

Inland Empire Regional Intelligent Transportation System (ITS) Architecture Project



Chapter 2: ITS Needs, Services and Operational Concepts Report

Submitted by:



J99-0495

**INLAND EMPIRE REGIONAL
INTELLIGENT TRANSPORTATION SYSTEMS (ITS)
ARCHITECTURE PROJECT**

**CHAPTER 2
DRAFT
ITS NEEDS, SERVICES AND
OPERATIONAL CONCEPTS
REPORT**

Submitted by

ITERIS, INC.

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Contained in this Report...

Each of the written deliverables for the Inland Empire Regional Intelligent Transportation Systems (ITS) Architecture Project will be introduced to the project stakeholders as an individual Chapter of the overall project documentation set. This Report is the second Chapter in what will ultimately be one comprehensive document concerning the ITS Architecture development as well as other associated activities. After receiving stakeholder comments on each Chapter, a disposition of comments will be released detailing the individual comments and how they will be dealt with in modifying the Chapter under review. The individual Chapters (revised based on stakeholder comments) will be re-issued as one document in the Final Report.

Following is a summary listing of the Chapters that will, in total, make up the complete documentation set for the Inland Empire Regional ITS Architecture Project. The Chapters that are either complete or currently under review by the stakeholder group are indicated in bold type.

- **Chapter 1: Inventory Report**
- **Chapter 2: ITS User Needs, Services and Operational Concepts**
- Chapter 3: Functional Requirements Define and Interface Definitions
- Chapter 4: Project Sequencing
- Chapter 5: List of Agency Agreements
- Chapter 6: ITS Architecture Maintenance Plan
- FINAL REPORT

This Report contains the following sections.

Section 2.1: Introduction

Provides a brief introduction and background to the project.

Section 2.2: Inland Empire ITS Needs

Section 2.2 contains a description of the process used to collect and assemble input from the stakeholder group regarding ITS Needs in the Inland Empire. Also shown is the relative priority assigned to the ITS Needs by the stakeholder group.

Section 2.3: ITS Services

Section 2.3 introduces and describes Market Packages from the National ITS Architecture. The previously identified ITS Needs are then compared to the universe of Market Packages to determine which Market Packages are already existing in the Inland Empire and where there is a need for additional Market Packages.

Section 2.4: ITS Operational Concepts

Provides an overview of roles and responsibilities in the operation of integrated ITS in the Inland Empire.

Section 2.5: Next Steps

Provides a discussion of what was accomplished in this Report, and how the subject material contained in this Report will flow into subsequent project activities and deliverables. This section will also outline the next steps in the project.



2.0 ITS USER NEEDS, SERVICES AND OPERATIONAL CONCEPTS

2.1 Introduction

The Inland Empire* Intelligent Transportation Systems (ITS) Strategic Plan, developed in 1998, was a joint effort of the local transportation agencies to develop an approach for integration of regional ITS opportunities and projects. Since the development of this Plan, the Federal Highway Administration (FHWA) published a Rule (National ITS Architecture and Standards) and the Federal Transit Agency (FTA) published a companion Policy to implement Section 5206(e) of the Transportation Equity Act for the 21st Century (TEA-21). This Rule/Policy seeks to foster regional integration by requiring that all ITS projects funded from the Highway Trust Fund be in conformance with the National ITS Architecture and appropriate standards. “Conformance” is defined as using the National ITS Architecture to develop a regional ITS architecture tailored to address the local situation and ITS investment needs, and the subsequent adherence of ITS projects to the regional ITS architecture. The Inland Empire ITS Strategic Plan preceded the Rule/Policy and is, therefore, in need of modifications in order for the region to continue on a path to conformance.

2.2 Inland Empire ITS Needs

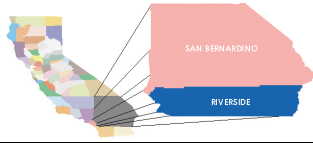
In Chapter 1 of the documentation set for this project, an ITS Inventory for the Inland Empire was developed showing existing and planned (near term) systems owned and / or operated by Inland Empire ITS stakeholders. The next step in the process of developing a Regional ITS Architecture is determining the needs of the Stakeholders in the region. The needs are then compared to the inventory to determine which needs are currently being met with existing ITS; or will be met in the near future with planned ITS.

In order to determine the ITS needs of the Inland Empire Region a “strawman” list of ITS needs was developed to use as a starting point. The strawman list was developed based on knowledge of the Inland Empire Region as well as experience in developing Regional ITS Architectures in other regions of California.

The project stakeholders then provided input to determine a set of appropriate needs for the Inland Empire. At the same time, the group also provided input on the relative priorities of the identified ITS needs. This input was taken at a Project Workshop conducted March 4, 2003, and via a subsequent survey sent out to the entire project stakeholder group. **Appendix A** of this document contains the Needs Survey that was distributed to the stakeholder group.

The needs have been broken into categories, similar to the manner in which the Inventory Survey Forms were categorized. In the strawman list of ITS needs, there were several needs that applied to more than one category. So those needs were listed more than once. In assembling the needs input from the stakeholder group, along with the relative priorities, the Needs List was condensed as much as possible. **Table 2.2-1** shows the resulting condensation of ITS Needs as well as the summation of relative priorities collected from the stakeholder group.

* The Inland Empire is the moniker for the Counties of Riverside and San Bernardino in California.



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Table 2.2-1 – Inland Empire ITS Needs

ITS Category	H=High, M=Medium, L=Low		
Arterial / Traffic Management	Needs	Relative Priority	
<i>Examples: Signal Coordination, Centralized Control, Vehicle Detection Systems, Video Systems, Adaptive Signal Control, Traffic Management Systems / Centers, Highway Rail Intersection Technologies</i>	1	Improve system operation monitoring	H
	2	Improve signal optimization	H
	3	Improve traffic flow monitoring	H
	4	Provide more widespread centralized computer control	M
	5	Improve hardware issues in interconnecting signal systems between agencies	L
	6	Improve signal control and timing	H
	7	Improve/implement ability to remotely modify signal timing	H
	8	Reduce emergency vehicle delays at signals	M
	9	Reduce transit vehicle delays at signals	M
	10	Better balance signal timings favoring local traffic over through traffic	L
	11	Improve inter-jurisdictional continuity	H
	12	Upgrade signal hardware	H
	13	Remote monitoring of signal system status / operations by public safety agencies	M
	14	Reduce vehicle traffic delays at grade crossings	H
	15	Better coordinate grade crossing operations with signals	H

ITS Category	H=High, M=Medium, L=Low		
Freeway Management	Needs	Relative Priority	
<i>Examples: Vehicle Speed Detection Systems, Video Systems, Ramp Metering, Variable Message Signs, Highway Advisory Radio, Traffic Management Systems/Centers</i>	16	Deploy additional vehicle detection coverage	M
	17	Implement additional field device interconnect	L
	18	Improve collection of traffic demand data	M
	19	Improve information exchange between Caltrans District 8 and other Caltrans Districts	M
	20	Improve information exchange between Caltrans and Nevada DOT and Arizona DOT	M

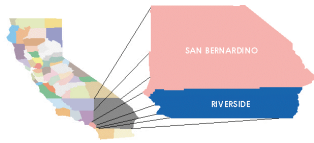


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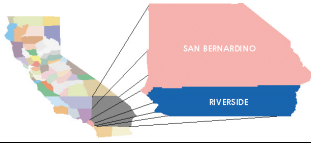
ITS Category		H=High, M=Medium, L=Low	
	21	Improve information exchange between Caltrans District 8 and other local agencies	H
	22	Improve incident response, especially in rural areas	M
	23	Better manage periods of high traffic demand in poor roadway conditions	L

ITS Category		H=High, M=Medium, L=Low	
Public Transportation Management		Needs	Relative Priority
<i>Examples: Public Transportation Management, En-route Transit Information, Personalized Public Transit, Public Traveler Safety, Traveler Service Information, Ride Matching and Reservations, Smart Card Payment/Transaction Systems</i>	24	Improve regional and interregional trip planning	M
	25	Improve patron safety (in-vehicle and at stations / waypoints)	M
	26	Provide transit priority at signals	M
	27	Implement bus queue jump lanes	M
	28	Improve transit transfers within and between systems and modes to improve service delivery	H
	29	Enable dissemination / display of bus arrival times	M
	30	Enable transit agencies to locate bus fleet (AVI/AVL)	H
	31	Improve information exchange between/among transit agencies	H
	32	Improve information exchange between transit agencies and freeway / arterial management centers	L
	33	Disseminate better rail information and arrival times (connectivity issues)	H
34	Enable emergency information dissemination to transit operators	M	



ITS Category		H=High, M=Medium, L=Low	
Emergency Management		Needs	Relative Priority
<i>Examples: Incident Detection, Incident Management, Hazardous Materials Response and Handling, Emergency Notification and Personal Security, Emergency Vehicle Management, Advanced Dispatching and Response Systems</i>	35	Reduce response delays at signals	M
	36	Improve response to weather events	M
	37	Improve incident response coordination between agencies	M
	38	Improve incident detection	M
	39	Improve incident response times	M
	40	Improve communications in mountain and rural areas of the region	M
	41	Provide better information dissemination regarding diversion of traffic and alternative routing	L
	42	Improve traffic management during wildfires (evacuation, response, suppression, etc.)	L
	43	Improve response to hazardous materials spills / incidents (better manage resulting traffic congestion, improve clean-up time)	M
	44	Increase use of portable traffic control equipment (CMS, HAR, etc.)	L

ITS Category		H=High, M=Medium, L=Low	
Maintenance and Construction Operations		Needs	Relative Priority
<i>Examples: Advanced Work Zone Management and Traffic Control, Vehicle Detection Systems, Video Systems, Vehicle / Speed Detection Systems, Variable Message Signs, Highway Advisory Radio, Integration with Traffic Management Systems / Centers, Advanced Dispatching and Routing Systems, Advanced Vehicle Tracking Systems, Fleet Maintenance and Management Systems</i>	45	Provide automated vehicle location systems for maintenance and construction operations vehicles	L
	46	Improve / enhance work zone traffic handling plans	M
	47	Improve detection and removal of falling rocks, snow, mud and trees on roadways	M
	48	Improve coordination on construction notification and information distribution	H
	49	Improve fleet information / management (maintenance schedules, mileage accumulations, tracking snow removal vehicles w/AVL)	L
	50	Coordinate traffic control plans between jurisdictions	M
	51	Increase use of portable traffic control equipment (CMS, HAR, etc.)	M



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ITS Category		H=High, M=Medium, L=Low	
	52	Provide signal preemption for some maintenance fleet vehicles	L

ITS Category		H=High, M=Medium, L=Low	
Regional Traveler Information		Needs	Relative Priority
<i>Examples: En-route Traveler Information, Pre-trip Traveler Information, Portable Event Management Systems, In-vehicle Route Guidance, Variable Message Signs, Highway Advisory Radio, Internet, Media, Tourist Information Systems</i>	53	Provide quality real time congestion related information	H
	54	Expand traveler information delivery methods	M
	55	Improve method of disseminating Caltrans delay and incident data	H
	56	Use public access cable television to disseminate traffic and weather information	L
	57	Improve quality and timeliness of communications	M
	58	Provide timely, accurate information on road conditions	H
	59	Provide better notification of recreational routes closed in winter	M
	60	Develop interstate / inter-region traveler information covering a wide area (targeted to CVO)	M
	61	Improve targeted traveler information for tourists and recreation travelers at visitor information areas / rest stops, etc.	L
	62	Provide weather and road info access at rest stops	L
	63	Provide more data source locations for the National Weather Service	M
	64	Provide information distribution to private/commercial information service providers (ISPs)	M
	65	Provide better road construction information and notification	H
66	Improve traveler information/directions (suggested routing for travelers not familiar with the region)	M	



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ITS Category		H=High, M=Medium, L=Low	
Commercial Vehicle Operations		Needs	Relative Priority
<i>Examples: Commercial Vehicle Electronic Clearance, Automated Roadside Safety Inspection, On-board Safety Monitoring, Commercial Vehicle Administration Processes, Hazardous Material Incident Response, Commercial Vehicle Fleet Management</i>	67	Provide interstate / inter-region traveler information covering a wide area (targeted to CVO)	M
	68	Provide tracking of hazmat vehicles	L
	69	Provide better information dissemination of winter vehicle restrictions (Chain control issues (ON/OFF))	L
	70	Improve truck storage / parking information (during major road closures)	M
	71	Disseminate better information regarding limited alternative routes	M
	72	Improve congestion management during seasonal/local events	M

ITS Category		H=High, M=Medium, L=Low	
Electronic Payment Systems		Needs	Relative Priority
<i>Examples: Electronic Toll Collection Systems, Electronic Transit Fare Payment Systems (Smart Cards)</i>	73	Improve transit fare payment systems	M
	74	Deploy Universal Card (parking / transit / tolls)	L

ITS Category		H=High, M=Medium, L=Low	
Advanced Vehicle Control and Safety Systems		Needs	Relative Priority
<i>Examples: Longitudinal Collision Avoidance, Lateral Collision Avoidance, Intersection Collision Avoidance, Vision Enhancement for Crash Avoidance, Safety Readiness, Pre-crash Restraint Deployment, Automated Highway System</i>	75	Provide snow plow tracking project	L
	76	Deploy advanced warning signs for road icing, excess speed, etc.	M
	77	Reduce red light running	H



ITS Category		H=High, M=Medium, L=Low	
Integration		Needs	Relative Priority
<i>Examples: Integration of Systems, Integration With Traffic Management Centers, Central vs. Distributed Control, Communications Infrastructure, Integration of Agencies, Institutional Issues</i>	78	Improve information sharing among agencies	H
	79	Improve communication limitations	M
	80	Reduce dependency on proprietary systems	M
	81	Provide central information clearinghouse	M
	82	Reduce impacts of different operating systems for signal control	M
	83	Develop integrated GIS for Region	M
	84	Develop political agreements (MOUs)	M
	85	Improve system compatibility	M

2.3 ITS Services

The National ITS Architecture contains many different concepts and is rich in industry jargon. One of the concepts is known as Market Packages. Market Packages provide an accessible, deployment-oriented perspective to the National ITS Architecture. They are tailored to fit, separately or in combination, real world transportation problems and needs. Market Packages bring together one or more Equipment Packages that must work together to deliver a given transportation service as well as the Architecture Flows that connect them to other important external systems. In other words, they identify the pieces of the Physical Architecture that are required to implement a particular transportation service. In short, a market package is:

A series of relatively detailed groupings of subsystems, equipment packages, and data flow definitions, which can be logically and incrementally deployed over-time to provide increasing capabilities and levels of integration.

A typical market package contains subsystems, equipment packages, architecture flows and supporting logical architecture elements. The equipment packages were assembled into 75 market packages that are models of what an agency or company might deploy to provide a given ITS user service.

Additional Terminology Defined

The Market Package definition includes three concepts that require further definition for a complete understanding of Market Packages.



1) Subsystem – Subsystems are not “brick and mortar” entities. Each Subsystem is a cohesive set of functional definitions with required interfaces to other Subsystems. Subsystems are defined functionally, not physically.

Example – A regional implementation may include a single physical “brick and mortar” center that collocates the capabilities from several Subsystems. For instance, a single Transportation Management Center (TMC) may include Traffic Management Subsystem, Transit Management Subsystem, Emergency Management Subsystem, and Information Service Provider Subsystem functionalities. On the other hand, a single Subsystem may be replicated in many different physical “brick and mortar” TMCs in a complex metropolitan area system. For instance, multiple traffic management Subsystems may be implemented in a region reflecting distinct State freeway and local arterial management centers.

2) Equipment Package – A Market Package is implemented with a combination of interrelated equipment. An Equipment Package represents a set of equipment/capabilities that are likely to be purchased by an end-user as a component to an overall system. This equipment often resides in several different Subsystems within the Architecture Framework and may be operated by different stakeholders. Since Equipment Packages are both the most detailed elements of the Physical Architecture and associated with specific Market Packages, there is clear traceability between the interface-oriented Architecture Framework and the deployment-oriented Market Packages.

Example – The Transit Vehicle Tracking Market Package includes vehicle location equipment in the Transit Vehicle Subsystem and a base station element in the Transit Management Subsystem. In this example, all Market Package elements are owned and operated by the same transit stakeholder. In other cases, the Market Package elements are owned and operated by different stakeholders. Many of the Traveler Information Market Packages require equipment in the Information Service Provider Subsystem that is owned and operated by a public or private information provider and equipment that is acquired and operated by the consumer as part of the Vehicle Subsystem or Personal Information Access Subsystem. Since equipment in different Subsystems may be purchased and operated by different end-users, these Subsystem-specific components may encounter varied deployment.

3) Architecture Flows – Architecture Flows are simply defined as the information and data exchange between and among various Equipment Packages and Subsystems. The Architecture Flows allow for a coordinated overall system operation by following pre-defined interfaces between equipment and subsystems which may be deployed by different procuring and operating sectors.

4) Terminators –Terminators define the boundary of an architecture. The National ITS Architecture terminators represent the people, systems, and general environment that interface to ITS.

To give a more visual understanding of a Market Package, **Figure 2.3-1** shows a Market Package diagram, and **Figure 2.3-2** is a Legend to assist in understanding the diagram. In general, only the most salient elements from the Architecture definition (e.g., directly involved Subsystems, system terminators, and the highest level data flows) are depicted in each graphic to ensure clarity.

The 75 National ITS Architecture (v4.0) Market Packages are broken down into eight groups. **Table 2.3-1** contains a summary listing of all 75 of the National ITS Architecture, by group. Each of the 75 Market



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Packages is described in the National ITS Architecture documentation and has an accompanying diagram. **Figure 2.3-3** is another example of a Market Package diagram, this time with the accompanying description from the National ITS Architecture documentation. **Appendix B** contains all 75 of the Market Package diagrams and descriptions.



Figure 2.3-1 – Sample Market Package Diagram

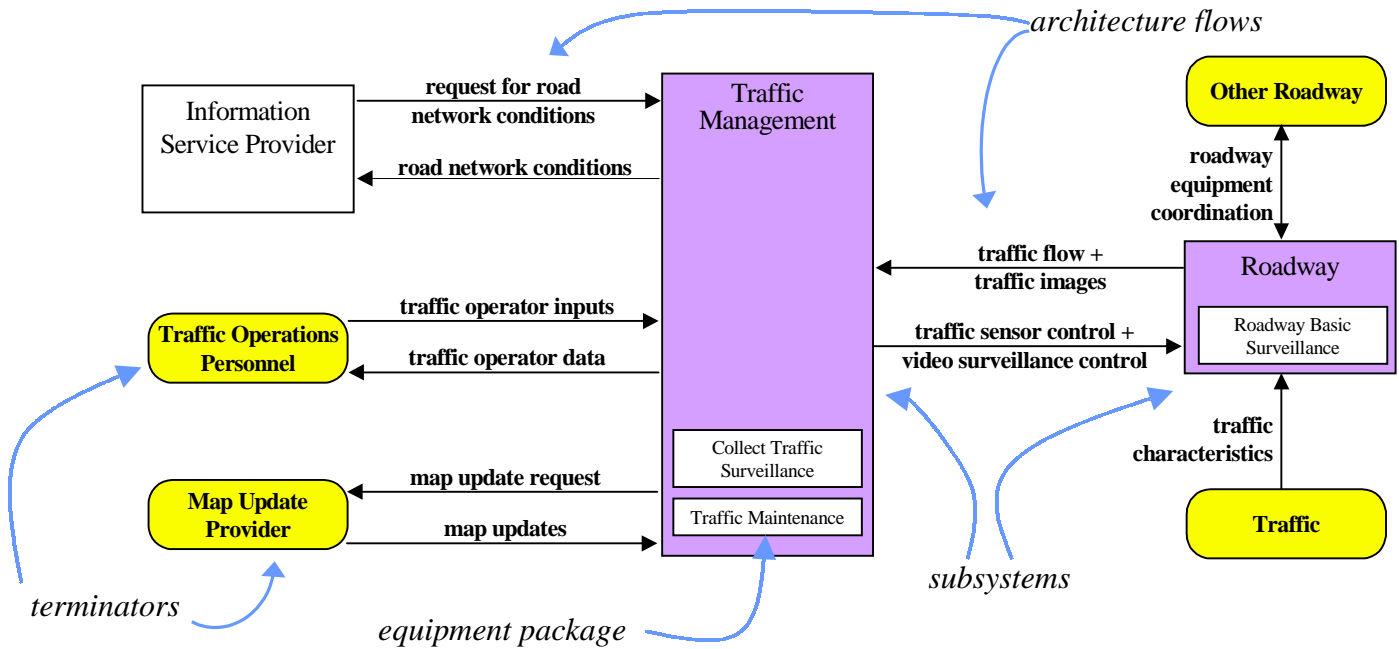


Figure 2.3-2 – Market Package Diagram Legend

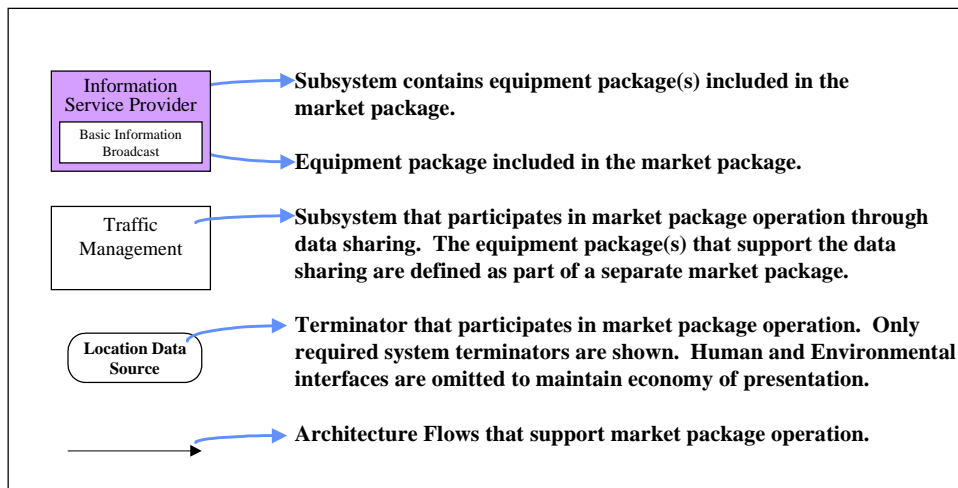
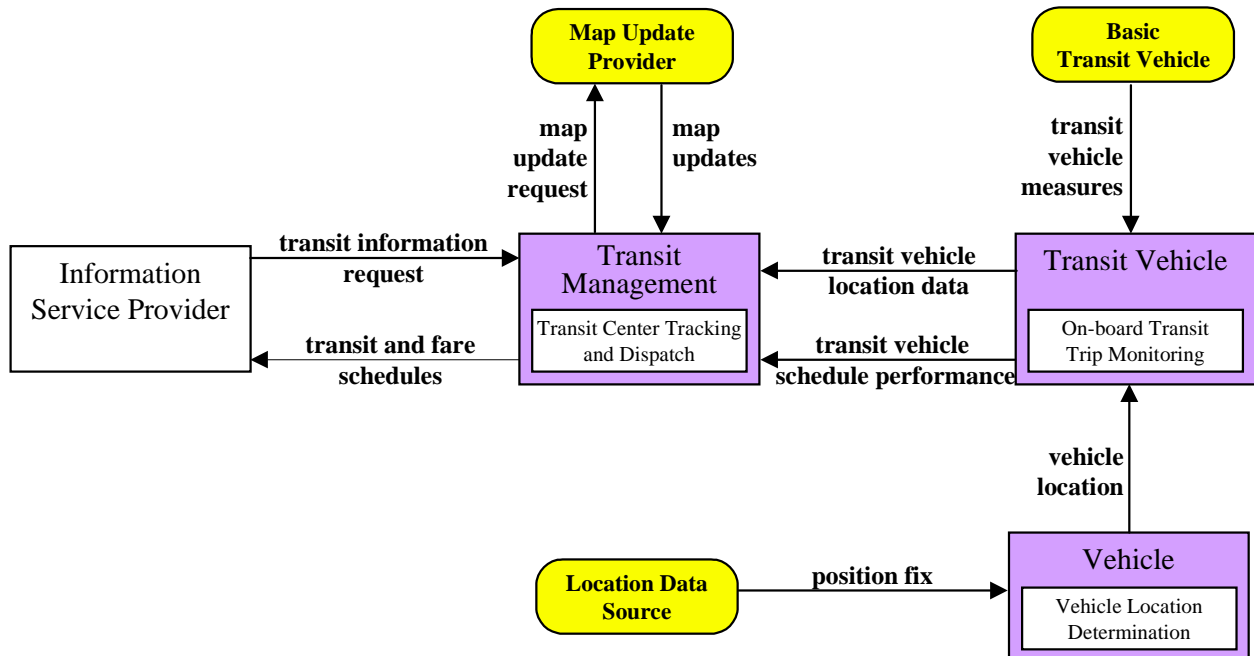




Figure 2.3-3 – Market Package APTS1 – Transit Vehicle Tracking

This market package provides for an Automated Vehicle Location System to track the 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 with the Transit Management Subsystem is used for relaying vehicle position and control measures. Fixed route transit systems may also employ beacons along the route to enable position determination and facilitate communications with each vehicle at fixed intervals. The Transit Management Subsystem processes this information, updates the transit schedule and makes real-time schedule information available to the Information Service Provider Subsystem via a wireline link.



