areas. This Equipment package is generally constrained to a single jurisdiction.	1.1.1.1, 1.2.7.1, 1.2.7.2
Roadway Traffic Information Dissemination	This Equipment package provides the roadside elements of traffic information dissemination including DMS and HAR.	1.2.7.1, 1.2.7.5
Standard Rail Crossing	This Equipment Package manages highway traffic at highway-rail intersections (HRIs) where operational requirements do not dictate advanced features (e.g., where rail operational speeds are less than 80 miles per hour). Either passive (e.g., the crossbuck sign) or active warning systems (e.g., flashing lights and gates) are supported depending on the specific requirements for each intersection. These traditional HRI warning systems may also be augmented with other standard traffic management devices. The warning systems are activated on notification by interfaced wayside equipment of an approaching train. The equipment at the HRI may also be interconnected with adjacent signalized intersections so that local control can be adapted to highway-rail intersection activities. Health monitoring of the HRI equipment and interfaces is performed; detected abnormalities are reported through interfaces to the wayside interface equipment and the traffic management subsystem.	1.1.1.1, 1.2.7.1, 1.6.1.2.1, 1.6.1.2.2, 1.6.1.2.3, 1.6.1.2.5, 1.6.1.2.6, 1.6.1.3, 1.6.1.4.2, 1.6.1.4.4, 1.6.1.7.1, 1.6.1.7.2, 1.6.1.7.3, 1.6.3.1, 1.6.5.2, 1.6.5.3
Remote Basic Information Reception	This Equipment package shall provide the capability for travelers to interface with the ISP Subsystem Basic Information Broadcast Equipment package and receive formatted traffic advisories including accurate traveling information concerning available travel options and their availability, and congestion information at the Remote Traveler Support Subsystem.	6.3.2, 6.3.3
Remote Interactive Information Reception	This Equipment package shall provide the capability for travelers to interface with the ISP Subsystem Infrastructure Equipment packages including the Interactive Infrastructure Information Equipment package, the Infrastructure Provided Route Selection, Yellow Pages and Reservation, and Dynamic Ridesharing Equipment packages. These capabilities shall be provided using the Remote Traveler Support Subsystem equipment such as interactive TV and kiosk using communication medium and equipment such as CATV and wireline and wireless data transceivers.	6.3.3, 6.3.4, 7.3.4, 7.5.2, 7.5.5

Thurston Region Equipment Package	Description	Associated P-Specs
Remote Mayday Interface	This Equipment package provides the capability to report an emergency and summons assistance. The equipment includes a traveler interface that facilitates generation of a distress signal under duress and wireline communications that carries this distress signal and allows follow-up verification and determination of the nature of the emergency and the required response. This equipment package notifies either the Emergency Management or Transit Management Subsystem depending on the implementation.	4.4.1.8, 6.3.3
Remote Transit Fare Management	This Equipment package provides the capability for the traveler to use a common fare medium for all applicable surface transportation services, to pay without stopping, have payment media automatically identified as void and/or invalid and eligibility verified. This may be implemented as a payment instrument reader at a kiosk. In addition, capability to provide expansion into other uses for payment medium such as retail and telephone and for off-line billing for fares paid by agencies shall be supported.	4.7.2.1, 4.7.2.2, 4.7.2.3, 4.7.2.4, 4.7.2.5, 4.7.2.6, 4.7.2.7, 7.3.4, 7.5.2
Remote Transit Information Services	The Equipment package furnishes transit users with real-time travel-related information at transit stops, multi-modal transfer points, and other public transportation areas. It provides transit users with the latest available information on transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events. In addition to tailored information for individual transit users, this equipment package supports general annunciation and/or display of imminent arrival information and other information of general interest to transit users.	4.7.1.1, 4.7.1.2
Secure Area Monitoring	This Equipment package provides the capability to monitor the safety of transit users at Remote Traveler Subsystem locations. It collects surveillance images and data and relays this information back to the Transit Management Subsystem.	4.4.1.7
Collect Traffic Surveillance	This Equipment package collects, stores, and provides electronic access to the traffic surveillance data.	1.1.2.1, 1.1.2.2, 1.1.2.3, 1.1.4.1, 1.1.4.2, 1.1.4.4