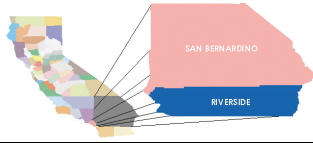


Table 2.3-1 – Summary Listing of National ITS Architecture Market Packages

<p>ARCHIVED DATA MANAGEMENT <i>Archived Data (AD)</i></p> <p>AD1 ITS Data Mart AD2 ITS Data Warehouse AD3 ITS Virtual Data Warehouse</p>	<p>VEHICLE SAFETY <i>Advanced Vehicle Safety Systems (AVSS)</i></p> <p>AVSS01 Vehicle Safety Monitoring AVSS02 Driver Safety Monitoring AVSS03 Longitudinal Safety Warning AVSS04 Lateral Safety Warning AVSS05 Intersection Safety Warning AVSS06 Pre-Crash Restraint Deployment AVSS07 Driver Visibility Improvement AVSS08 Advanced Vehicle Longitudinal Control AVSS09 Advanced Vehicle Lateral Control AVSS10 Intersection Collision Avoidance AVSS11 Automated Highway System</p>
<p>PUBLIC TRANSPORTATION <i>Advanced Public Transportation Systems (APTS)</i></p> <p>APTS1 Transit Vehicle Tracking APTS2 Transit Fixed-Route Operations APTS3 Demand Response Transit Operations APTS4 Transit Passenger and Fare Management APTS5 Transit Security APTS6 Transit Maintenance APTS7 Multi-modal Coordination APTS8 Transit Traveler Information</p>	<p>COMMERCIAL VEHICLE OPERATIONS <i>Commercial Vehicle Operations (CVO)</i></p> <p>CVO01 Fleet Administration CVO02 Freight Administration CVO03 Electronic Clearance CVO04 CV Administrative Processes CVO05 International Border Electronic Clearance CVO06 Weigh-In-Motion CVO07 Roadside CVO Safety CVO08 On-board CVO Safety CVO09 CVO Fleet Maintenance CVO10 HAZMAT Management</p>
<p>TRAVELER INFORMATION <i>Advanced Traveler Information Systems (ATIS)</i></p> <p>ATIS1 Broadcast Traveler Information ATIS2 Interactive Traveler Information ATIS3 Autonomous Route Guidance ATIS4 Dynamic Route Guidance ATIS5 ISP Based Route Guidance ATIS6 Integrated Transportation Management/Route Guidance ATIS7 Yellow Pages and Reservation ATIS8 Dynamic Ridesharing ATIS9 In Vehicle Signing</p>	<p>EMERGENCY MANAGEMENT <i>Emergency Management (EM)</i></p> <p>EM1 Emergency Response EM2 Emergency Routing EM3 Mayday Support EM4 Roadway Service Patrols</p>
<p>TRAFFIC MANAGEMENT <i>Advanced Transportation Management Systems (ATMS)</i></p> <p>ATMS01 Network Surveillance ATMS02 Probe Surveillance ATMS03 Surface Street Control ATMS04 Freeway Control ATMS05 HOV Lane Management ATMS06 Traffic Information Dissemination ATMS07 Regional Traffic Control ATMS08 Incident Management System ATMS09 Traffic Forecast and Demand Management ATMS10 Electronic Toll Collection ATMS11 Emissions Monitoring and Management ATMS12 Virtual TMC and Smart Probe Data ATMS13 Standard Railroad Grade Crossing ATMS14 Advanced Railroad Grade Crossing ATMS15 Railroad Operations Coordination ATMS16 Parking Facility Management ATMS17 Regional Parking Management ATMS18 Reversible Lane Management ATMS19 Speed Monitoring ATMS20 Drawbridge Management</p>	<p>MAINTENANCE & CONSTRUCTION OPERATIONS <i>Maintenance & Construction Operations (MCO)</i></p> <p>MC01 Maintenance and Construction Vehicle Tracking MC02 Maintenance and Construction Vehicle Maintenance MC03 Road Weather Data Collection MC04 Weather Information Processing and Distribution MC05 Roadway Automated Treatment MC06 Winter Maintenance MC07 Roadway Maintenance and Construction MC08 Work Zone Management MC09 Work Zone Safety Monitoring MC10 Maintenance and Construction Activity Coordination</p> <p><i>From the National ITS Architecture (v4.0)</i></p>



Based on the inventory and needs information collected thus far, **Table 2.3-2** presents a summary of the status of Market Package deployment in the Inland Empire. The “Existing or Planned in the Inland Empire” column identifies which Market Packages have already been deployed, or are planned for near term. Only one instance of the Market Package need be deployed, or planned, for the box to be checked. The next column, “Identified Inland Empire Need” indicates where the stakeholder group identified a Need but no Market Package deployment to fulfill that Need was uncovered. The column titled “No Inland Empire Need” indicates Market Packages where the Stakeholder Group did not state a Need for that particular Market Package functionality. And finally, the column titled “Inland Empire Need Indeterminate” identifies Market Packages that fall into one or both of two categories: 1) Market Packages where the Stakeholder Group did not indicate a specific need but there may be some interest in deploying that functionality at some point in the future, and 2) Market Packages that are, or will be, largely private sector efforts, where the public sector may not necessarily participate in deployment of the Market Package.

Table 2.3-2 – Inland Empire Market Package Analysis

Market Packages		Existing or Planned in the Inland Empire	Identified Inland Empire Need	No Inland Empire Need	Inland Empire Need Indeterminate
ARCHIVED DATA MANAGEMENT <i>Archived Data (AD)</i>					
AD1	ITS Data Mart	✓			
AD2	ITS Data Warehouse		✓		
AD3	ITS Virtual Data Warehouse				✓
PUBLIC TRANSPORTATION <i>Advanced Public Transportation Systems (APTS)</i>					
APTS1	Transit Vehicle Tracking	✓			
APTS2	Transit Fixed-Route Operations	✓			
APTS3	Demand Response Transit Operations	✓			
APTS4	Transit Passenger and Fare Management	✓			
APTS5	Transit Security	✓			
APTS6	Transit Maintenance	✓			
APTS7	Multi-modal Coordination		✓		
APTS8	Transit Traveler Information		✓		
TRAVELER INFORMATION <i>Advanced Traveler Information Systems (ATIS)</i>					
ATIS1	Broadcast Traveler Information	✓			
ATIS2	Interactive Traveler Information	✓			
ATIS3	Autonomous Route Guidance	✓			
ATIS4	Dynamic Route Guidance				✓
ATIS5	ISP Based Route Guidance	✓			



Market Packages		Existing or Planned in the Inland Empire	Identified Inland Empire Need	No Inland Empire Need	Inland Empire Need Indeterminate
ATIS6	Integrated Transportation Management/Route Guidance				✓
ATIS7	Yellow Pages and Reservation				✓
ATIS8	Dynamic Ridesharing	✓			
ATIS9	In Vehicle Signing				✓
TRAFFIC MANAGEMENT <i>Advanced Transportation Management Systems (ATMS)</i>					
ATMS01	Network Surveillance	✓			
ATMS02	Probe Surveillance				✓
ATMS03	Surface Street Control	✓			
ATMS04	Freeway Control	✓			
ATMS05	HOV Lane Management	✓			
ATMS06	Traffic Information Dissemination	✓			
ATMS07	Regional Traffic Control		✓		
ATMS08	Incident Management System		✓		
ATMS09	Traffic Forecast and Demand Management				✓
ATMS10	Electronic Toll Collection				✓
ATMS11	Emissions Monitoring and Management	✓			✓
ATMS12	Virtual TMC and Smart Probe Data				✓
ATMS13	Standard Railroad Grade Crossing	✓			
ATMS14	Advanced Railroad Grade Crossing		✓		
ATMS15	Railroad Operations Coordination		✓		
ATMS16	Parking Facility Management	✓			
ATMS17	Regional Parking Management				✓
ATMS18	Reversible Lane Management			✓	
ATMS19	Speed Monitoring		✓		
ATMS20	Drawbridge Management			✓	
VEHICLE SAFETY <i>Advanced Vehicle Safety Systems (AVSS)</i>					
AVSS01	Vehicle Safety Monitoring				✓
AVSS02	Driver Safety Monitoring				✓
AVSS03	Longitudinal Safety Warning				✓
AVSS04	Lateral Safety Warning				✓
AVSS05	Intersection Safety Warning				✓
AVSS06	Pre-Crash Restraint Deployment				✓
AVSS07	Driver Visibility Improvement				✓
AVSS08	Advanced Vehicle Longitudinal Control				✓



Market Packages		Existing or Planned in the Inland Empire	Identified Inland Empire Need	No Inland Empire Need	Inland Empire Need Indeterminate
AVSS09	Advanced Vehicle Lateral Control				✓
AVSS10	Intersection Collision Avoidance				✓
AVSS11	Automated Highway System				✓
COMMERCIAL VEHICLE OPERATIONS <i>Commercial Vehicle Operations (CVO)</i>					
CVO01	Fleet Administration	✓			
CVO02	Freight Administration				✓
CVO03	Electronic Clearance	✓			
CVO04	CV Administrative Processes	✓			
CVO05	International Border Electronic Clearance				✓
CVO06	Weigh-In-Motion	✓			
CVO07	Roadside CVO Safety	✓			
CVO08	On-board CVO Safety				✓
CVO09	CVO Fleet Maintenance				✓
CVO10	HAZMAT Management		✓		
EMERGENCY MANAGEMENT <i>Emergency Management (EM)</i>					
EM1	Emergency Response	✓			
EM2	Emergency Routing				✓
EM3	Mayday Support				✓
EM4	Roadway Service Patrols	✓			
MAINTENANCE & CONSTRUCTION OPERATIONS <i>Maintenance & Construction Operations (MCO)</i>					
MC01	Maintenance and Construction Vehicle Tracking			✓	
MC02	Maintenance and Construction Vehicle Maintenance				✓
MC03	Road Weather Data Collection	✓			
MC04	Weather Information Processing and Distribution	✓			
MC05	Roadway Automated Treatment				✓
MC06	Winter Maintenance	✓			
MC07	Roadway Maintenance and Construction	✓			
MC08	Work Zone Management		✓		
MC09	Work Zone Safety Monitoring		✓		
MC10	Maintenance and Construction Activity Coordination		✓		



2.4 ITS Operational Concepts

Operational concepts focus on a definition of each stakeholder's role in providing the region's intelligent transportation systems and services. The operational concept process develops and documents stakeholders' current and future roles and responsibilities in the implementation and operation of ITS based on a common regional architecture. An operational concept is one of the required components of a regional ITS architecture. In later steps, these roles and responsibilities will form the basis for interagency agreements.

This section first presents an overall high-level conceptual representation of the Inland Empire Architecture, provided in **Figure 2.4-1**. This diagram was derived based on inventory analysis and an understanding of stakeholder needs. Major needs categories addressed in this conceptual architecture diagram include the following:

- Arterial / Traffic Management
- Freeway Management Systems
- Public Transportation Management
- Emergency Management
- Maintenance and Construction Operations
- Regional Traveler Information
- Commercial Vehicle Operations

Operational concepts are then presented in **Table 2.4-1** detailing the projected roles and responsibilities of groupings of Inland Empire stakeholders. The stakeholder groupings include:

- California Highway Patrol (CHP)
- Local Police, Fire, Ambulance
- Caltrans D8
- County Emergency Agencies, Sheriff's Departments, County/Regional 9-1-1 Call Centers
- Local City and County Traffic Operations
- Transit Operators
- Commercial Vehicle Operators



Figure 2.4-1 – Inland Empire Architecture Conceptual Implementation

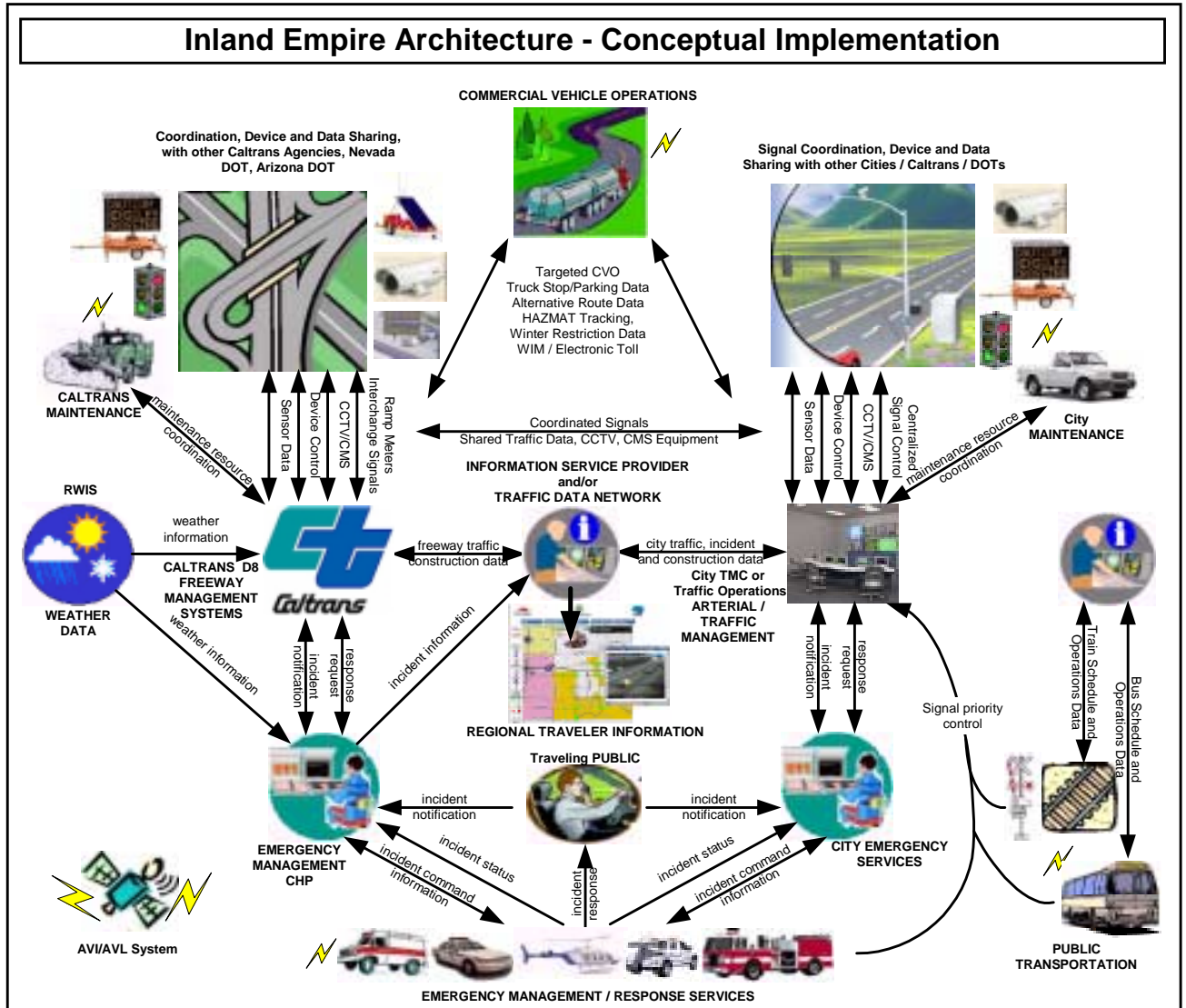




Table 2.4-1 – Inland Empire Operational Concept

Operating Agency	Roles / Responsibility
California Highway Patrol	<ul style="list-style-type: none"> • Receive public safety calls from cellular (wireless) telephones and forward to appropriate dispatch center • Dispatch state patrol vehicles • Interface with other emergency and traffic agencies to support coordinated emergency response involving multiple agencies • Create, store, and utilize emergency response plans to facilitate coordinated response • Track and manage emergency vehicle fleets using automated vehicle location technology and two-way communications with the vehicle fleet • Use real-time traffic information received from other agencies to aide the emergency dispatcher in selecting the emergency vehicle(s) and routes that will provide the most timely response • Monitor traffic on designated arterials • Provide traffic and incident information to the public • Maintain centralized emergency management systems software and systems • Perform other “non-transportation related” public safety duties • Update Information to ISP and Media Outlets (web sites, TV, etc.) and request alerts on CMS and HAR equipment • Report State Highway road closures to all agencies • Be first responder to incidents (typically) • Request Emergency Services actions taken or needed • Maintain resource database updated for others to monitor • Operate and monitor electronic credentialing and safety screening programs
Local Police, Fire, Ambulance	<ul style="list-style-type: none"> • Receive public safety calls from land line telephones and forward to appropriate dispatch center • Dispatch local police, fire and ambulance vehicles • Interface with other emergency and traffic agencies to support coordinated emergency response involving multiple agencies • Create, store, and utilize emergency response plans to facilitate coordinated response • Track and manage emergency vehicle fleets using automated vehicle location technology and two-way communications with the vehicle fleet • Use real-time traffic information received from other agencies to aide the emergency dispatcher in selecting the emergency vehicle(s) and routes that will provide the most timely response



Operating Agency	Roles / Responsibility
	<ul style="list-style-type: none"> • Monitor traffic on designated arterials • Provide traffic and incident information to drivers • Maintain centralized emergency management systems software and systems • Share CCTV, CMS and HAR equipment and its control with partner agencies • Perform other “non-transportation related” public safety duties
Caltrans D8	<ul style="list-style-type: none"> • Manage traffic on freeway on-ramps and Caltrans controlled highways using traffic signals including preemption for emergency • Monitor traffic on freeway on-ramps and Caltrans controlled highways • Provide traffic and incident information to drivers • Implement traffic control response to incidents • Coordinate traffic control response to incidents with emergency and traffic agencies • Share traffic information with other emergency and transportation agencies • Share control of field equipment with other transportation and emergency agencies • Maintain field equipment • Provide resources when requested by emergency management agencies • Coordinate road closures with other agencies • Maintain centralized emergency management systems software and systems • Maintain centralized signal systems and software • Receive signal priority requests from transit operators (where applicable) • Provide transit signal priority requests (where applicable) • Determine maintenance vehicle locations • Send location information to agency center • Maintain vehicle status for deployment • Send status information to agency center • Maintain AVI/AVL systems for maintenance vehicles • Monitor weather conditions with available CCTV and RWIS sensors and provide road weather conditions to other agencies • Provide snowplow operations support and availability information for other agencies (CHP, county sheriff, etc.) • Update Information to ISP and Media Outlets (web sites, TV, etc.) and issue alerts on CMS and HAR equipment • Install CCTV cameras, CMS and HAR along the freeways • Share freeway CCTV, CMS and HAR equipment and its control with partner agencies • Maintain systems



Operating Agency	Roles / Responsibility
County Emergency Agencies, County Sheriff's Departments, County / Regional 9-1-1 Call Centers (Riverside and San Bernardino Counties)	<ul style="list-style-type: none"> • Maintain resource database updated for others to monitor • Receive public safety calls and forward to appropriate dispatch center • Dispatch emergency vehicles for various public safety agencies in the county that do not have local dedicated dispatch capabilities • Dispatch sheriff vehicles • Interface with other emergency and traffic agencies to support coordinated emergency response involving multiple agencies • Create, store, and utilize emergency response plans to facilitate coordinated response • Track and manage emergency vehicle fleets using automated vehicle location technology and two-way communications with the vehicle fleet • Use real-time traffic information received from other agencies to aide the emergency dispatcher in selecting the emergency vehicle(s) and routes that will provide the most timely response • Monitor traffic on arterials • Provide traffic and incident information to the public • Perform other “non-transportation related” public safety duties • Maintain centralized emergency management systems software and systems • Report County road closures to all agencies • Request Emergency Services actions taken or needed
Local City and County Traffic Operations	<ul style="list-style-type: none"> • Manage traffic on arterials using traffic signals including preemption for emergency vehicles and at highway-rail intersections • Maintain centralized signal systems and software • Monitor traffic on arterials • Provide traffic and incident information to the public • Install CCTV cameras, CMS, and HAR along major corridors • Maintain systems • Implement traffic control response to incidents • Coordinate traffic control response to incidents with emergency and traffic agencies • Share traffic information with other emergency and transportation agencies • Share control of field equipment with other transportation and emergency agencies • Maintain field equipment • Provide resources when requested by emergency management agency • Coordinate road closures with other agencies • Receive signal priority requests from transit operators (where applicable) • Provide transit signal priority requests (where applicable)



Operating Agency	Roles / Responsibility
	<ul style="list-style-type: none"> • Determine maintenance vehicle locations for respective agency • Send location information to agency center • Maintain vehicle status for deployment • Send status information to agency center • Monitor weather conditions with available CCTV and RWIS sensors and provide road weather conditions to other agencies • Provide snowplow operations support and availability information for other agencies (CHP, county sheriff, etc.) • Initiate adverse weather event signal timing and coordination where feasible • Update Information to ISP and Media Outlets (web sites, TV, etc.) and issue alerts on CMS and HAR equipment. • Maintain resource database updated for others to monitor
Transit Operators	<ul style="list-style-type: none"> • Receive bus location and occupancy information from AVI/AVL system • Send bus status and location information to transit center • Maintain passenger counts • Send passenger counts to transit center • Maintain AVI/AVL system • Issue requests for traffic signal priority (where applicable) • Maintain Transit Center software and systems • Determine maintenance vehicle locations for respective agency • Send location information to agency center • Maintain vehicle status for deployment • Send status information to agency center
Commercial Vehicle Operators	<ul style="list-style-type: none"> • Uses AVI/ AVL system to determine vehicle location • Provide location information to Trucking Center, Caltrans and CHP (as appropriate) • Participate in electronic credentialing and safety screening programs • Maintain AVI/AVL system

2.5 Next Steps

This draft ITS Needs, Services, and Operational Concepts Report has been completed based on analysis of the Inland Empire inventory, needs, and services. The Inland Empire ITS stakeholders are asked to review this report with a critical eye for accuracy and representation of their input. Comments are requested back to the consultant team by April 2, 2003. Comments will be dispositioned and this report will be fine-tuned as a chapter in the Final Report. More importantly, stakeholder input will be used for solidifying the next steps of defining ITS interfaces and interconnects. The workshop scheduled for April 8, 2003 will discuss the findings in this report and will introduce the upcoming interface and interconnect results.



INLAND EMPIRE REGIONAL ITS ARCHITECTURE PROJECT
DRAFT ITS NEEDS, SERVICES AND OPERATIONAL CONCEPTS REPORT

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APPENDIX A
ITS NEEDS SURVEY



ITS Needs Survey and Exercise

Background:

The following pages contain a fairly comprehensive listing of ITS Needs that Iteris compiled based on our knowledge of the Inland Empire transportation challenges and based on situations we have encountered in other similar locales. This list was distributed at the project Workshop conducted in San Bernardino, this past Tuesday (March 4, 2003). The group went over the list in some detail and Iteris was able to garner some valuable input regarding Relative Priority of specific Needs on the list.

How can you help?

We are asking all of the project stakeholders to scan through the following list of potential ITS Needs and give us their input on relevancy and priority. Please let us know whether specific Needs are either a High Priority for the Region or a Low Priority for the Region, from your perspective. There is even value in having reviewers scan only specific subject areas of the list to provide input. For example, there would be value in having transit agency representatives review and provide input on the Public Transportation Management portion of the list, even if they do not provide input on other portions of the list. Also, more importantly, please let us know if you have any other items to add to the list.

Specific Instructions:

Please insert your name, agency and other requested contact information on the following page. Then please review the following list of ITS Needs and provide your input on the relative priority of selected Needs for the Inland Empire. Insert the letter H for High, M for Medium and L for Low in the “Relative Priority” column of the ITS Needs list.

Then, please email this file to Tom Petrosino, of Iteris at tmp@iteris.com.

We will then take the input into account when preparing the upcoming Needs and Services deliverable.



Workshop #2
ITS Needs Exercise

Reviewer Name	
Representing	
Phone #	
Email address	



INLAND EMPIRE REGIONAL ITS ARCHITECTURE PROJECT
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H=High, M=Medium, L=Low

ITS Categories	Needs	Relative Priority
Arterial / Traffic Management		
<i>Examples: Signal Coordination, Centralized Control, Vehicle Detection Systems, Video Systems, Adaptive Signal Control, Traffic Management Systems / Centers, Highway Rail Intersection Technologies</i>	Improve system operation monitoring	
	Provide systemwide arterial management strategies	
	Develop access management plans/strategies (signal spacing)	
	Improve signal optimization	
	Improve traffic flow monitoring	
	Provide more widespread centralized computer control	
	Improve hardware issues in interconnecting signal systems between agencies	
	Improve signal control and timing	
	Improve/implement ability to remotely modify signal timing	
	Better manage congestion at signals	
	Reduce detector failures when pavement “breaks up”	
	Improve emergency vehicle preemption systems (speed-up return to coordination)	
	Reduce emergency vehicle delays at signals	
	Reduce transit vehicle delays at signals	
	Better balance signal timings favoring local traffic over through traffic	
	Improve inter-jurisdictional continuity	
	Upgrade signal hardware	
	Implement or improve signal coordination	
	Better manage periods of high traffic demand in poor roadway conditions	
	Provide quality real time congestion related information	
	Remote monitoring of signal system status / operations by public safety agencies	
	Reduce vehicle traffic delays at grade crossings	
	Better coordinate grade crossing operations with signals	
Deploy network vs. corridor based signal coordination		



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H=High, M=Medium, L=Low

ITS Categories	Needs	Relative Priority
Freeway Management Systems		
<i>Examples: Vehicle Speed Detection Systems, Video Systems, Ramp Metering, Variable Message Signs, Highway Advisory Radio, Traffic Management Systems/Centers</i>	Deploy additional vehicle detection coverage	
	Implement additional field device interconnect	
	Improve collection of traffic demand data	
	Improve inter-agency coordination	
	Improve information exchange between Caltrans District 8 and other Caltrans Districts	
	Improve information exchange between Caltrans and Nevada DOT and Arizona DOT	
	Improve information exchange between Caltrans District 8 and other local agencies	
	Improve incident response, especially in rural areas	
	Disseminate more timely incident information dissemination (traveler information)	
	Better manage periods of high traffic demand in poor roadway conditions	
	Provide quality real time congestion related information	
	Improve traveler information/directions (suggested routing for travelers not familiar with the region)	



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ITS Categories	Needs	Relative Priority
Public Transportation Management		
<i>Examples: Public Transportation Management, En-route Transit Information, Personalized Public Transit, Public Traveler Safety, Traveler Service Information, Ride Matching and Reservations, Smart Card Payment/Transaction Systems</i>	Improve regional and interregional trip planning	
	Improve patron safety (in-vehicle and at stations / waypoints)	
	Better notification and coordination of special event loads resulting in congestion	
	Provide transit priority at signals	
	Implement bus queue jump lanes	
	Improve transit transfers within and between systems and modes to improve service delivery	
	Enable dissemination / display of bus arrival times	
	Enable transit agencies to locate bus fleet (AVI/AVL)	
	Improved information exchange between/among transit agencies	
	Improved information exchange between transit agencies and freeway / arterial management centers	
	Disseminate better rail information and arrival times (connectivity issues)	
	Provide quality real time congestion related information	
	Enable emergency information dissemination to transit operators	
	Improve efficiency of social service transportation providers	



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ITS Categories	Needs	Relative Priority	
Emergency Management			
<i>Examples: Incident Detection, Incident Management, Hazardous Materials Response and Handling, Emergency Notification and Personal Security, Emergency Vehicle Management, Advanced Dispatching and Response Systems</i>	Reduce response delays at signals		
	Improve response to weather events		
	Provide alternate route plans		
	Increase broad understanding of existing incident management procedures for: OES, FEMA, FHWA, CDF, USFS, CHP, Fish & Game, etc.		
	Increase broad understanding of, and implement Standardized Emergency Management System (SEMS)		
	Better notification of recreational routes closed in winter		
	Improve incident response coordination between agencies		
	Improve incident detection		
	Improve incident response times		
	Improve communications in mountain and rural areas of the region		
	Better information dissemination regarding diversion of trucks		
	Improve traffic management during wildfires (evacuation, response, suppression, etc.)		
	Improve response to hazardous materials spills / incidents (better manage resulting traffic congestion, improve clean-up time)		
	Increase use of portable traffic control equipment (CMS, HAR, etc.)		
	Provide quality real time congestion related information		
	Improve traveler information / directions (suggested routing for travelers not familiar with the region)		



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H=High, M-Medium, L=Low

ITS Categories	Needs	Relative Priority
Maintenance and Construction Operations		
<i>Examples: Advanced Work Zone Management and Traffic Control, Vehicle Detection Systems, Video Systems, Vehicle / Speed Detection Systems, Variable Message Signs, Highway Advisory Radio, Integration with Traffic Management Systems / Centers, Advanced Dispatching and Routing Systems, Advanced Vehicle Tracking Systems, Fleet Maintenance and Management Systems</i>	Provide automated vehicle location systems for maintenance and construction operations vehicles	
	Improve / enhance work zone traffic handling plans	
	Improve detection and removal of falling rocks, snow, mud and trees on roadways	
	Provide more data source locations for the National Weather Service	
	Improve coordination on construction notification and information distribution	
	Improve fleet information / management (maintenance schedules, mileage accumulations, tracking snow removal vehicles w/AVL)	
	Coordinate traffic control plans between jurisdictions	
	Increase use of portable traffic control equipment (CMS, HAR, etc.)	
	Provide signal preemption for some maintenance fleet vehicles	
	Interagency coordination on most advantageous placement of maintenance vehicles (prior to anticipated need)	
	Provide quality real time congestion related information	
	Improved traveler information/directions (suggested routing for travelers not familiar with the region)	



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ITS Categories	Needs	Relative Priority
Regional Traveler Information		
<i>Examples: En-route Traveler Information, Pre-trip Traveler Information, Portable Event Management Systems, In-vehicle Route Guidance, Traffic Information, Variable Message Signs, Highway Advisory Radio, Internet, Media, Tourist Information Systems</i>	Provide quality real time congestion related information	
	Expand traveler information delivery methods	
	Improve method of disseminating Caltrans delay and incident data	
	Use public access cable television to disseminate traffic and weather information	
	Improve quality and timeliness of communications	
	Improve processes for announcing when chain control is in effect in mountains and passes	
	Better disseminate correct traffic information	
	Provide timely, accurate information on road conditions	
	Better manage traffic flow to and from recreation areas	
	Improve procedures to get accurate information disseminated in a timely manner	
	Develop interstate / inter-region traveler information covering a wide area (targeted to CVO)	
	Improve targeted traveler information for tourists and recreation travelers at visitor information areas / rest stops, etc.	
	Provide weather and road info access at rest stops (could be radar screen video/monitor)	
	Provide more data source locations for the National Weather Service	
	Provide information distribution to private/commercial information service providers (ISPs)	
	Provide better road construction information and notification	
	Provide more timely dissemination of traveler information	
	Provide alternate weather and road information	
	Improve traveler information/directions (suggested routing for travelers not familiar with the region)	



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ITS Categories	Needs	Relative Priority
Commercial Vehicle Operations		
<i>Examples: Commercial Vehicle Electronic Clearance, Automated Roadside Safety Inspection, On-board Safety Monitoring, Commercial Vehicle Administration Processes, Hazardous Material Incident Response, Commercial Vehicle Fleet Management, Services to Assist Agricultural Harvesting and Migration</i>	Provide interstate / inter-region traveler information covering a wide area (targeted to CVO)	
	Provide tracking of hazmat vehicles	
	Provide better information dissemination of winter vehicle restrictions (Chain control issues (ON/OFF))	
	Provide quality real time congestion related information	
	Improve truck storage / parking information (during major road closures)	
	Disseminate better information regarding limited alternative routes	
	Improve congestion management during seasonal/local events	



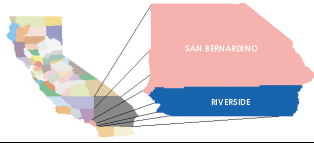
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H=High, M=Medium, L=Low

ITS Categories	Needs	Relative Priority
Electronic Payment Systems		
<i>Examples: Electronic Toll Collection Systems, Electronic Transit Fare Payment Systems (Smart Cards)</i>	Improved transit fare payment systems	

H=High, M=Medium, L=Low

ITS Categories	Needs	Relative Priority
Advanced Vehicle Control and Safety Systems		
<i>Examples: Longitudinal Collision Avoidance, Lateral Collision Avoidance, Intersection Collision Avoidance, Vision Enhancement for Crash Avoidance, Safety Readiness, Pre-crash Restraint Deployment, Automated Highway System</i>	Snow plow tracking project	
	Advanced warning signs for road icing, excess speed, etc.	
	Reduce red light running	



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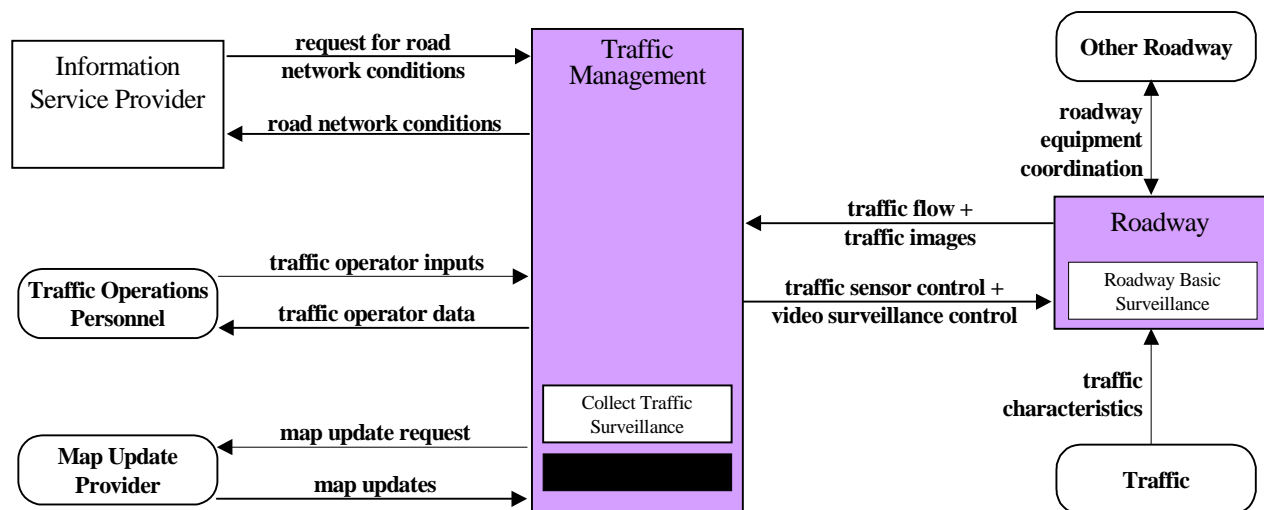
ITS Categories	Needs	Relative Priority
Integration		
<i>Examples: Integration of Systems, Integration With Traffic Management Centers, Central vs. Distributed Control, Communications Infrastructure, Integration of Agencies, Institutional Issues</i>	Improve information sharing among agencies	
	Improve communication limitations	
	Reduce dependency on proprietary systems	
	Improve understanding and capabilities of other agencies	
	Develop better understand needs of other agencies	
	Coordination with schools and Office of Emergency Services	
	Provide central information clearinghouse	
	Use common verbiage	
	Use common road condition classifications	
	Reduce impacts of different operating systems for signal control	
	Develop integrated GIS for Region	
	Develop political agreements (MOUs)	
	Improve system compatibility	
	Improve agency coordination (Incident Mgmt, General Information, ICS & Incident Command)	

APPENDIX B
NATIONAL ITS ARCHITECTURE
MARKET PACKAGES

Traffic Management: ATMS

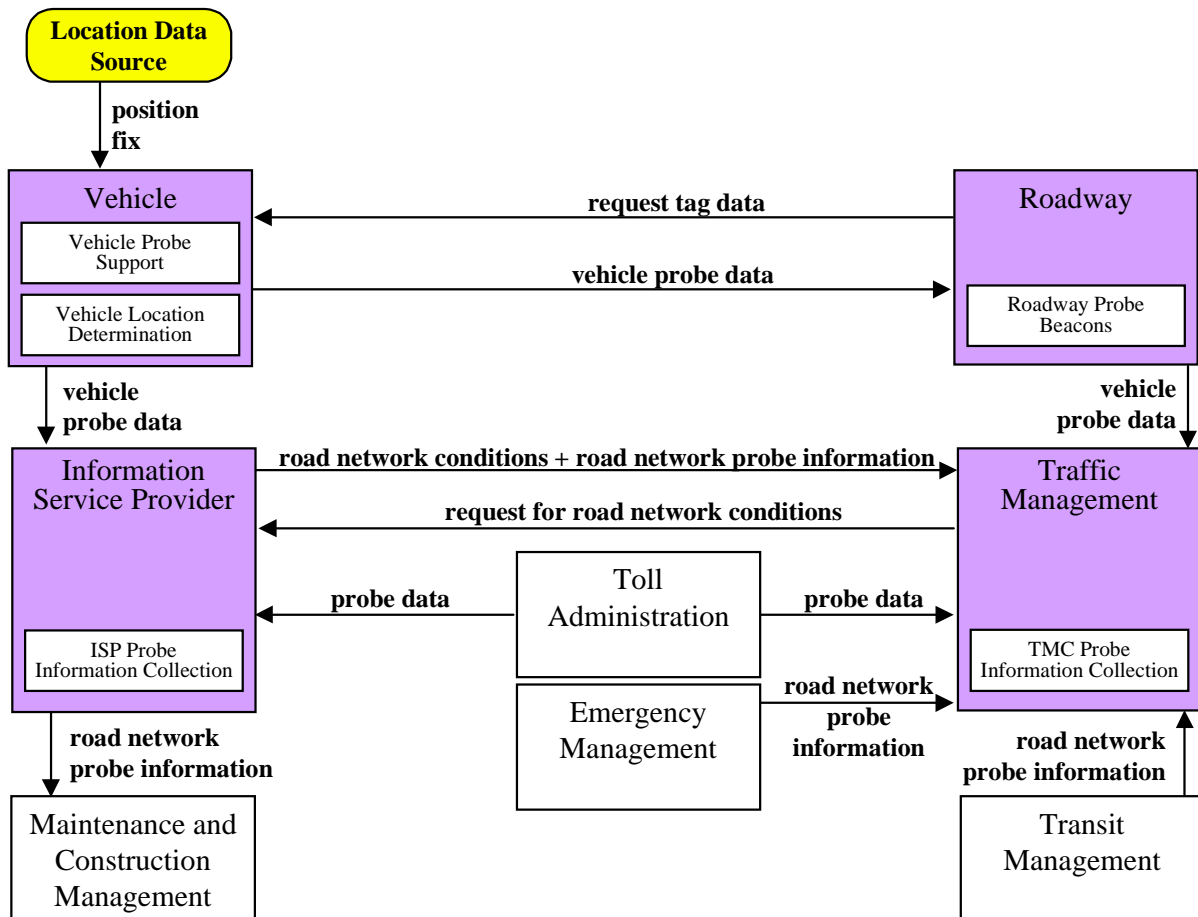
Network Surveillance (ATMS1)

This market package includes traffic detectors, other surveillance equipment, the supporting field equipment, and wireline communications to transmit the collected data back to the Traffic Management Subsystem. 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 Traffic Management Subsystem). 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.



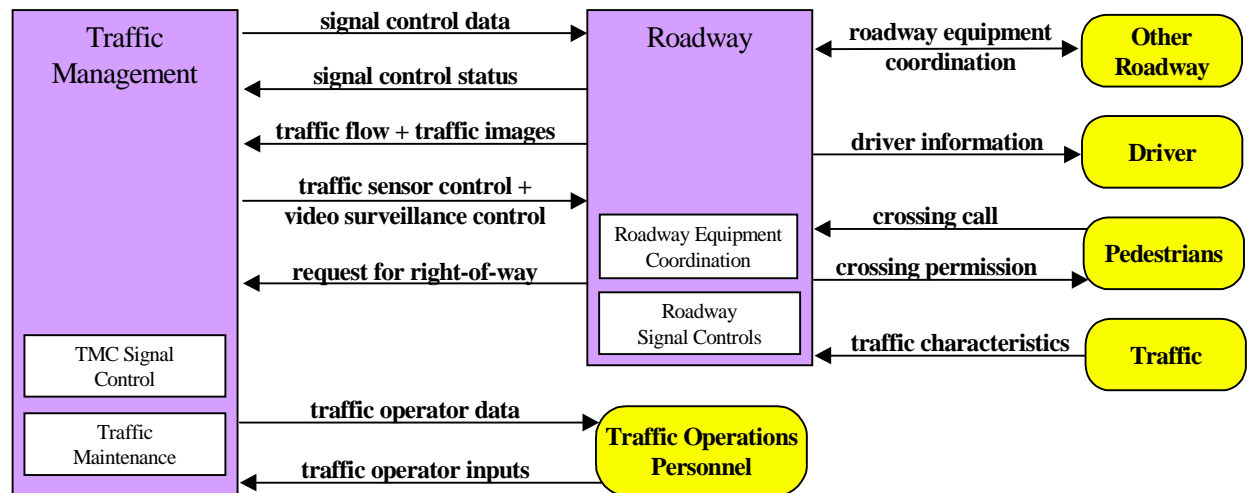
Probe Surveillance (ATMS2)

This market package provides an alternative approach for surveillance of the roadway network. Two general implementation paths are supported by this market package: 1) wide-area wireless communications between the vehicle and Information Service Provider is used to communicate current vehicle location and status, and 2) dedicated short range communications between the vehicle and roadside is used to provide equivalent information back to the Traffic Management Subsystem. The first approach leverages wide area communications equipment that may already be in the vehicle to support personal safety and advanced traveler information services. The second approach utilizes vehicle equipment that supports toll collection, in-vehicle signing, and other short range communications applications identified within the architecture. 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 wireline communications for the short range communications option, data reduction software, and utilizes wireline links between the Traffic Management Subsystem and Information Service Provider Subsystem to share the collected information. Both “Opt out” and “Opt in” strategies are available to ensure the user has the ability to turn off the probe functions to ensure individual privacy. Due to the large volume of data collected by probes, data reduction techniques are required in this market package which include the ability to identify and filter out-of-bounds or extreme data reports.



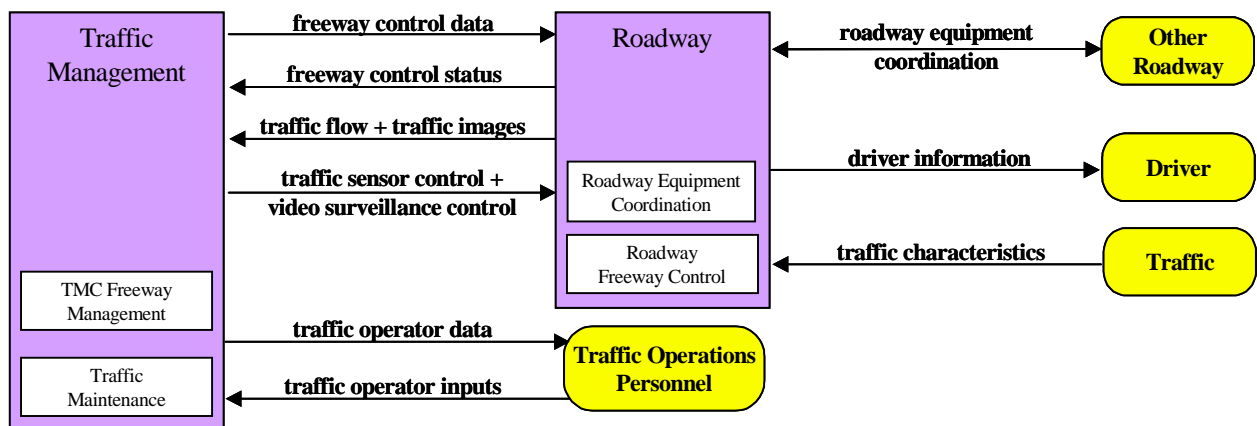
Surface Street Control (ATMS3)

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. 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. Additionally, general advisory and traffic control information can be provided to the driver while en-route. 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.