HRI Traffic Management	This equipment package monitors highway-rail intersection (HRI) equipment at the roadside, which manages highway traffic. Various levels of roadside equipment may be interfaced to, and supported by, this equipment package to include standard speed active warning systems and high speed systems which provide additional information on approaching trains and detect and report on obstructions in the HRI. This equipment package remotely monitors and reports the status of this roadside equipment. A two way interface supports explicitly status requests or remote control plan updates to be generated by this equipment package. Status may also be received periodically in the absence of a request or asynchronously in the event of a detected failure or other unsafe condition at the intersection.	1.6.2.1, 1.6.2.2, 1.6.4.1, 1.6.4.2
Rail Operations Coordination	This equipment package provides strategic coordination between rail operations and traffic management centers. It receives train schedules, maintenance schedules, and any other forecast events which will result in highway-rail intersection (HRI) closures from Rail Operations. The provided information is used to develop forecast HRI closure times and durations which may be applied in advanced traffic control strategies or delivered as enhanced traveler information. This equipment package includes the processing and algorithms necessary to derive HRI closure times and the communications capabilities necessary to communicate with rail operations and interface to the traffic control and information distribution capabilities included in other Traffic Management Subsystem equipment packages.	1.1.3, 1.6.2.1, 1.6.2.3

Thurston Region Equipment Package	Description	Associated P-Specs
TMC Freeway Management	Control system for efficient freeway management including integration of surveillance information with freeway road geometry, vehicle control such as ramp metering, CMS, HAR. Interface to coordinated traffic subsystems for information dissemination to the public.	1.1.4.2, 1.2.2.1, 1.2.4.2
TMC Incident Detection	This Equipment package provides the capability to traffic managers to detect and verify incident. This capability includes analyzing and reducing the collected data from traffic surveillance equipment, including planned incidents and hazardous conditions.	1.3.1.1, 1.3.1.2, 1.3.2.1, 1.3.2.2, 1.3.2.3, 1.3.2.4, 1.3.2.5, 1.3.4.2, 1.3.4.3
TMC Incident Dispatch, Coordination/Communication	This Equipment package provides the capability for an incident response formulation function minimizing the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.	1.1.5.1, 1.2.4.1, 1.2.4.2, 1.3.2.3, 1.3.3, 1.3.4.1, 1.3.4.2, 1.3.4.4, 1.3.4.5, 1.3.5, 1.3.6, 1.3.7
TMC Multi-Modal Coordination	This Equipment package provides the capability of signal control at the traffic management subsystem to provide signal priority for transit vehicles	1.2.2.1, 1.2.2.2, 1.4.2
TMC Probe Information Collection	This Equipment package provides the capability to accept and process probe vehicle information. This capability shall be provided through the use of additional hardware and probe vehicle control and tracking software.	1.1.2.5, 1.1.4.1
TMC Regional Traffic Control	This Equipment package provides capabilities in addition to those provided by the TMC Basic Signal Control Equipment package for analyzing, controlling, and optimizing area-wide traffic flow. These capabilities provide for wide area optimization integrating control of a network signal system with control of freeway, considering current demand as well as expected demand with a goal of providing the capability for real-time traffic adaptive control while balancing inter-jurisdictional control issues to achieve regional solutions. These capabilities are best provided using a Traffic Management Center (TMC) to monitor and manage freeway ramp meters and intersection traffic signals and software to process traffic information and implement traffic management measures (e.g., ramp metering, signalization, and traffic coordination between both local and regional jurisdiction). The TMC shall be able to communicate with other TMCs in order to receive and transmit traffic information on other jurisdictions within the region.	1.1.4.2, 1.1.5, 1.2.4.1, 1.2.4.2
TMC Road Weather Monitoring	This equipment package assimilates current and forecast road conditions and weather information using a combination of weather service information and an array of environmental sensors deployed on and about the roadway. The collected road weather information is monitored and analyzed to detect and forecast environmental hazards such as icy road conditions and dense fog. This information can be used to more effectively deploy road maintenance resources, issue general traveler advisories, and support location specific warnings to drivers.	1.1.2.1, 1.1.2.2, 1.1.4.1, 1.3.2.1, 1.3.2.2, 1.3.4.2, 1.3.4.5

Thurston Region Equipment Package	Description	Associated P-Specs
TMC Signal Control	This Equipment package provides the capability for traffic managers to monitor and manage the traffic flow at signalized intersections. This capability includes analyzing and reducing the collected data from traffic surveillance equipment and developing and implementing control plans for signalized intersections. Control plans may be developed and implemented that coordinate signals at many intersections under the domain of a single traffic management subsystem. In advanced implementations, this package collects route planning information and integrates and uses this information in predicting future traffic conditions and optimizing the traffic control strategy for these conditions. These capabilities are achieved through real-time communication of logged routes from an Information Service Provider. The planned control strategies can be passed back to the Information Service Provider so that the intended strategies can be reflected in future route planning.	1.1.2.2, 1.1.4.2, 1.2.11, 1.2.2.2, 1.2.4.1