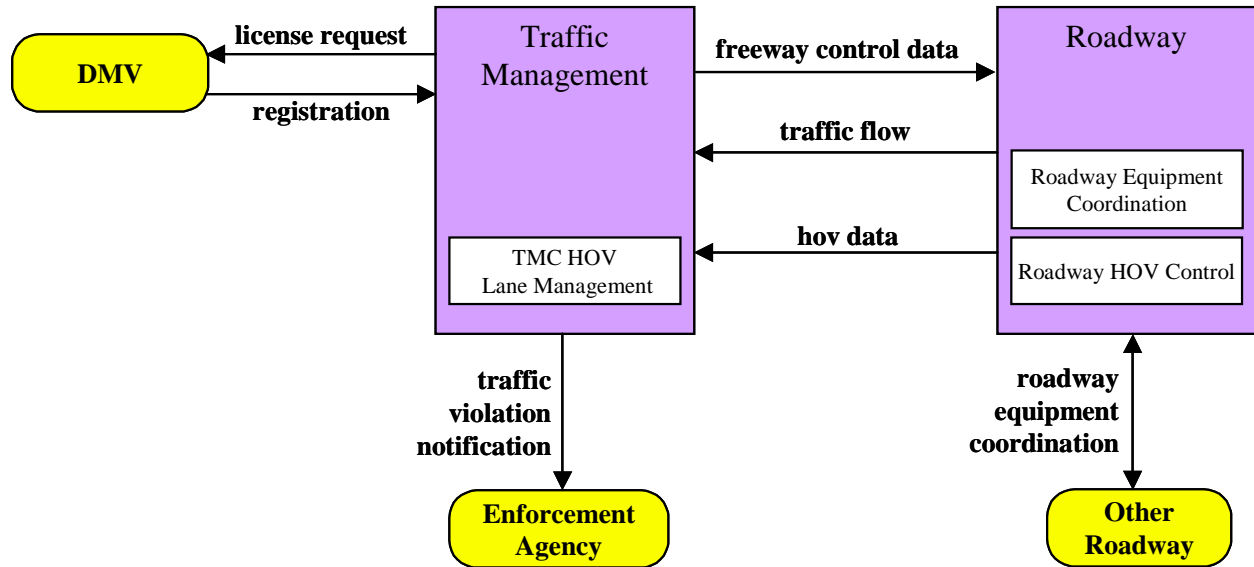
Freeway Control (ATMS4)

This market package provides the communications and roadside equipment to support ramp control, lane controls, and interchange control for freeways. 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. Typically, the processing would be performed at a traffic management center; however, developments might allow for point detection with roadway equipment. For example, a CCTV might include the capability to detect an incident based upon image changes. Additionally, this market package allows general advisory and traffic control information to be provided to the driver while en-route.



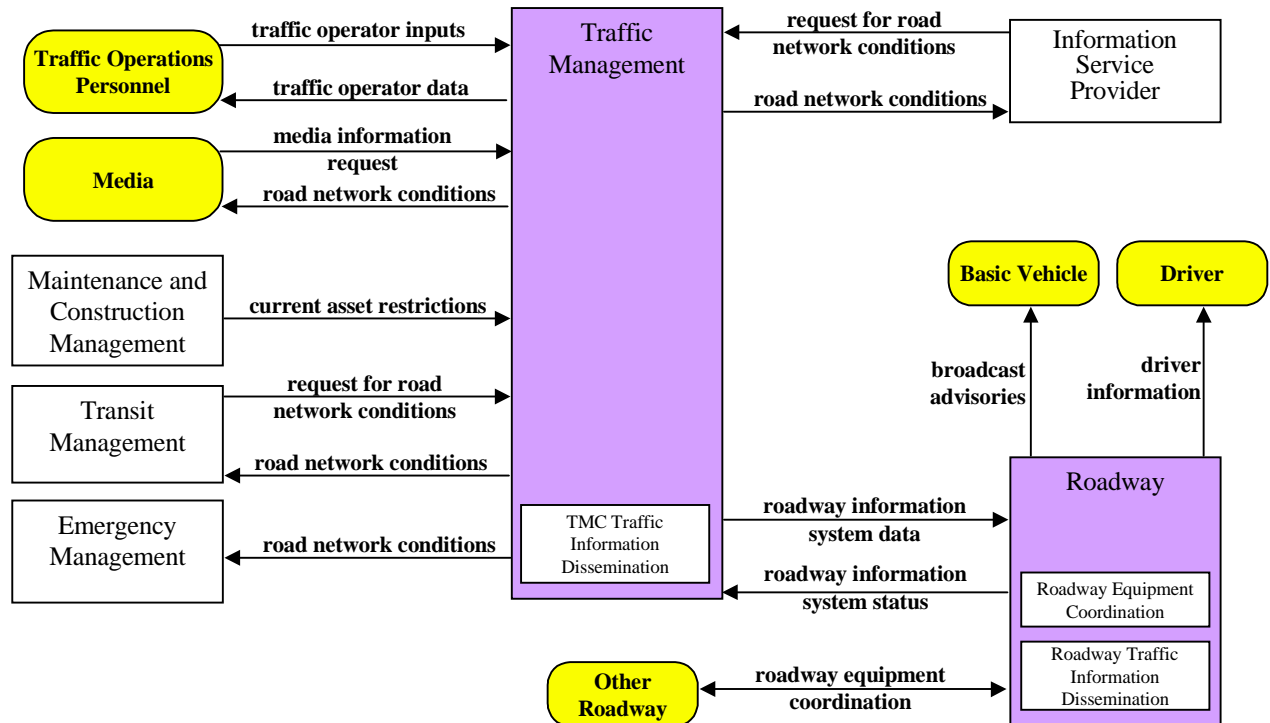
HOV Lane Management (ATMS5)

This market package manages HOV lanes by coordinating freeway ramp meters and connector signals with HOV lane usage signals. Preferential treatment is given to HOV lanes using special bypasses, reserved lanes, and exclusive rights-of-way that may vary by time of day. Vehicle occupancy detectors may be installed to verify HOV compliance and to notify enforcement agencies of violations.



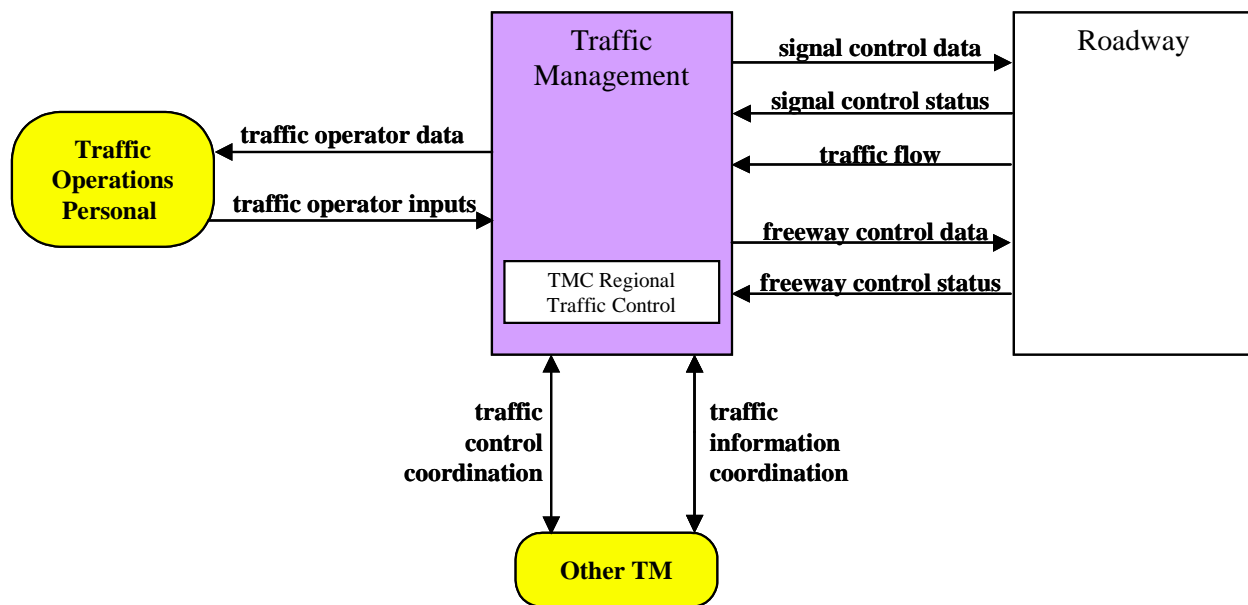
Traffic Information Dissemination (ATMS6)

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. This package provides a tool that can be used to notify drivers of incidents; careful placement of the roadway equipment provides the information at points in the network where the drivers have recourse and can tailor their routes to account for the new information. This package also covers the equipment and interfaces that provide traffic information from a traffic management center 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.



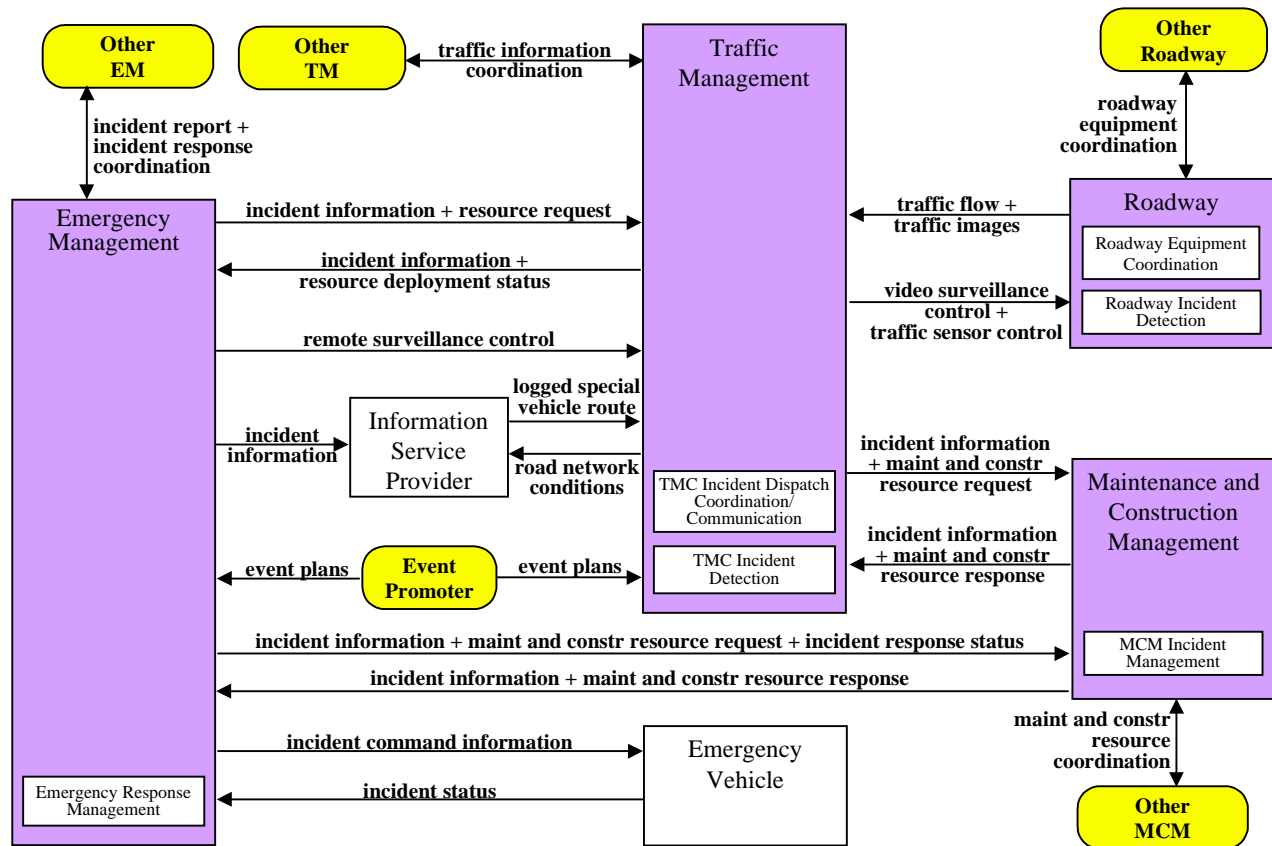
Regional Traffic Control (ATMS7)

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 Interjurisdictional traffic control. This market package provides for the sharing of traffic information and control among traffic management centers to support a regional control strategy. The nature of optimization and extent of information and control sharing is determined through working arrangements between jurisdictions. This package relies principally on roadside instrumentation supported by the Surface Street Control and Freeway Control Market Packages and adds hardware, software, and wireline communications capabilities to implement traffic management strategies which are coordinated between allied traffic management centers. Several levels of coordination are supported from sharing of information through sharing of control between traffic management centers.



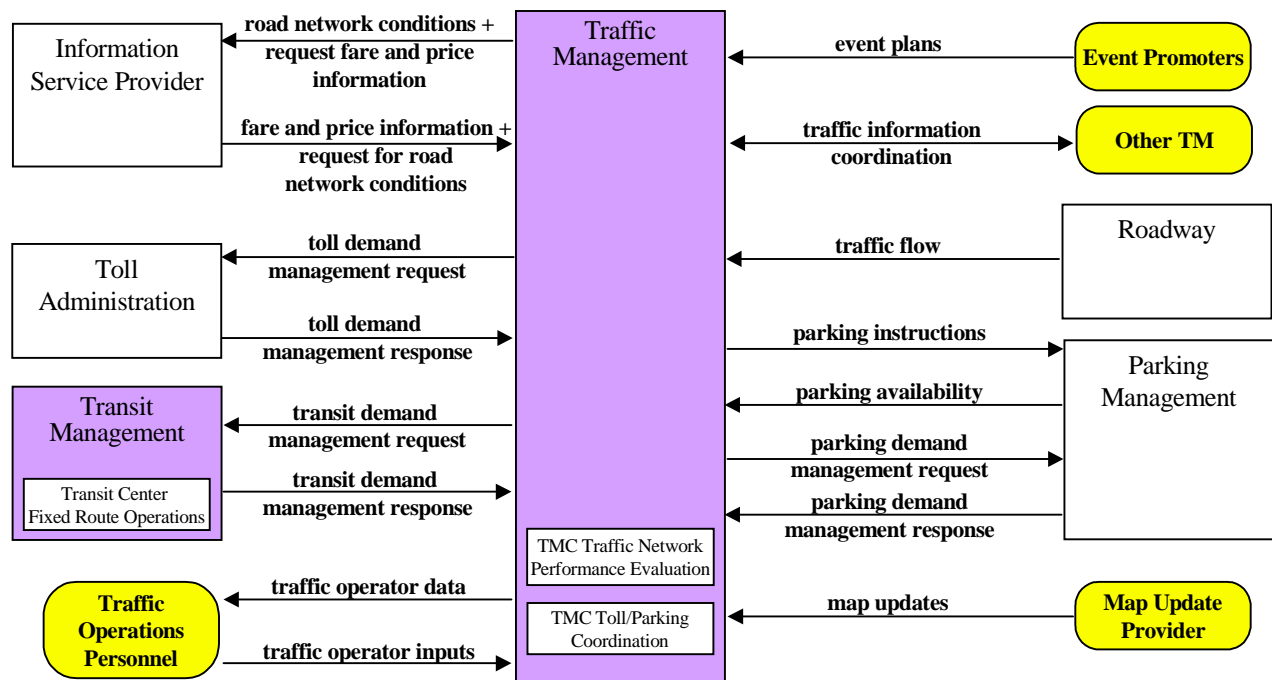
Incident Management System (ATMS8)

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. 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 or through other communication with emergency field personnel. The coordination can also extend to tow trucks and other field service personnel.



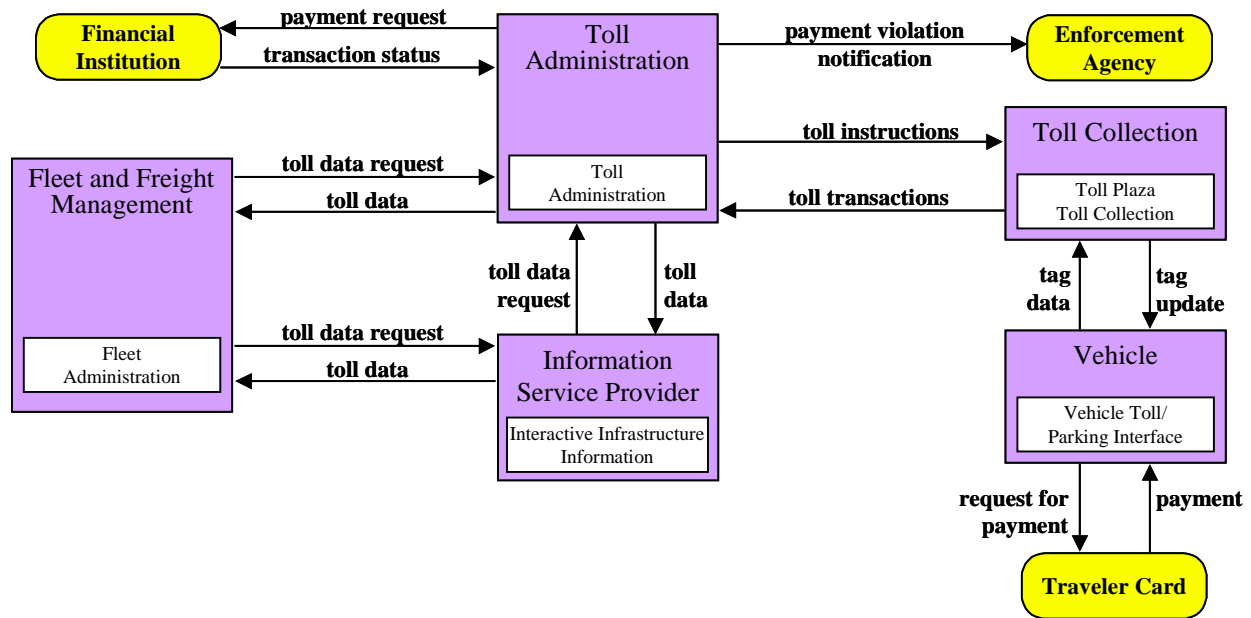
Traffic Forecast and Demand Management (ATMS9)

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. This includes the prediction of travel demand patterns to support better link travel time forecasts. The source data would come from the Traffic Management Subsystem itself as well as other traffic management centers and forecasted traffic loads derived from route plans supplied by the Information Service Provider Subsystem. In addition to short term forecasts, this market package provides longer range forecasts that can be used in transportation planning. This market package provides data that supports the implementation of TDM programs, and policies managing both traffic and the environment. Information on vehicle pollution levels, parking availability, usage levels, and vehicle occupancy are collected by monitoring sensors to support these functions. Demand management requests can also be made to Toll Administration, Transit Management, and Parking Management Subsystems.



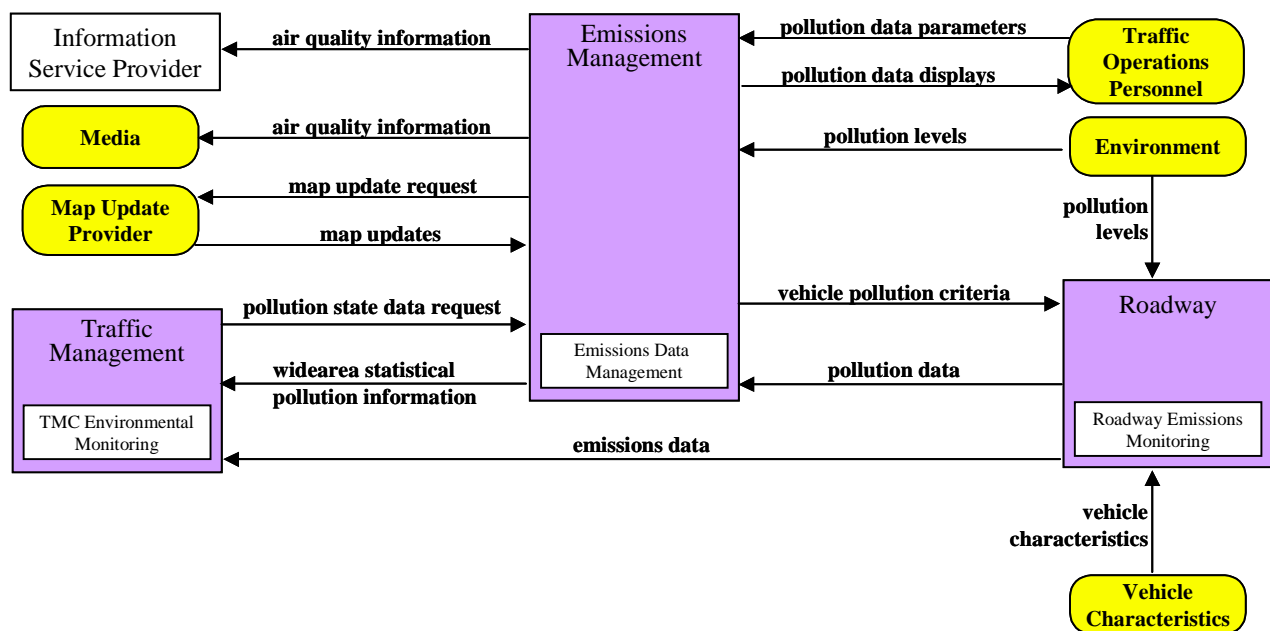
Electronic Toll Collection (ATMS10)

This market package provides toll operators with the ability to collect tolls electronically and detect and process violators. Variations in the fees that are collected enables implementation of demand management strategies. Dedicated short range communication between the roadway equipment and the vehicle is required as well as wireline interfaces between the toll collection equipment and transportation authorities and the financial infrastructure that supports fee collection. Vehicle tags of toll violators are read and electronically posted to vehicle owners. Standards, inter-agency coordination, and financial clearinghouse capabilities enable regional, and ultimately national interoperability for these services. The population of toll tags and roadside readers that these systems utilize can also be used to collect road use statistics for highway authorities. This data can be collected as a natural by-product of the toll collection process or collected by separate readers that are dedicated to probe data collection.



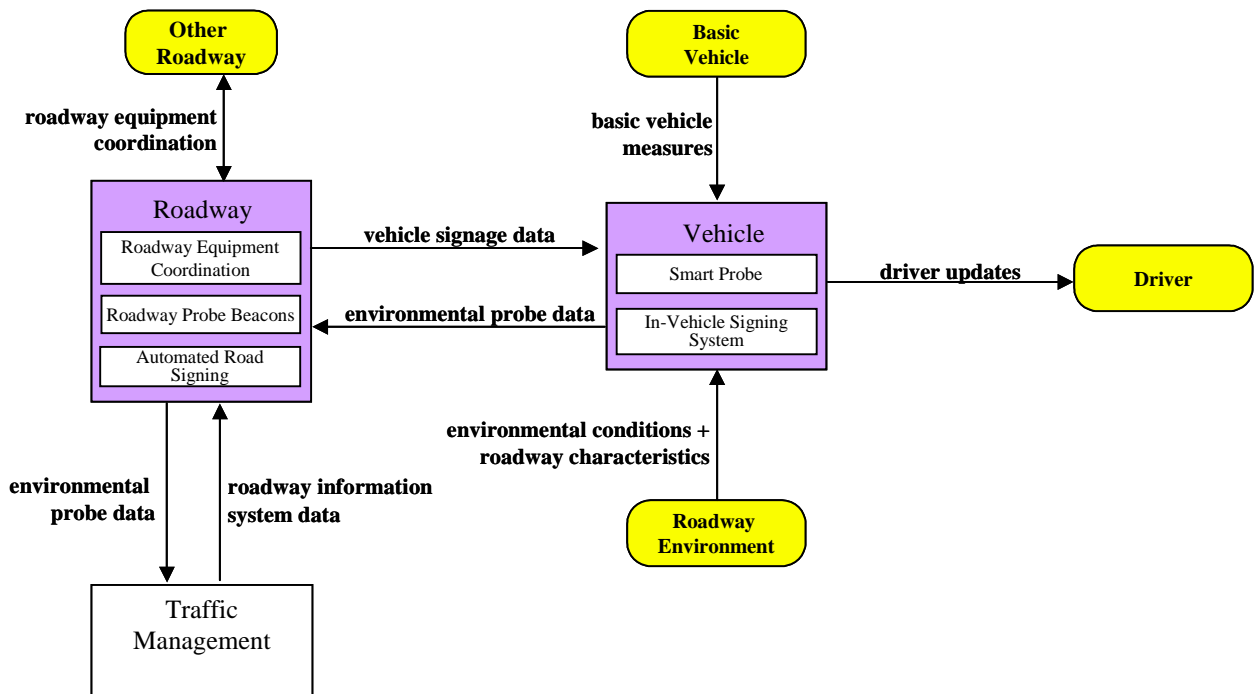
Emissions Monitoring and Management (ATMS11)

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. 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.



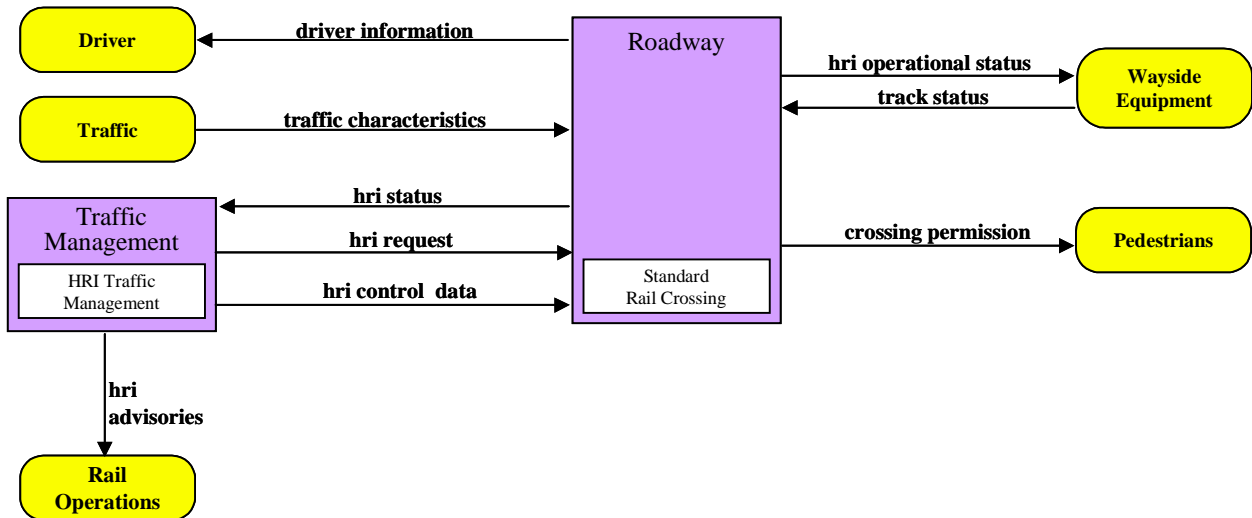
Virtual TMC and Smart Probe Data (ATMS12)

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 as smart probes that are capable of measuring road conditions and providing this information to the roadway for relay to the Traffic Management Subsystem and potentially direct relay to following vehicles (i.e., the automated road signing equipment is capable of autonomous operation). In-vehicle signing is used to inform drivers of detected road conditions.



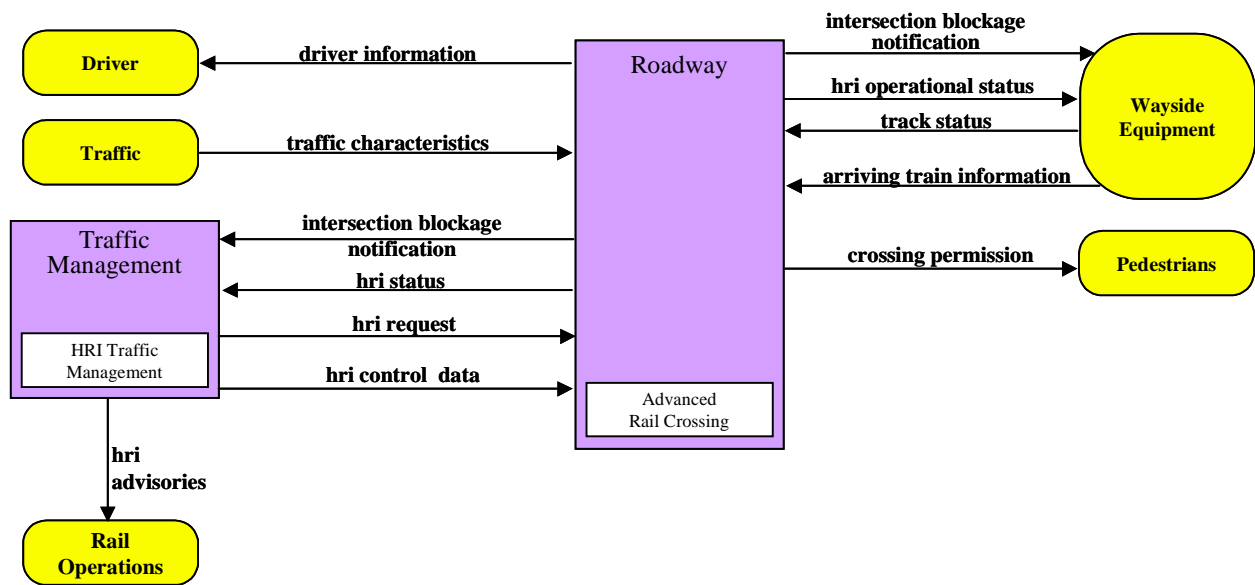
Standard Railroad Grade Crossing (ATMS13)

This market package manages highway 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 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 to both highway and railroad officials through wayside interfaces and interfaces to the traffic management subsystem. Similar interfaces and services are provided for other types of multimodal crossings (e.g., draw bridges).



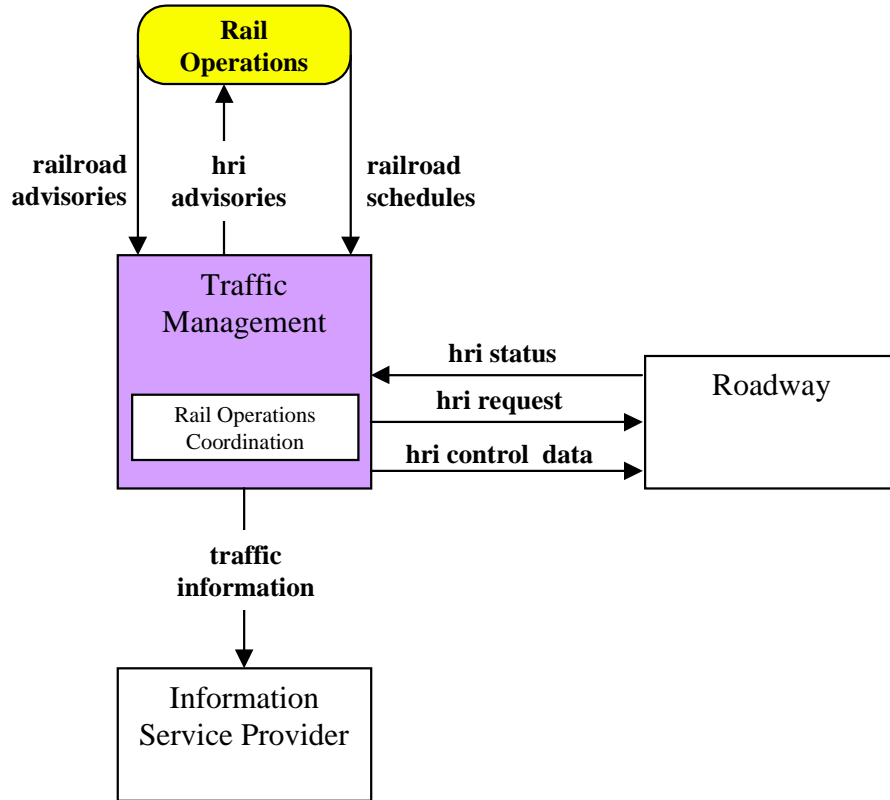
Advanced Railroad Grade Crossing (ATMS14)

This market 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). This market package includes all capabilities from the Standard Railroad Grade Crossing Market Package and augments these with additional safety features to mitigate the risks associated with higher rail speeds. The active warning systems supported by this market package include 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 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.



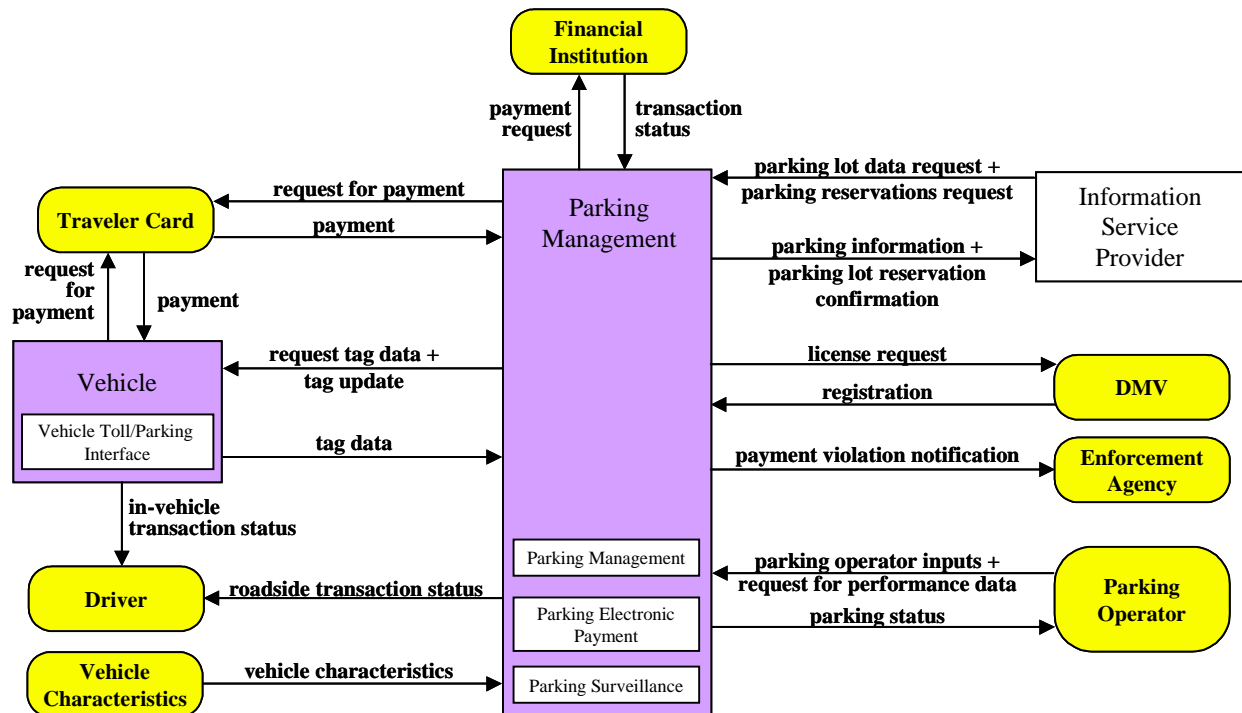
Railroad Operations Coordination (ATMS15)

This market package provides an additional level of strategic coordination between rail operations and traffic management centers. Rail operations provides train schedules, maintenance schedules, and any other forecast events which 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.



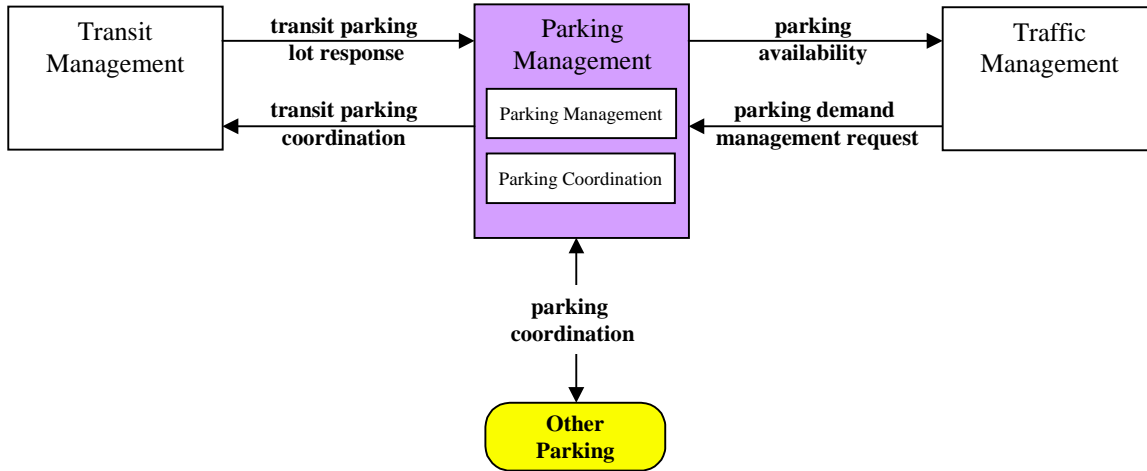
Parking Facility Management (ATMS16)

This market package provides enhanced monitoring and management of parking facilities. The included equipment assists in the management of parking operations, coordinates with transportation authorities, and supports electronic collection of parking fees. This is performed by sensing and collecting current parking facilities status, sharing the data with information service providers and traffic operations, and automatic fee collection using short range communications with the same in-vehicle equipment utilized for electronic toll collection.



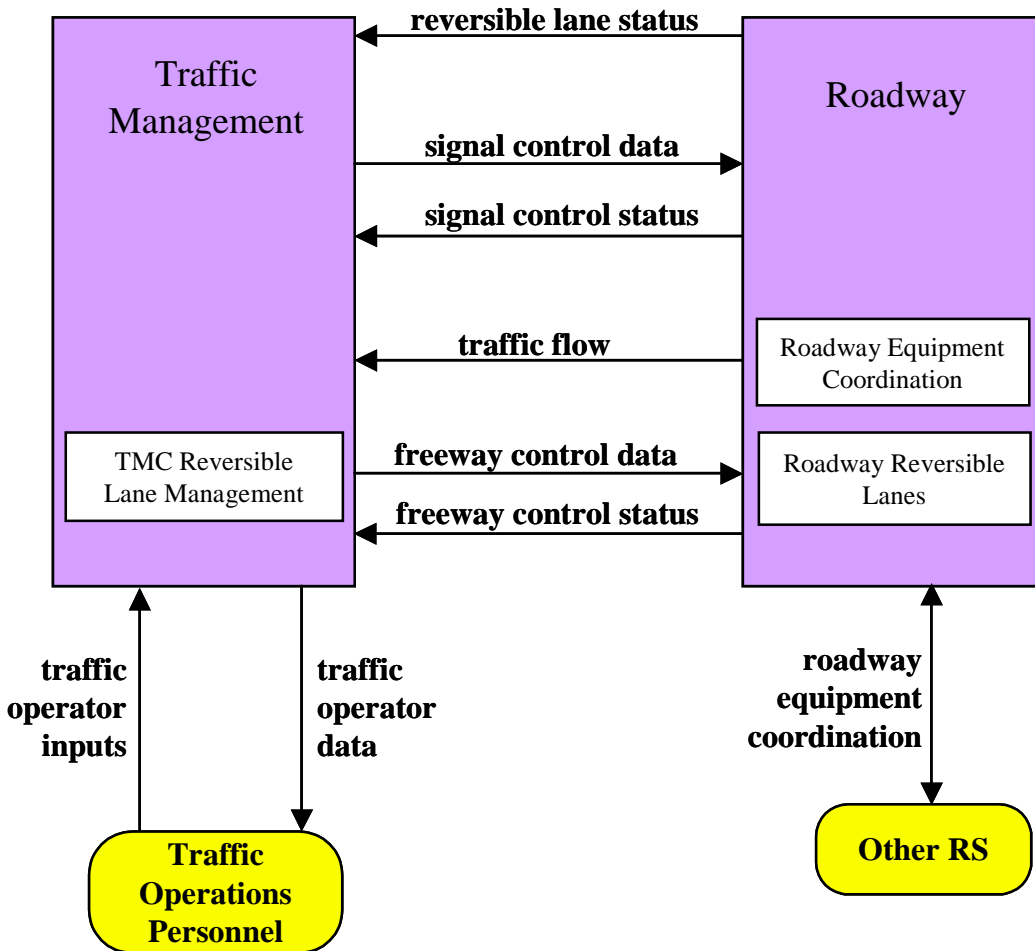
Regional Parking Management (ATMS17)

This market package supports coordination between parking facilities to enable regional parking management strategies.



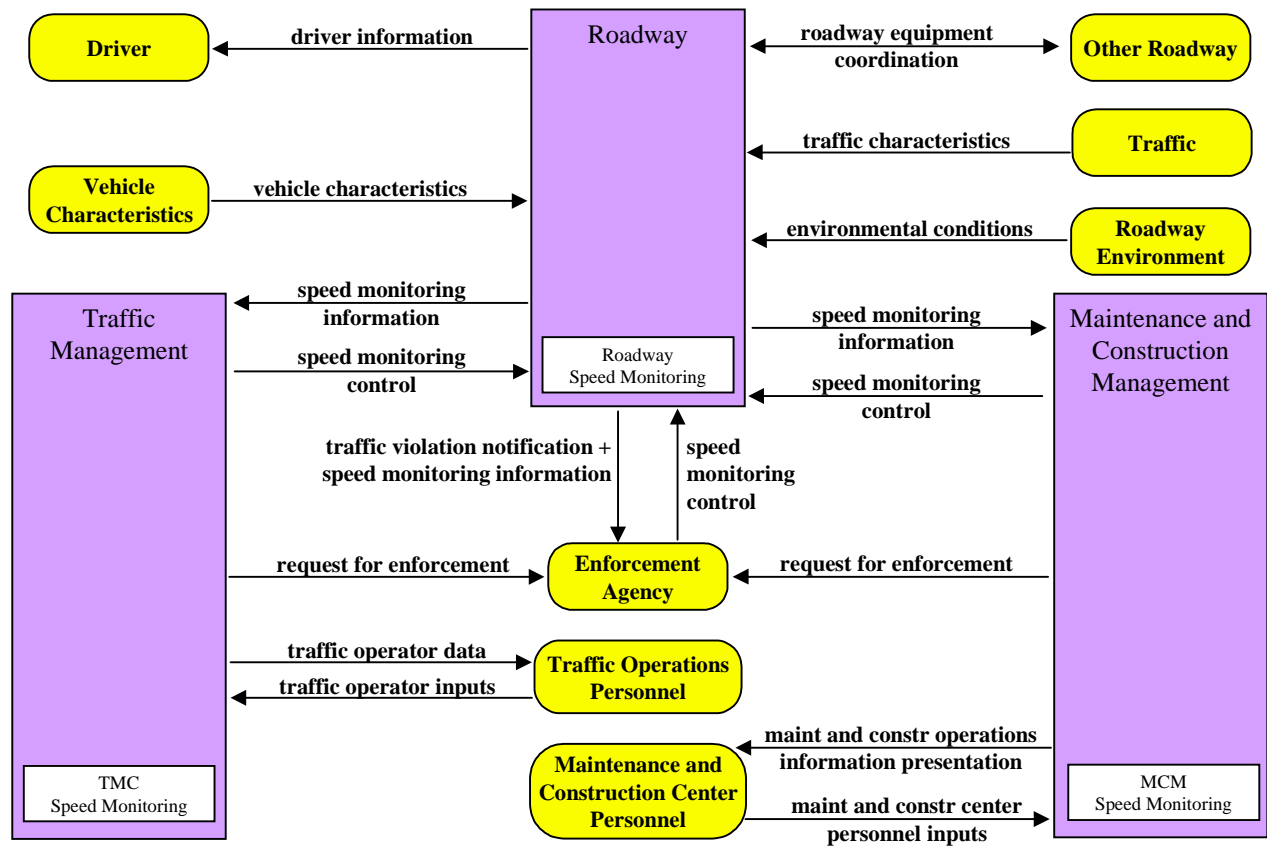
Reversible Lane Management (ATMS18)

This market package provides for the management of reversible lane facilities. In addition to standard surveillance capabilities, this market package includes sensory functions that detect wrong-way vehicles and other special surveillance capabilities that mitigate safety hazards associated with reversible lanes. The package includes the field equipment, physical lane access controls, and associated control electronics that manage and control these special lanes. This market package also includes the equipment used to electronically reconfigure intersections and manage right-of-way to address dynamic demand changes and special events.



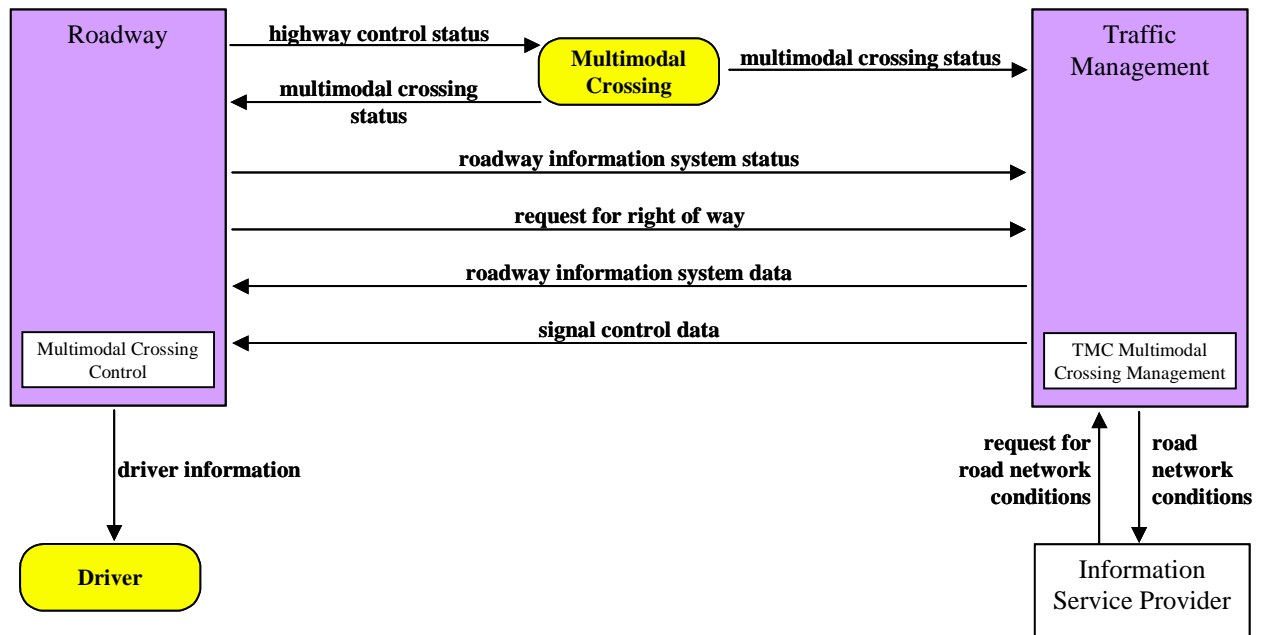
Speed Monitoring (ATMS19)

This market package will monitor the speeds of vehicles traveling through a roadway system. If the speed is determined to be excessive, then roadside equipment can suggest a safe driving speed. Environmental conditions may be monitored and factored into the safe speed advisories that are provided to the motorist. This service can also support notifications to an enforcement agency to enforce the speed limit on a roadway system.