TMC Traffic Information Dissemination	This Equipment package provides the capability to disseminate incident related information to travelers, potential travelers, and private information service providers. These capabilities shall be provided using a workstation type processor within a facility connected to traveler information providers by utilizing existing wireline links.	1.1.4.1, 1.1.4.2, 1.1.4.3, 1.3.4.3
TMC Traffic Network Performance Evaluation	This Equipment package provides the capability to predict travel demand patterns to support traffic flow optimization, demand management, and incident management. This Equipment package requires the data collected by surveillance Equipment packages as well as input from other management subsystems including the ISP Subsystem, Transit Management Subsystem.	1.1.2.1, 1.1.2.2, 1.1.3, 1.1.5, 1.2.6.1, 1.2.6.2, 1.4.1, 1.4.2, 1.4.4, 1.4.5
Traffic Data Collection	This equipment package collects and stores traffic information that is collected in the course of traffic operations performed by the Traffic Management Subsystem. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.	1.1.4.7
Traffic Maintenance	This Equipment package provides monitoring and remote diagnostics of field equipment to detect field equipment failures, issues problem reports, and tracks the repair or replacement of the failed equipment.	1.1.1.2, 1.2.8.1, 1.2.8.2, 1.2.8.3, 1.2.8.4
Transit Center Fare and Load Management	This Equipment package provides the capability to accept collected data required to determine accurate ridership levels and implement variable and flexible fare structures. Support shall be provided for the traveler for use of a fare medium for all applicable surface transportation services, to pay without stopping, have payment media automatically identified as void and/or invalid and eligibility verified, and allow for third party payment. In addition, capability to provide expansion into other uses for payment medium such as retail and telephone and for off-line billing for fares paid by agencies shall be supported. This Equipment package also supports the capability for two-way voice communication between the transit vehicle driver and a facility, two-way data communication between the transit vehicles and a facility, sensor data to be transmitted from the transit vehicles to a facility, and data transmission from individual facilities to a central facility for processing/analysis if desired. These capabilities shall be provided through a workstation type processor with GUI, high capacity storage, ride share software housed in a building with dialup lines and wireline telephone and require integration with an existing Transit Center Tracking and Dispatch Equipment package.	4.6.8, 5.4.5, 7.3.1.1, 7.3.1.2, 7.3.1.3, 7.3.1.4, 7.3.1.5, 7.3.1.6, 7.1.3.7

Thurston Region Equipment Package	Description	Associated P-Specs
Transit Center Fixed Route Operations	This Equipment package enhances the planning and scheduling associated with fixed route transit services. The package allows fixed-route services to develop, print and disseminate schedules and automatically updates customer service operator systems with the most current schedule information. Current vehicle schedule adherence and optimum scenarios for schedule adjustment shall also be provided.	4.1.6, 4.2.2, 4.2.3.1, 4.2.3.2, 4.2.3.4, 4.2.3.5, 4.2.3.6
Transit Center Information Services	This equipment package collects the latest available information for a transit service and makes it available to transit customers and to Information Service Providers for further distribution. Customers are provided information at transit stops and other public transportation areas before they embark and on-board the transit vehicle once they are enroute. Information provided can include the latest available information on transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events. In addition to general service information, tailored information (e.g., itineraries) are provided to individual transit users.	4.1.5, 4.1.6, 4.2.3.3, 4.6.8
Transit Center Multi-Modal Coordination	This Equipment package provides the transit management subsystem the capability to determine the need for transit priority on routes and at certain intersections and request transit vehicle priority at these locations. It also supports schedule coordination between transit properties and coordinates with other surface and air transportation modes.	4.1.2.4, 4.1.4, 4.1.5, 4.1.7, 4.2.3.2, 4.2.3.7, 4.2.3.8