Drawbridge Management (ATMS20)

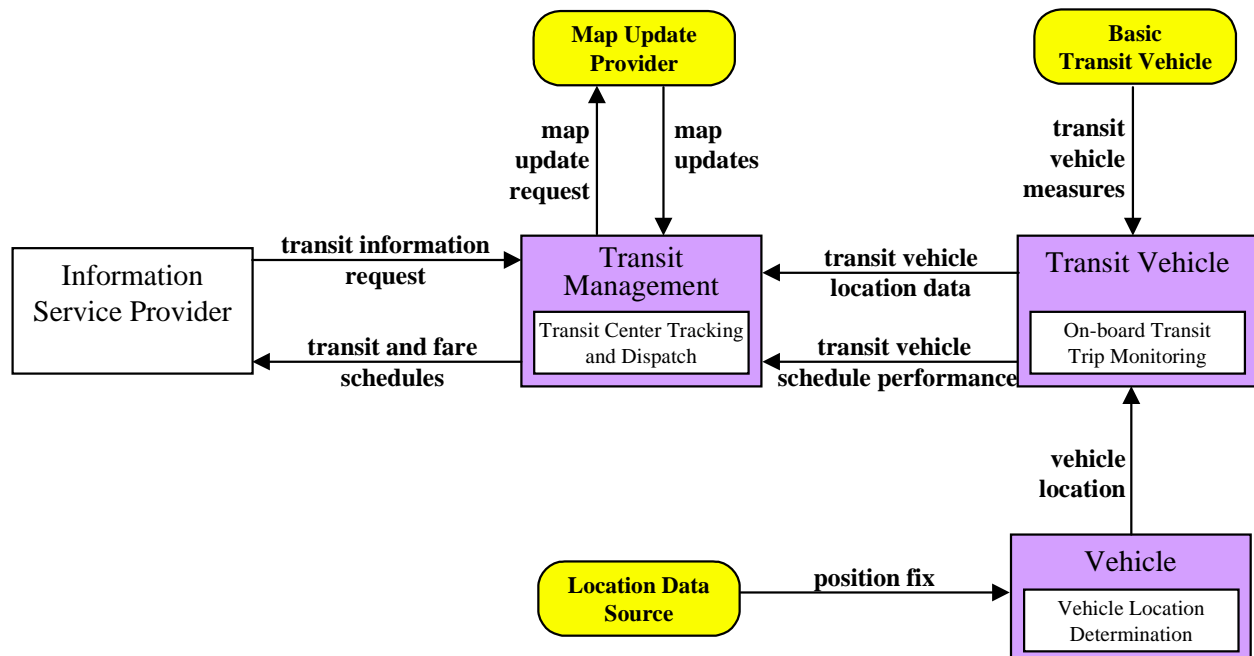
This market package will support systems that manage equipment at multimodal crossings such as drawbridges at rivers and canals and other multimodal crossings. (other than railroad grade crossings which are specifically covered by other market packages). The equipment managed by this market package includes control devices (e.g., gates, warning lights, dynamic message signs) at the draw bridge as well as the information systems that keep travelers apprised of current and forecast draw bridge status.



Public Transportation: APTS

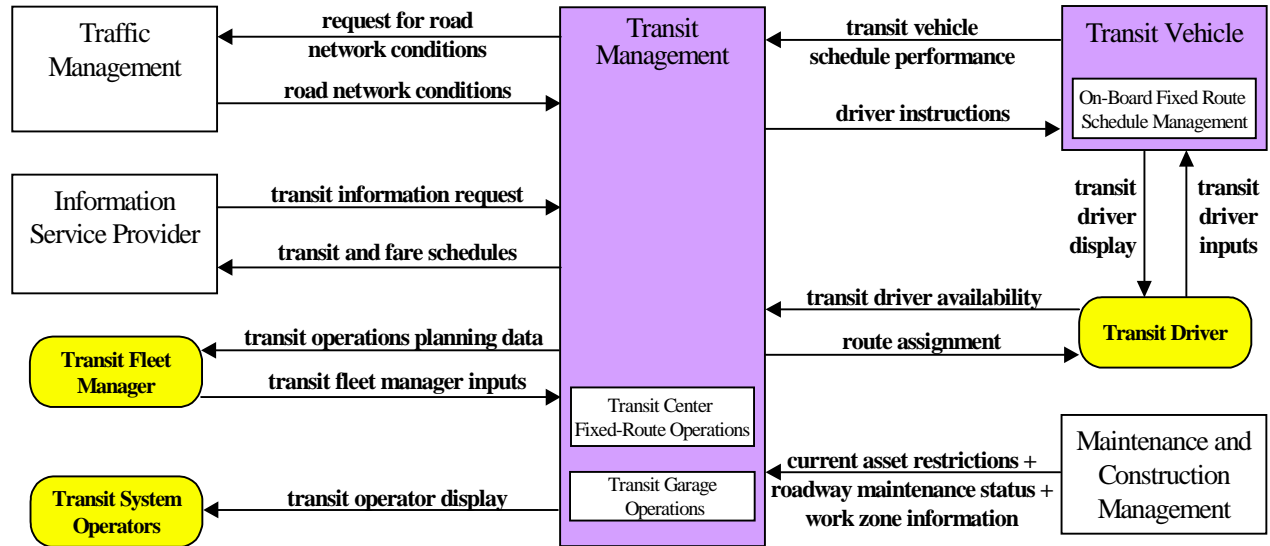
Transit Vehicle Tracking (APTS1)

This market package provides for an Automated Vehicle Location System to track the 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 with the Transit Management Subsystem is used for relaying vehicle position and control measures. Fixed route transit systems may also employ beacons along the route to enable position determination and facilitate communications with each vehicle at fixed intervals. The Transit Management Subsystem processes this information, updates the transit schedule and makes real-time schedule information available to the Information Service Provider Subsystem via a wireline link.



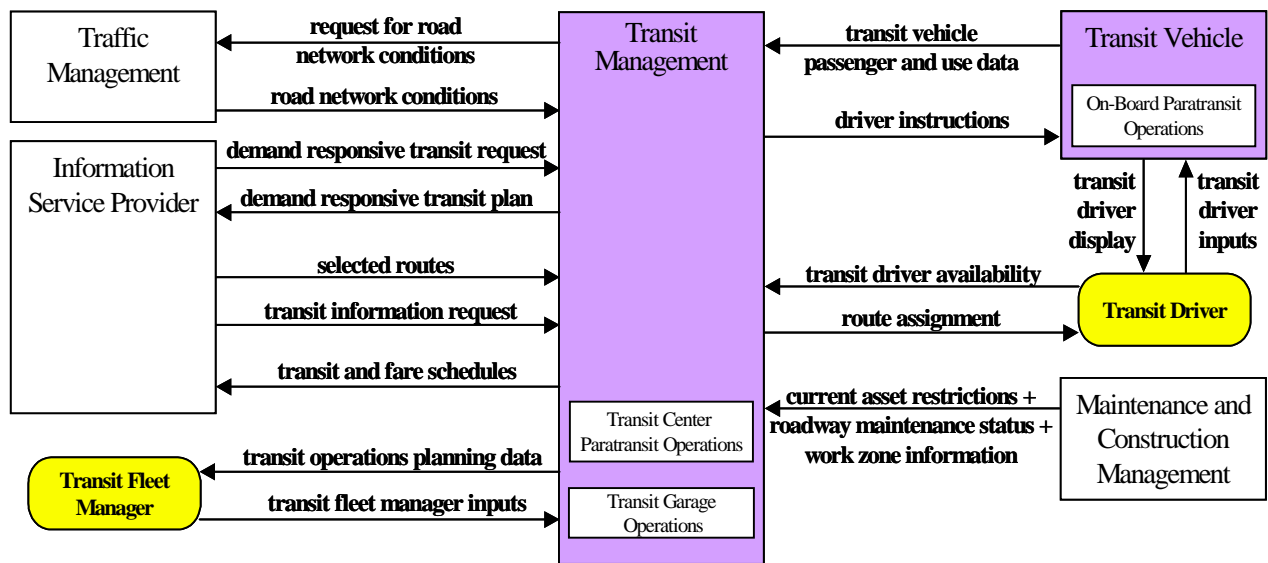
Transit Fixed-Route Operations (APTS2)

This market package performs automatic driver assignment and monitoring, as well as vehicle routing and scheduling for 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 the transit management subsystem. This data is exchanged using the existing wireline link to the information service provider where it is integrated with that from other transportation modes (e.g. rail, ferry, air) to provide the public with integrated and personalized dynamic schedules



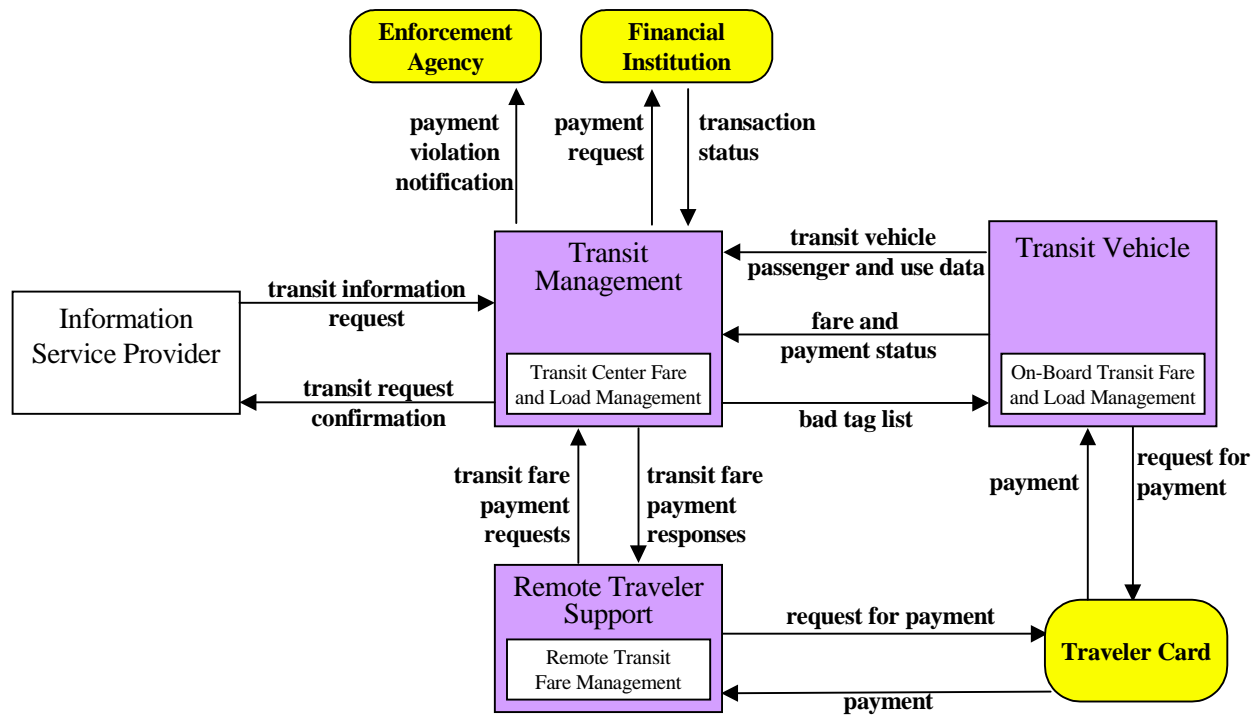
Demand Response Transit Operations (APTS3)

This market package performs automatic driver assignment and monitoring as well as vehicle routing and scheduling for demand response transit services. 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. The Transit Management Subsystem 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 be 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 paratransit service. In the second scenario, a third party service provider determines the paratransit service is a viable means of satisfying a traveler request and uses wireline communications to make a reservation for the traveler.



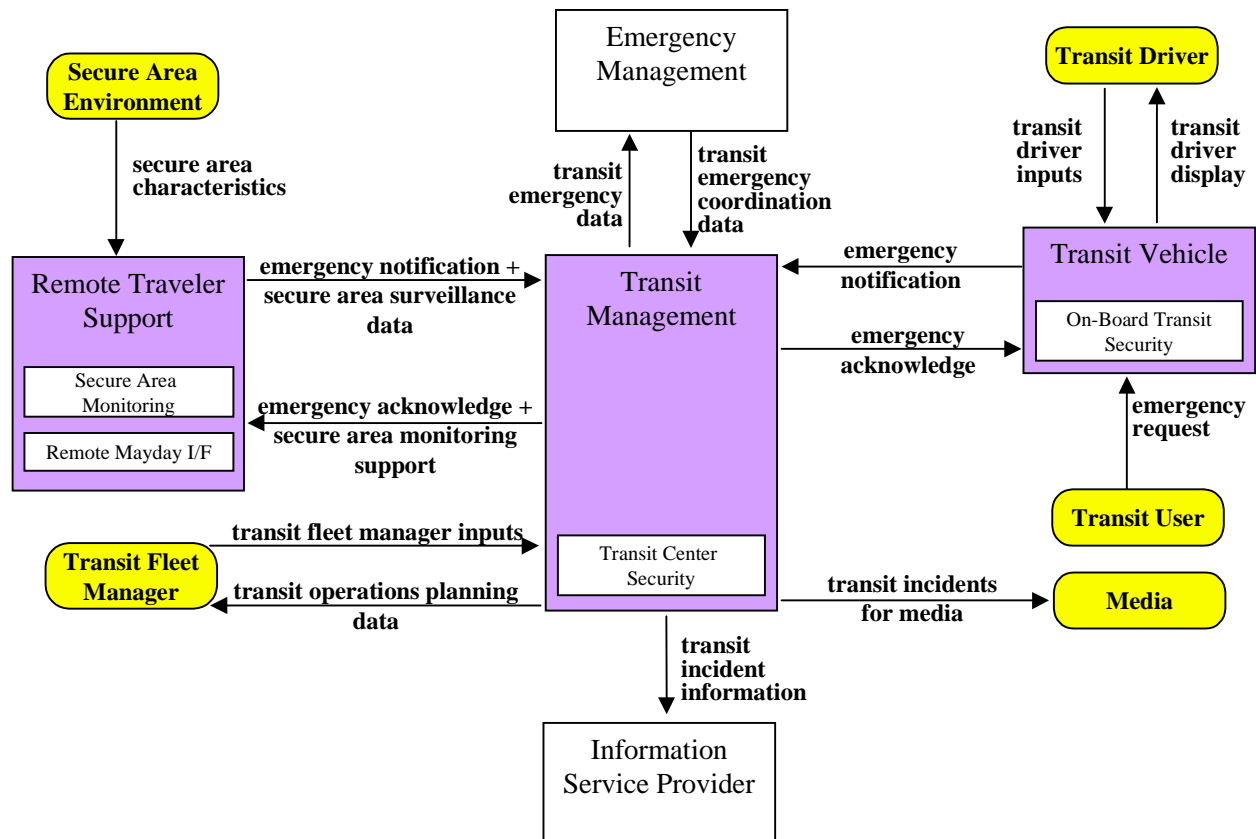
Transit Passenger and Fare Management (APTS4)

This market package allows for the management of passenger loading and fare payments on-board vehicles using electronic means. The payment instrument may be either a stored value or credit card. This package is implemented with sensors mounted on the vehicle to permit the driver and central operations to determine vehicle loads, and readers located either in the infrastructure or on-board the transit vehicle to allow fare payment. Data is processed, stored, and displayed on the transit vehicle and communicated as needed to the Transit Management Subsystem using existing wireless infrastructure.



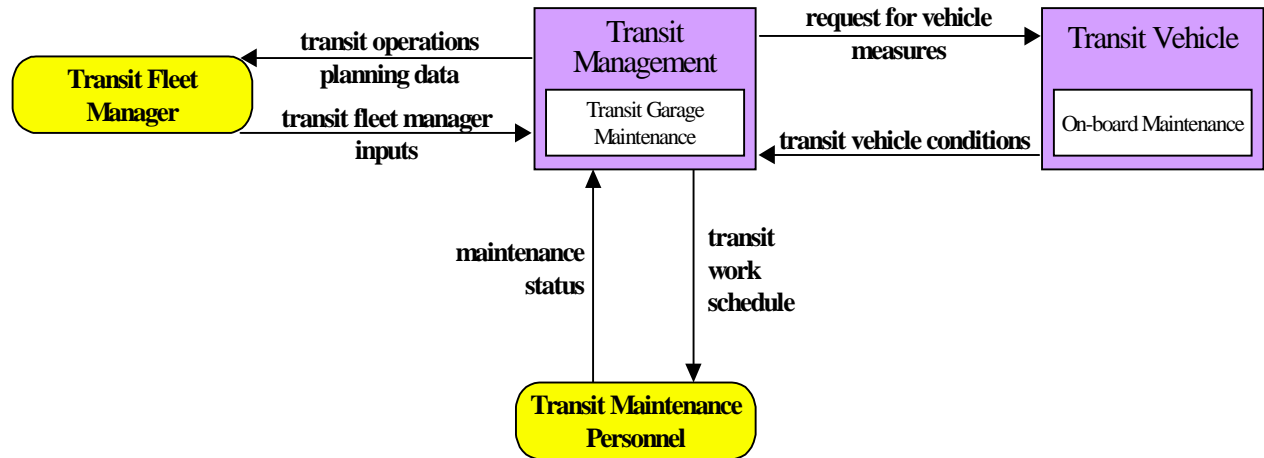
Transit Security (APTS5)

This market package provides for the physical security of transit passengers. An on-board 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 Transit Management Subsystem using the existing or emerging wireless (vehicle to center) or wireline (area to center) infrastructure. Security related information is also transmitted to the Emergency Management Subsystem when an emergency is identified that requires an external response. Incident information is communicated to the Information Service Provider.



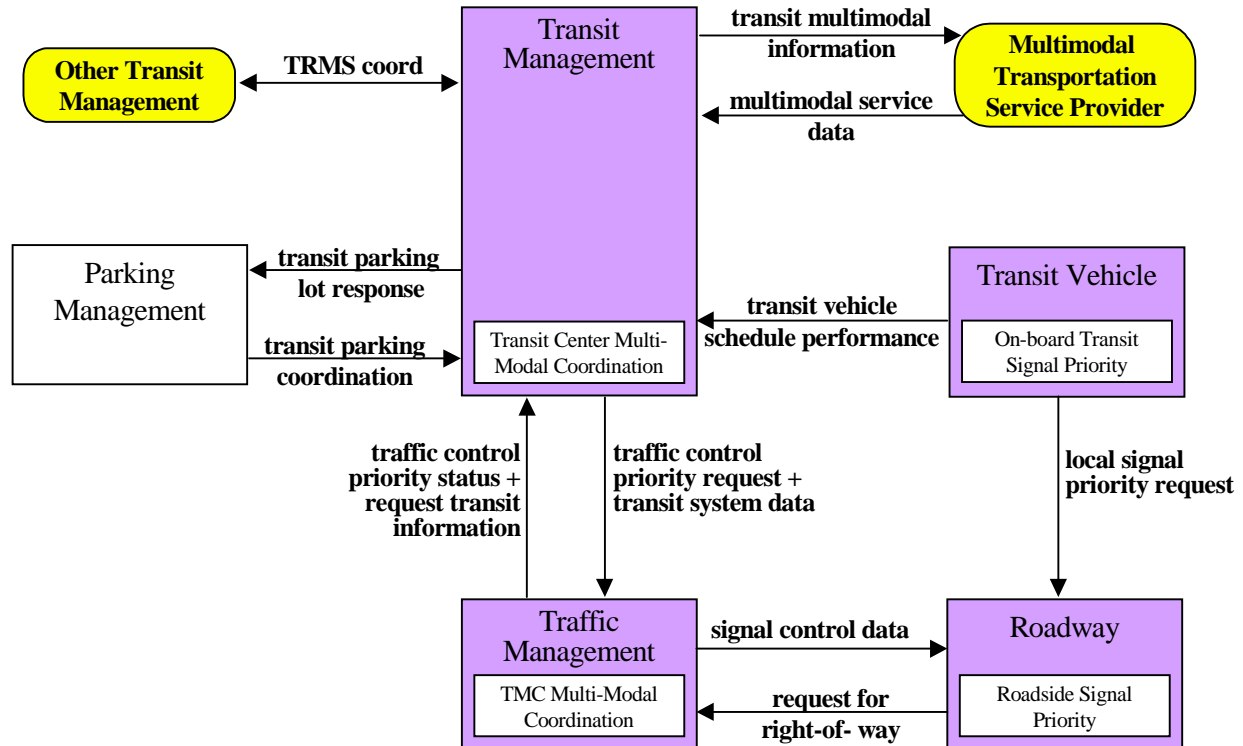
Transit Maintenance (APTS6)

This market package supports automatic maintenance scheduling and monitoring. On-board condition sensors monitor critical system status and transmit critical status information to the Transit Management Subsystem. Hardware and software in the Transit Management Subsystem processes this data and schedules maintenance activities.



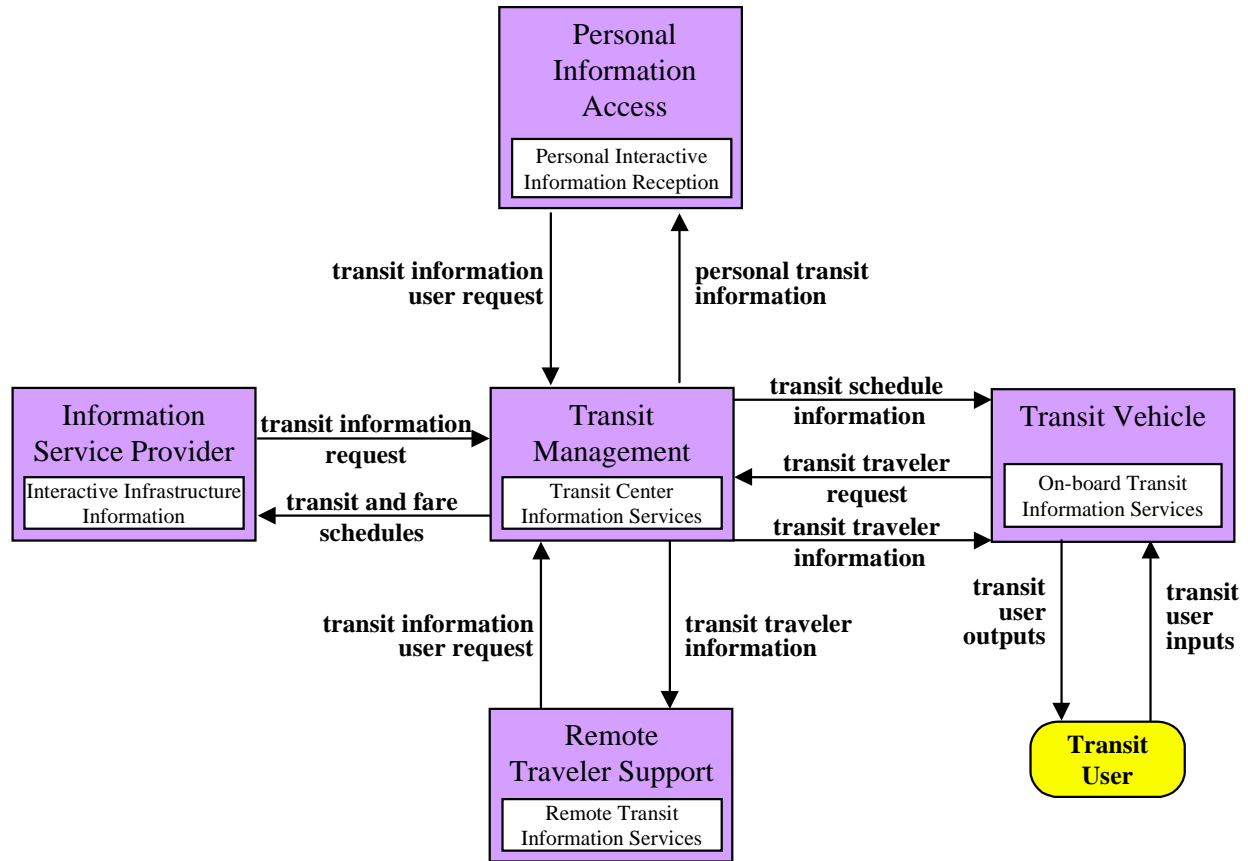
Multi-modal Coordination (APTS7)

This market package establishes two way communications between multiple transit and traffic agencies to improve service coordination. Intermodal coordination between transit agencies can increase traveler convenience at transfer points and also improve operating efficiency. Coordination between traffic and transit management is intended to improve on-time performance of the transit system to the extent that this can be accommodated without degrading overall performance of the traffic network. More limited local coordination between the transit vehicle and the individual intersection for signal priority is also supported by this package.



Transit Traveler Information (APTS8)

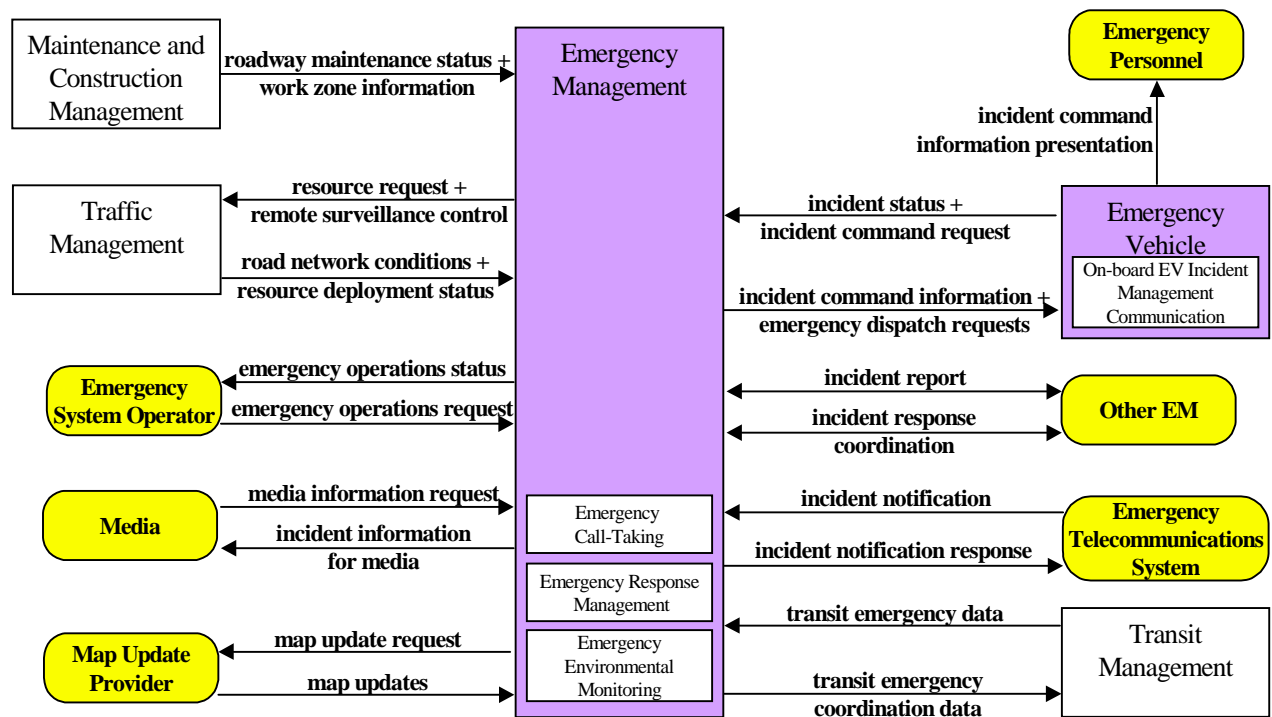
This market package provides transit users at transit stops and on-board transit vehicles with ready access to transit information. The information services include transit stop annunciation, imminent arrival signs, and real-time transit schedule displays that are of general interest to transit users. Systems that provide custom transit trip itineraries and other tailored transit information services are also represented by this market package.



Emergency Management: EM

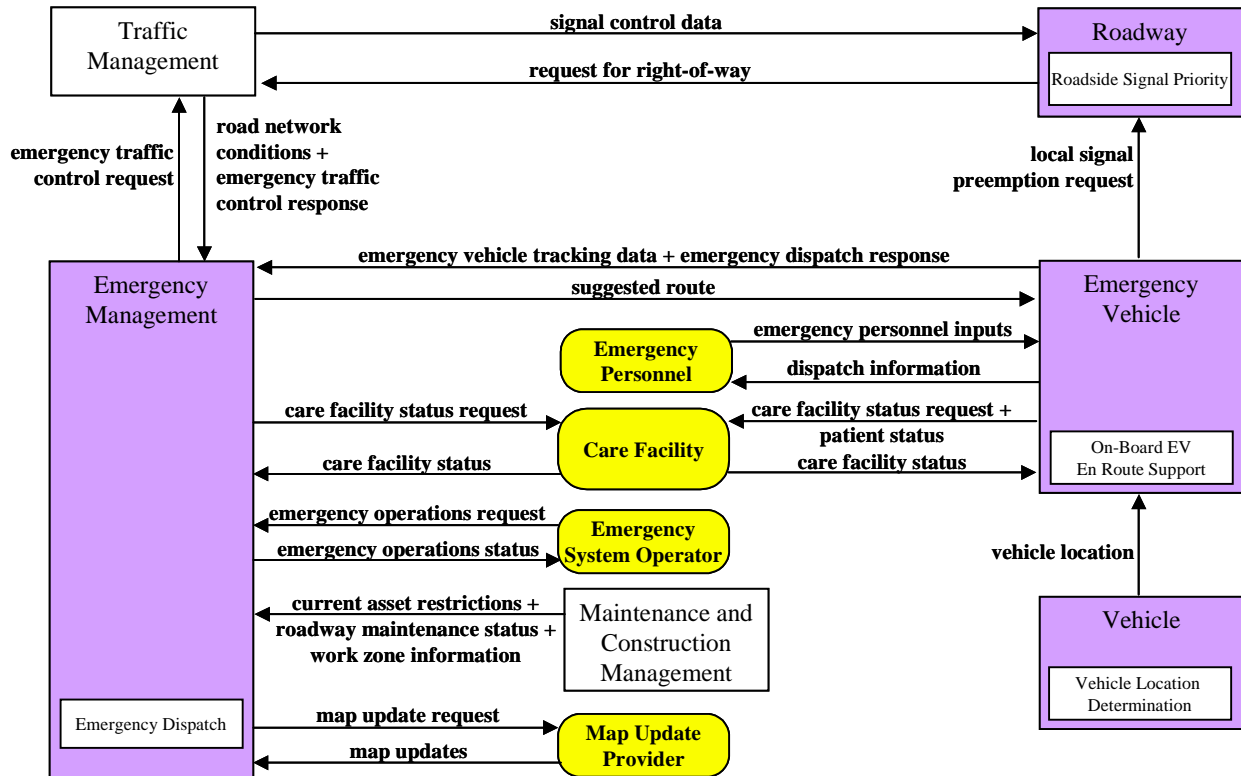
Emergency Response (EM1)

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 Emergency Management Subsystems supports emergency notification and coordinated response between agencies. Existing wide area wireless communications would be utilized between the Emergency Management Subsystem and an Emergency Vehicle to enable an incident command system to be established and supported at the emergency location. The Emergency Management Subsystem would include hardware and software for tracking the emergency vehicles. Public safety, traffic management, and many other allied agencies may each participate in the coordinated response managed by this package.



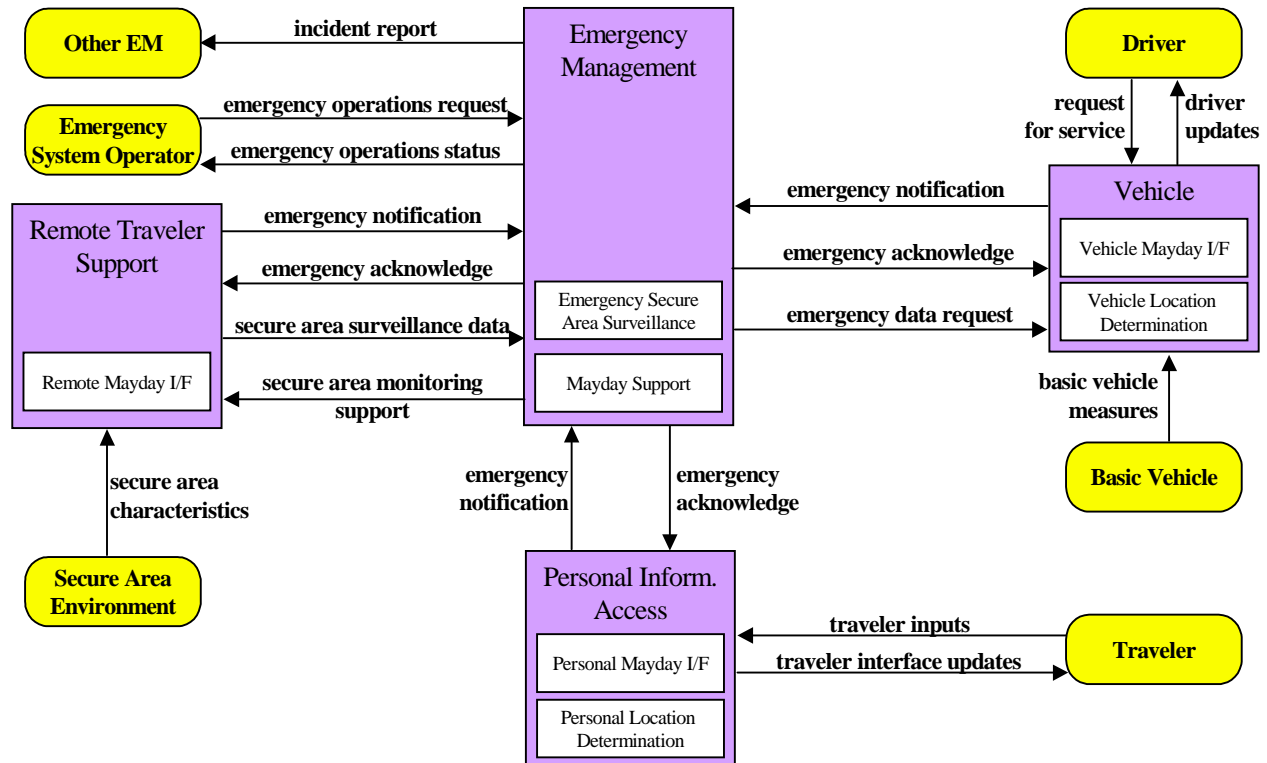
Emergency Routing (EM2)

This market package supports dynamic routing of emergency vehicles and coordination with the Traffic Management Subsystem for special priority on the selected route(s). The Information Service Provider Subsystem supports routing for the emergency fleet based on real-time traffic conditions and the emergency routes assigned to other responding vehicles. 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.



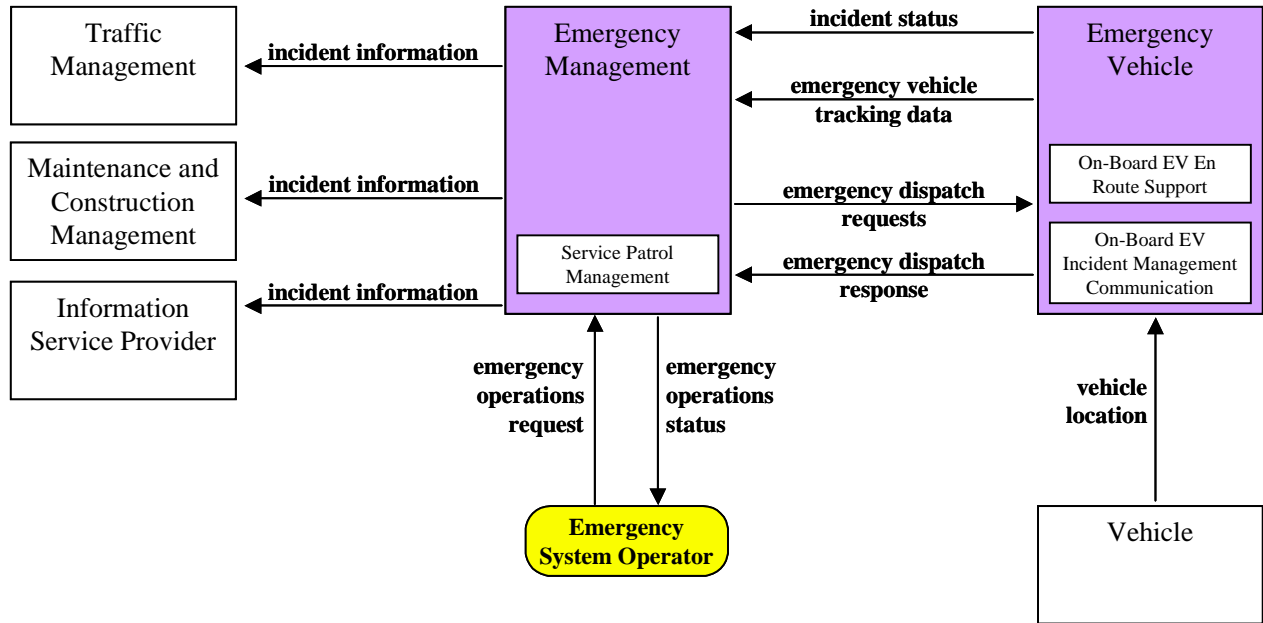
Mayday Support (EM3)

This package allows the user (driver or non-driver) to initiate a request for emergency assistance and enables the Emergency Management Subsystem to locate the user and determine the appropriate response. The Emergency Management Subsystem may be operated by the public sector or by a private sector provider. 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.



Roadway Service Patrols (EM4)

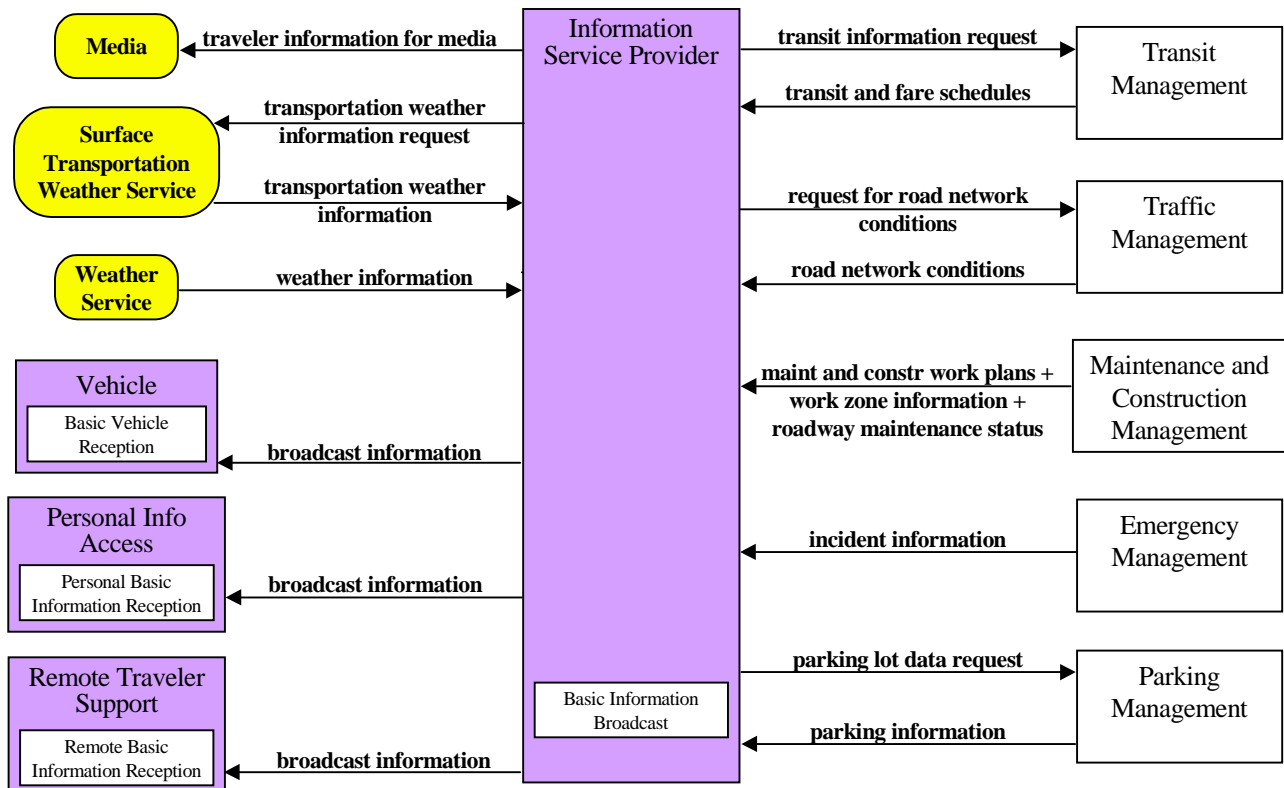
This market package supports roadway service patrol vehicles monitoring roads that typically have incidents (flat tire, accidents, out of gas) to determine if there are problems in the traffic stream. If problems are detected then the roadway service patrol vehicles will provided assistance to the motorist (e.g., push a vehicle to the shoulder or median).



Traveler Information: ATIS

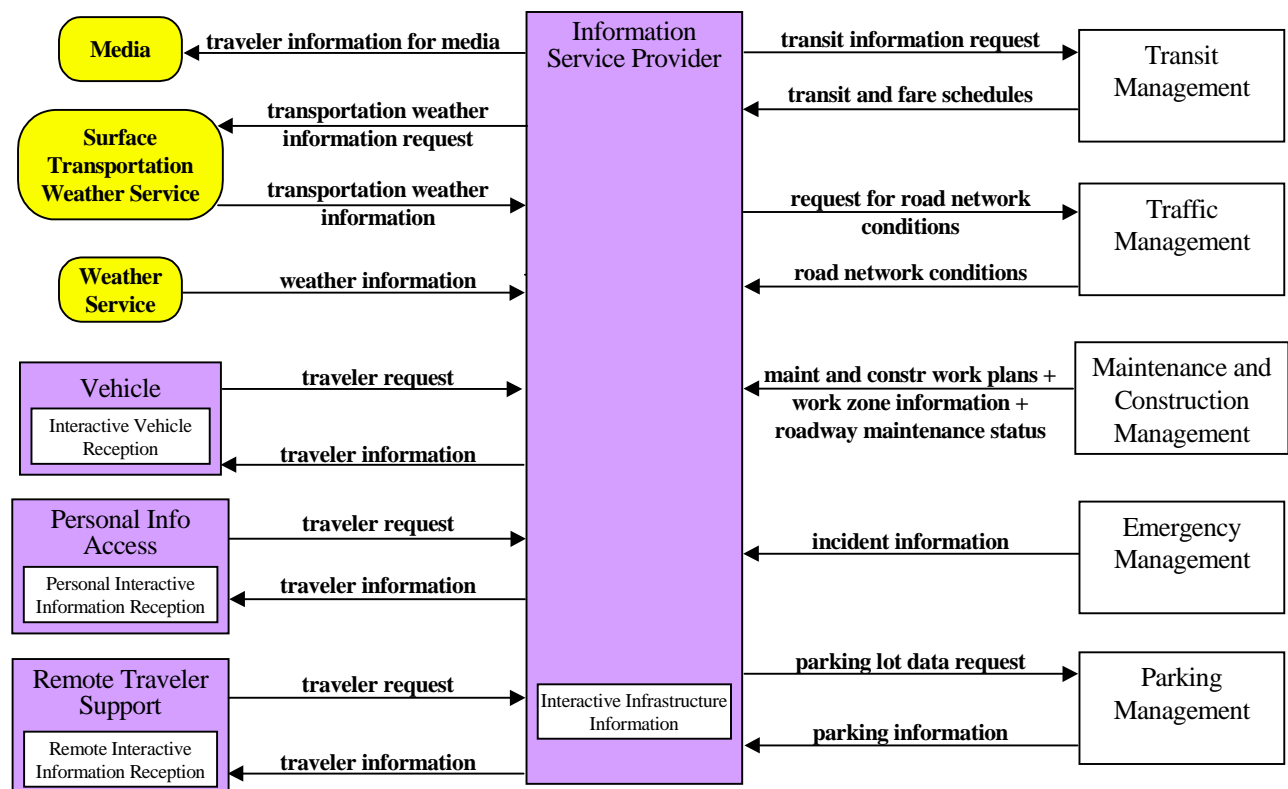
Broadcast Traveler Information (ATIS1)

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, general public transportation, toll and parking information, incident information, air quality and weather information, and the near real time dissemination of this information over a wide area through existing infrastructures and low cost user equipment (e.g., FM subcarrier, cellular data broadcast). Different from the market package ATMS6--Traffic Information Dissemination--which 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 traveler information from roadway instrumentation, probe vehicles or other sources.



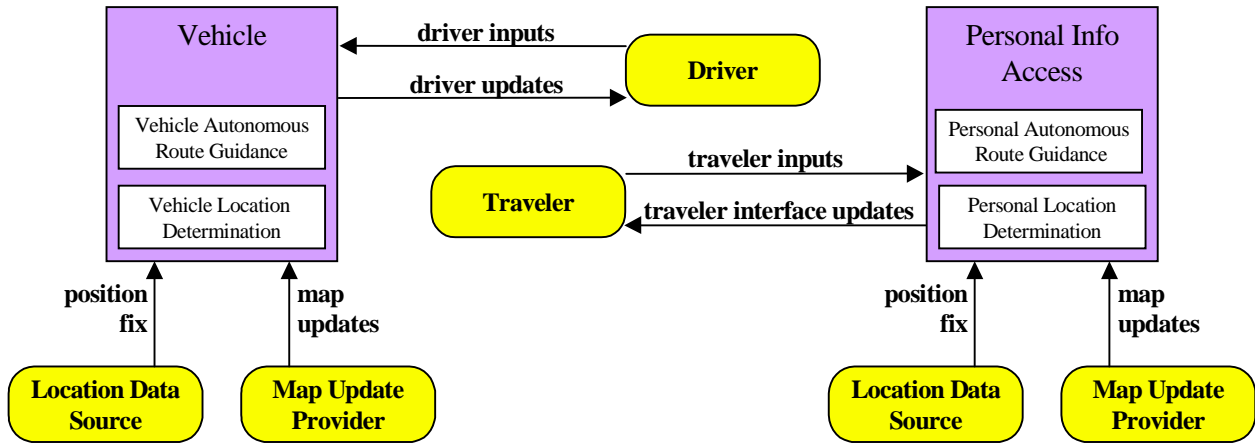
Interactive Traveler Information (ATIS2)

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, ride share/ride match, parking management, and pricing information. A range of two-way wide-area wireless and wireline 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 to include phone, kiosk, Personal Digital Assistant, personal computer, and a variety of in-vehicle devices. Successful deployment of this market package relies on availability of real-time transportation data from roadway instrumentation, probe vehicles or other means.