Transit Center Paratransit Operations	This Equipment package provides the capability to automate the planning and scheduling, allowing improvements in paratransit routes and services to develop, printing and disseminating schedules, and automatically updating customer service operator systems with the most current schedule. In addition, this Equipment package provides the capability to assign drivers to routes in a fair manner while minimizing labor and overtime services, including driver preferences and qualifications, and automatically tracking and validating the number of work hours performed by each individual driver. These capabilities shall be provided through the utilization of dispatch and fleet management software running on a workstation type processor.	4.1.6, 4.2.1.1, 4.2.1.2, 4.2.1.3, 4.2.1.4
Transit Center Security	This Equipment package provides the capability to monitor key transit locations and transit vehicles with both video and audio systems automatically alerting operators and police of potential incidents and supporting traveler activated alarms. The monitoring equipment shall also include capabilities to assist in responding to terrorist incidents.	4.4.1.1, 4.4.1.3, 3.3.1.4, 4.4.1.6, 4.4.2, 4.4.3, 7.3.3
Transit Center Tracking and Dispatch	This Equipment package provides the capabilities for monitoring transit vehicle locations and determining vehicle schedule adherence. The Equipment package shall also furnish users with real-time travel related information, continuously updated with real-time information from each transit system within the local area of jurisdiction, inclusive of all transportation modes, from all providers of transportation services, and provide users with the latest available information on transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents conditions, weather conditions, and special events. This Equipment package also supports the capability for two-way voice communication between the transit vehicle driver and a facility, two-way data communication between the transit vehicles and a facility.	4.1.6, 4.2.3.9
Transit Data Collection	This equipment package collects and stores transit information that is collected in the course of transit operations performed by the Transit Management Subsystem. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.	4.2.4

Thurston Region Equipment Package	Description	Associated P-Specs
Transit Garage Maintenance	This Equipment package provides advanced maintenance functions for the transit property. It collects operational and maintenance data from transit vehicles, manages vehicle service histories, and monitors drivers and vehicles. It collects vehicle mileage data and uses it to automatically generate preventative maintenance schedules for each vehicle by utilizing vehicle tracking data from a prerequisite vehicle tracking equipment package. In addition, it provides information to proper service personnel to support maintenance activities and records and verifies that maintenance work was performed. This equipment package receives special events and real-time incident data from the traffic management subsystem and assigns operators to vehicles and transit routes. Garage maintenance also receives information about incidents involving transit vehicles from the TMC in order to dispatch tow trucks and other repair vehicles.	4.3.1, 4.3.2, 4.3.3, 4.3.4, 4.3.5, 4.3.6, 4.3.7
Transit Garage Operations	This Equipment package automates and supports the assignment of transit vehicles and drivers to enhance the daily operation of a transit service. It provides the capability to assign drivers to routes or service areas in a fair manner while minimizing labor and overtime services, considering driver preferences and qualifications, and automatically tracking and validating the number of work hours performed by each individual driver.	4.5.1, 4.5.2, 4.5.3, 4.5.4, 4.5.5, 4.5.6, 4.5.7, 4.5.8
On-board Fixed Route Schedule Management	This Equipment package provides the capabilities for automated planning and scheduling, by collecting data for schedule generation. Capability shall also be provided to automatically determine optimum scenarios for schedule adjustment. This Equipment package also supports the capability for two-way voice communication between the transit vehicle driver and a facility, two-way data communication between the transit vehicles and a facility, on-board safety sensor data to be transmitted from the transit vehicles to a facility, and data transmission from individual facilities to a central facility for processing/analysis if desired.	4.1.2.1, 4.1.2.2, 4.1.2.3
On-board Maintenance	This Equipment package provides the capability to use transit vehicle mileage data to automatically generate preventative maintenance schedules for each specific bus by utilizing vehicle tracking data and storing with a trip computer. It also provides the capability for real-time condition monitoring on board the vehicle, and transmission of this information via two-way communication to the management center.	4.1.1, 4.1.9
On-board Paratransit Operations	This equipment package forwards paratransit dispatch requests to the driver and forwards acknowledgements to the center. It coordinates with, and assists the driver in managing multi-stop runs associated with demand responsive, flexibly routed transit services.	4.2.1.5, 4.2.16

Thurston Region Equipment Package	Description	Associated P-Specs
On-board Transit Fare and Load Management	This Equipment package provides the capability to collect data required to determine accurate ridership levels and implement variable and flexible fare structures. Support shall be provided for the traveler for use of a fare medium for all applicable surface transportation services, to pay without stopping, have payment media automatically identified as void and/or invalid and eligibility verified, and allow for third party payment. In addition, capability to provide expansion into other uses for payment medium such as retail and telephone and for off-line billing for fares paid by agencies shall be supported. This Equipment package also supports the capability for two-way voice communication between the transit vehicle driver and a facility, two-way data communication between the transit vehicles and a facility, sensor data to be transmitted from the transit vehicles to a facility, and data transmission from individual facilities to a central facility for processing/analysis if desired. These capabilities require integration with an existing On-board Trip Monitoring Equipment package.	4.6.1, 4.6.2, 4.6.3, 4.6.4, 4.6.5, 4.6.6, 4.6.7, 7.3.5
On-board Transit Information Services	The Equipment package furnishes enroute transit users with real-time travel-related information. Current information that can be provided to transit users includes transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events are provided. In addition to tailored information for individual transit users, this equipment package also supports general annunciation and/or display of general schedule information, imminent arrival information, and other information of general interest to transit users.	6.2.1.6, 6.2.3
On-board Transit Security	This Equipment package provides the capability to monitor the safety of transit vehicles using on-board safety sensors, processors and communications from the prerequisite On-board Trip Monitoring Equipment package.	4.4.1.2, 4.4.1.5
On-board Transit Signal Priority	This Equipment package provides the capability for transit vehicles to request signal priority through short range communication directly with traffic control equipment at the roadside.	4.1.2.5
On-board Transit Trip Monitoring	This Equipment package provides the capabilities to support fleet management with automatic vehicle location and automated mileage and fuel reporting and auditing. This package may also record other special events resulting from communication with roadside equipment. This includes only the equipment on board the vehicle to support this function including the vehicle location devices such as GPS equipment, communication interfaces, a processor to record trip length, and the sensors/actuators/interfaces necessary to record mileage and fuel usage.	4.1.1, 4.1.3
Vehicle Location Determination	This equipment package determines current location information and provides this information to other equipment packages that use the location information to provide various ITS services.	6.7.2.2
Vehicle Probe Support	This Equipment package includes capabilities for the probe vehicle to identify its location, measure traffic conditions such as link travel time and speed and possibly environmental hazards such as icy road conditions, and transmit these data to either the ISP or TMC.	3.2.3.5

Thurston Region Equipment Package	Description	Associated P-Specs
Basic Vehicle Reception	This Equipment package shall provide the capability for drivers to interface with the ISP Subsystem Basic Information Broadcast Equipment package and receive formatted traffic advisories including accurate traveling information concerning available travel options and their availability, and congestion information in their vehicle. These capabilities shall be based upon the reception of infrastructure information using in-vehicle devices such as an in-vehicle AM/FM radio with data Subcarrier connected with the existing audio system and a dash-mounted LCD.	6.2.2, 6.2.5
Interactive Vehicle Reception	This Equipment package shall provide the capability for drivers to interface with the ISP Subsystem Infrastructure Equipment packages including the Interactive Infrastructure Information Equipment package, the Infrastructure Provided Route Selection, Yellow Pages and Reservation, and Dynamic Ridesharing Equipment packages. These capabilities shall be provided using the Vehicle Subsystem equipment.	6.2.2, 6.2.5
Vehicle Mayday Interface	This Equipment package shall provide the capability for an in-vehicle manually initiated distress signal with cancel a prior issued manual request for help feature. This capability shall include automatically identifying that a collision had occurred using equipment such as collision detection sensors with interface to mayday type equipment that would automatically detect vehicle problems and for some cases, automatically send appropriate distress signals to the Emergency Management Subsystem.	3.3.2, 3.3.3, 6.2.5, 6.7.1.1, 6.7.1.2