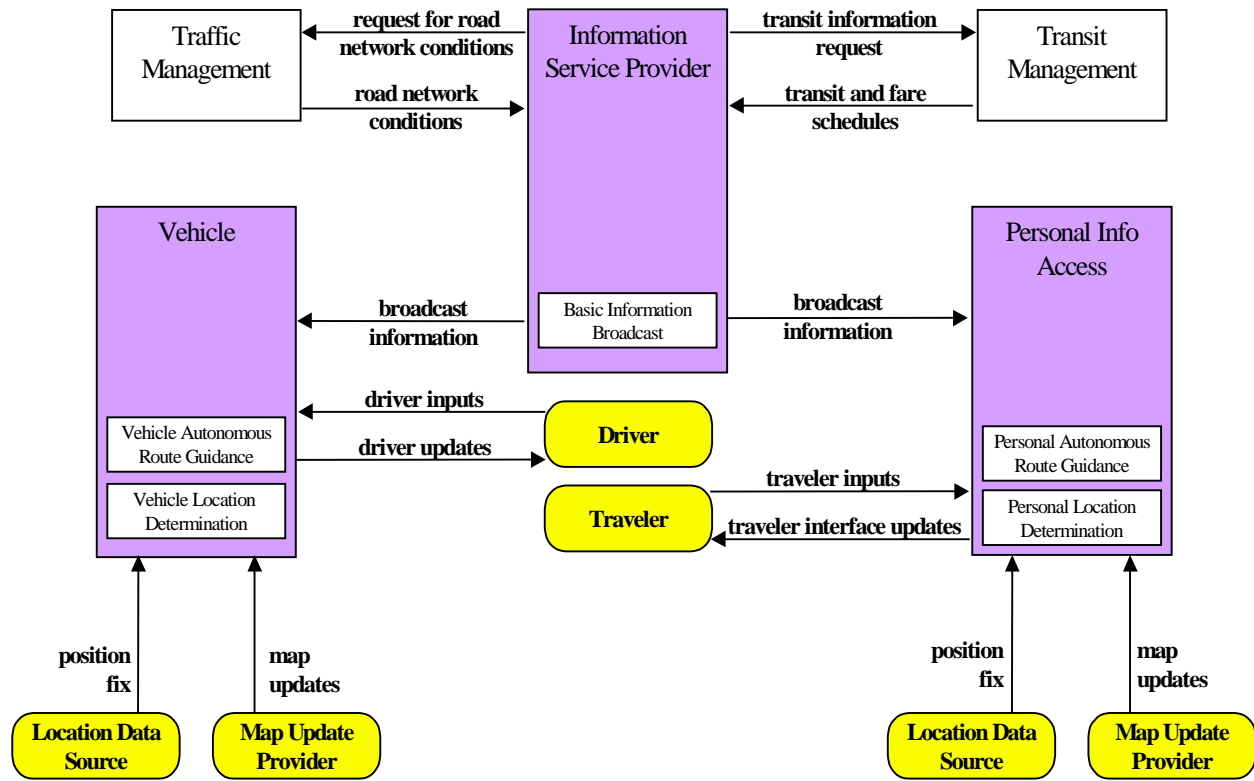
Autonomous Route Guidance (ATIS3)

This market package relies on in-vehicle sensory, location determination, computational, map database, and interactive driver interface equipment to enable route planning and detailed route guidance based on static, stored information. No communication with the infrastructure is assumed or required. Identical capabilities are available to the traveler outside the vehicle by integrating a similar suite of equipment into portable devices.



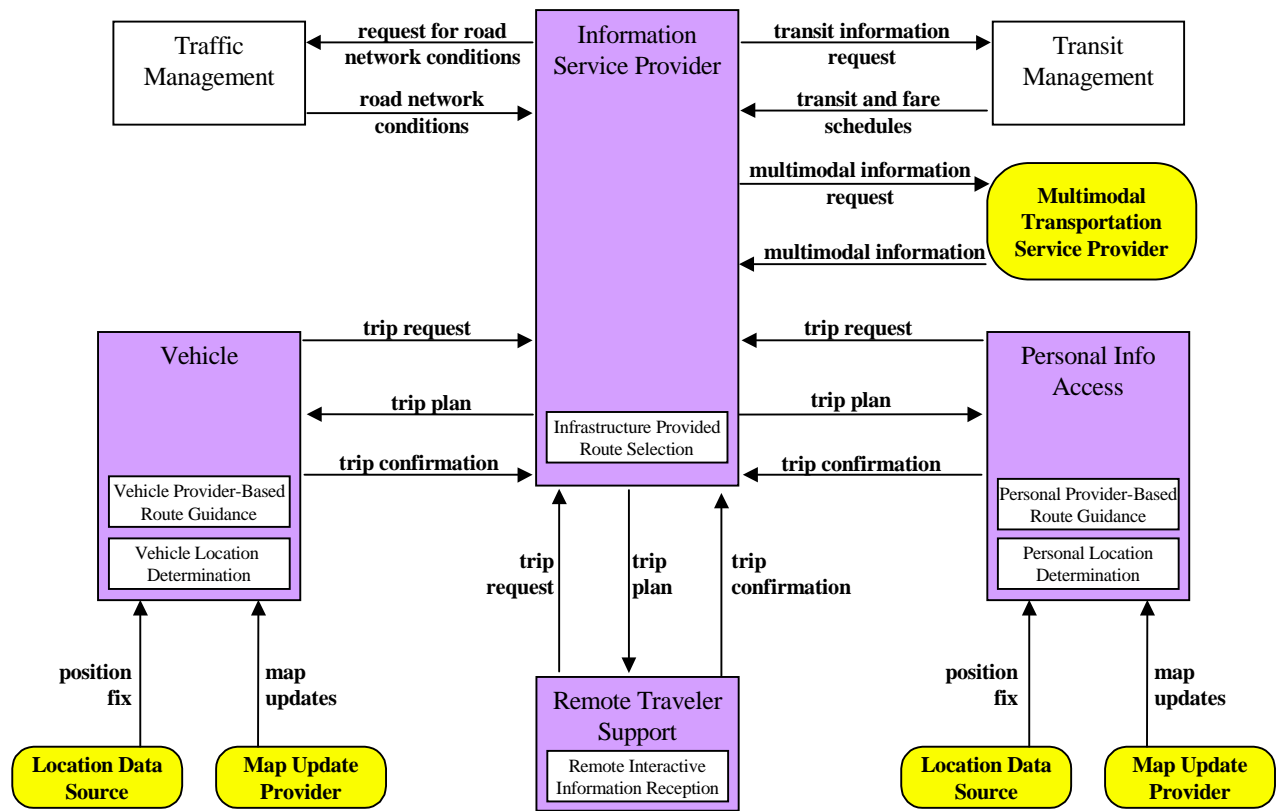
Dynamic Route Guidance (ATIS4)

This market package offers the user advanced route planning and guidance which is responsive to current conditions. The package combines the autonomous route guidance user equipment with a digital receiver capable of receiving real-time traffic, transit, and road condition information which is considered by the user equipment in provision of route guidance.



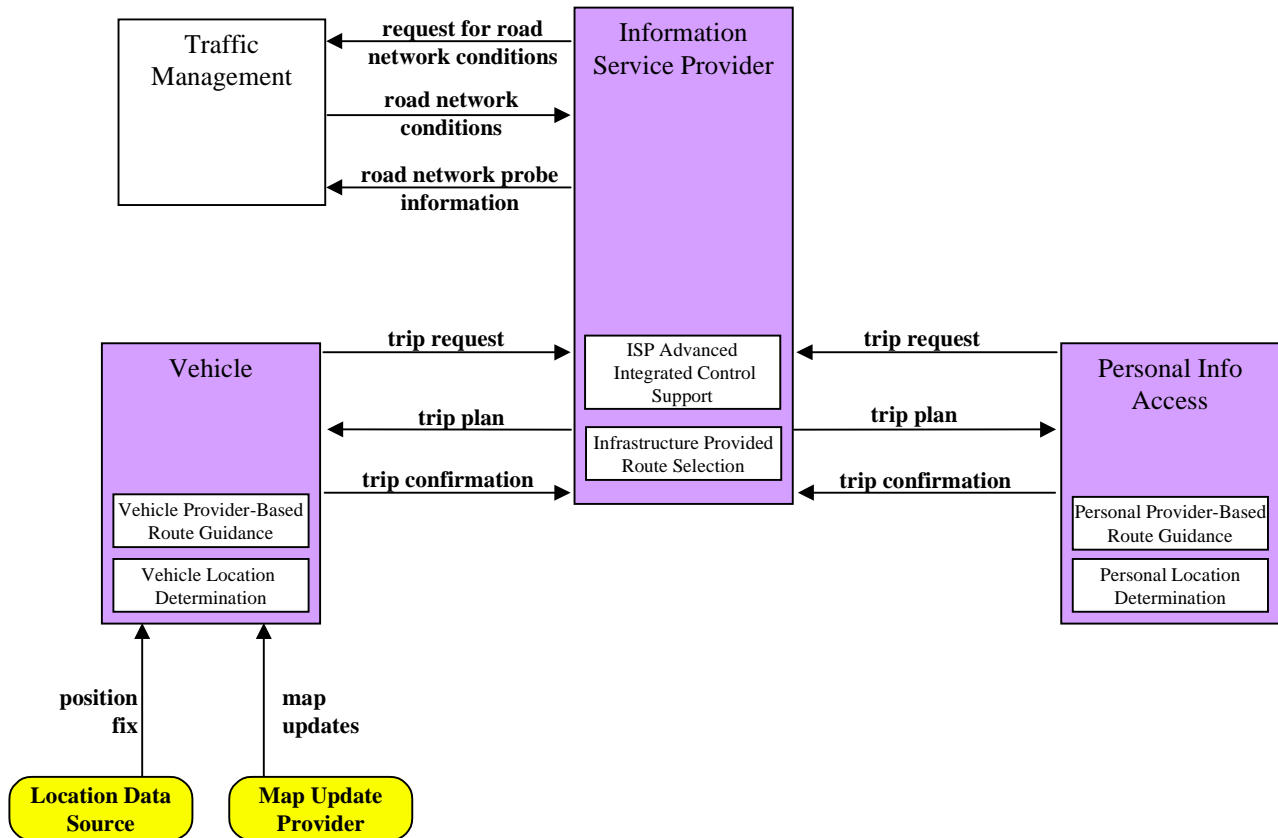
ISP-Based Route Guidance (ATIS5)

This market package offers the user advanced route planning and guidance which is responsive to current conditions. Different than the Dynamic Route Guidance Market Package, this market package moves the route planning function from the user device to the information service provider. This approach simplifies the user equipment requirements and can provide the infrastructure better information on which to predict future traffic and appropriate control strategies to support basic route planning with minimal user equipment. The package includes both turn by turn route guidance as might be used in a vehicle, as well as pre-trip routes. The package includes two way data communications and optionally also equips the vehicle with the databases, location determination capability, and display technology to support turn by turn route guidance.



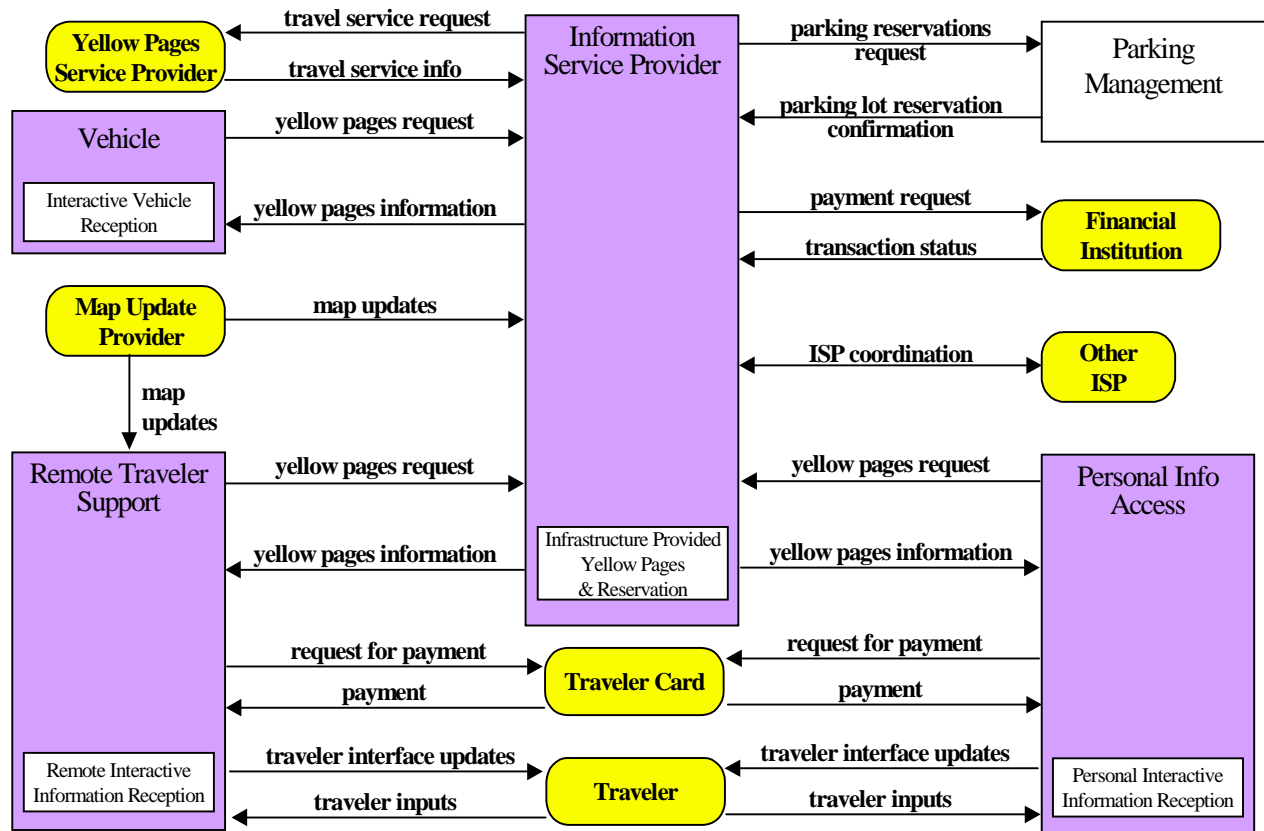
Integrated Transportation Management/Route Guidance (ATIS6)

This market package allows a traffic management center to continuously optimize the traffic control strategy based on near-real time information on intended routes for a proportion of the vehicles within their network while offering the user advanced route planning and guidance which is responsive to current conditions . It would utilize the individual and ISP route planning information to optimize signal timing while at the same time providing updated signal timing information to allow optimized route plans. The use of predictive link times for this market package are possible through utilizing the market package ATMS9--Traffic forecast and Demand Management--at the traffic management center.



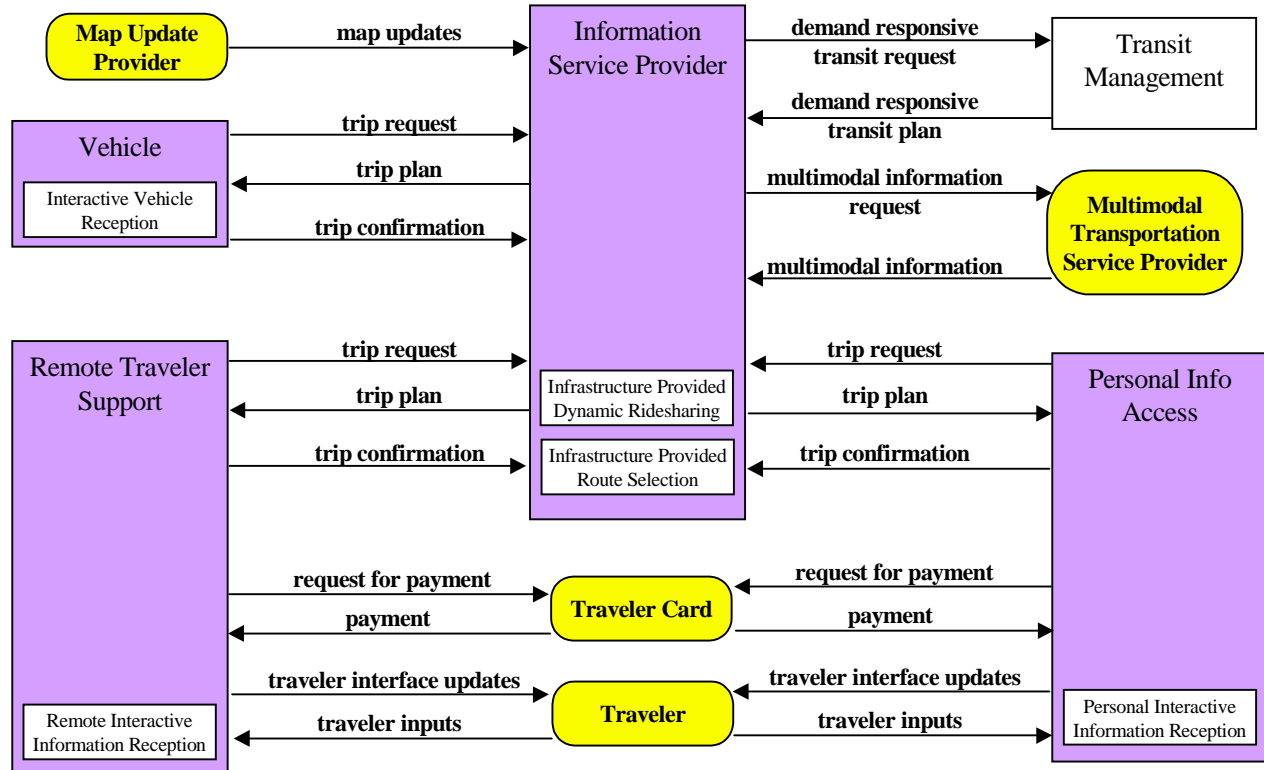
Yellow Pages and Reservation (ATIS7)

This market package enhances the Interactive Traveler Information package by making infrastructure provided yellow pages and reservation services available to the user. The same basic user equipment is included. This market package provides multiple ways for accessing information either while en-route in a vehicle using wide-area wireless communications or pre-trip via wireline connections.



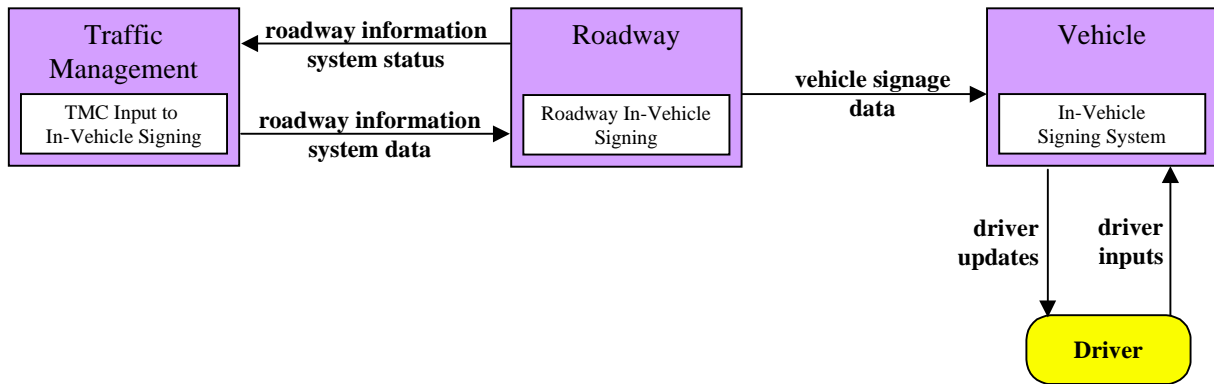
Dynamic Ridesharing (ATIS8)

This market package enhances the Interactive Traveler Information package by adding an infrastructure provided dynamic ridesharing/ride matching capability. In terms of equipment requirements, ATIS8 is similar to ATIS7.



In Vehicle Signing (ATIS9)

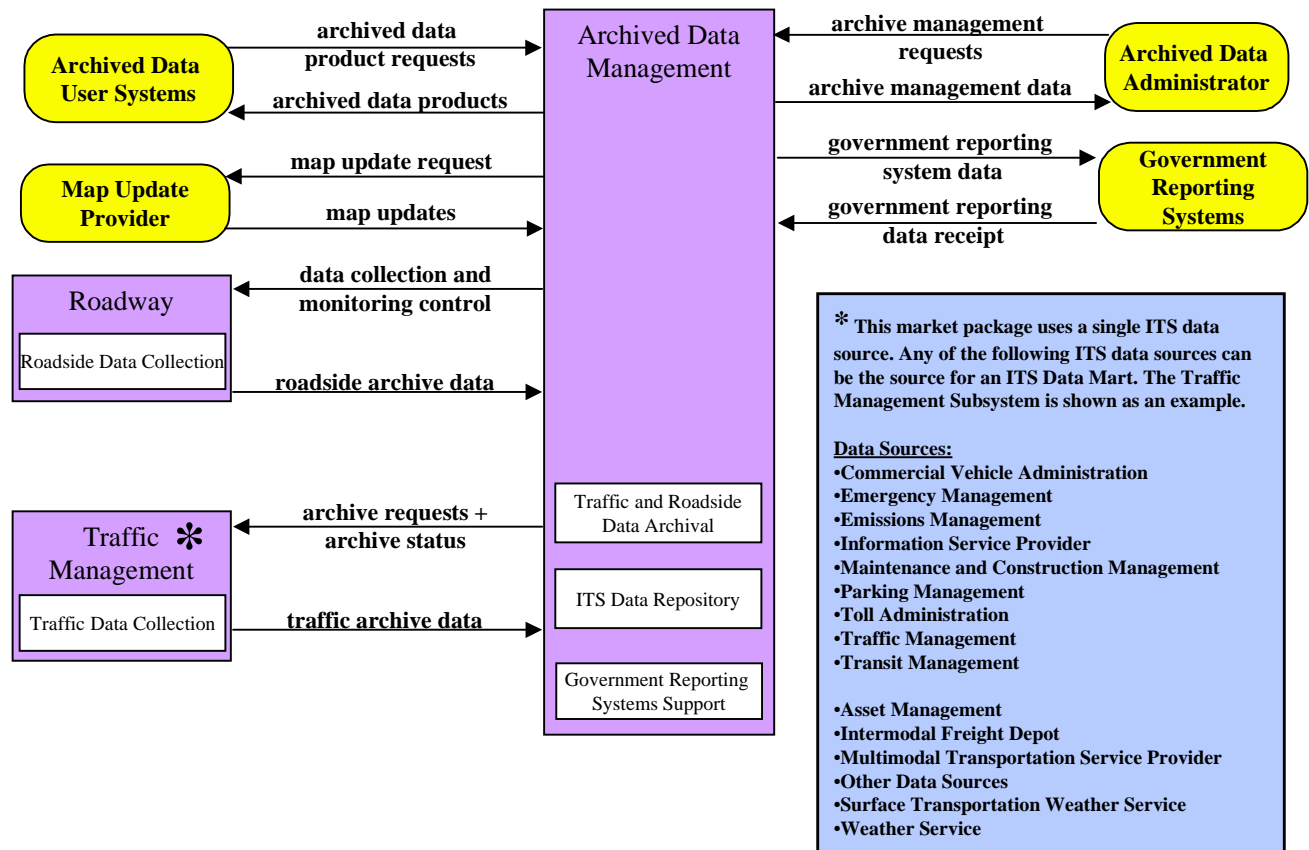
This market package supports distribution of traffic and travel advisory information to drivers through in-vehicle devices. It includes short range communications between roadside equipment and the vehicle and wireline connections to the Traffic Management Subsystem for coordination and control. This market package also informs the driver of both highway-highway and highway-rail intersection status.



Archived Data Management: AD

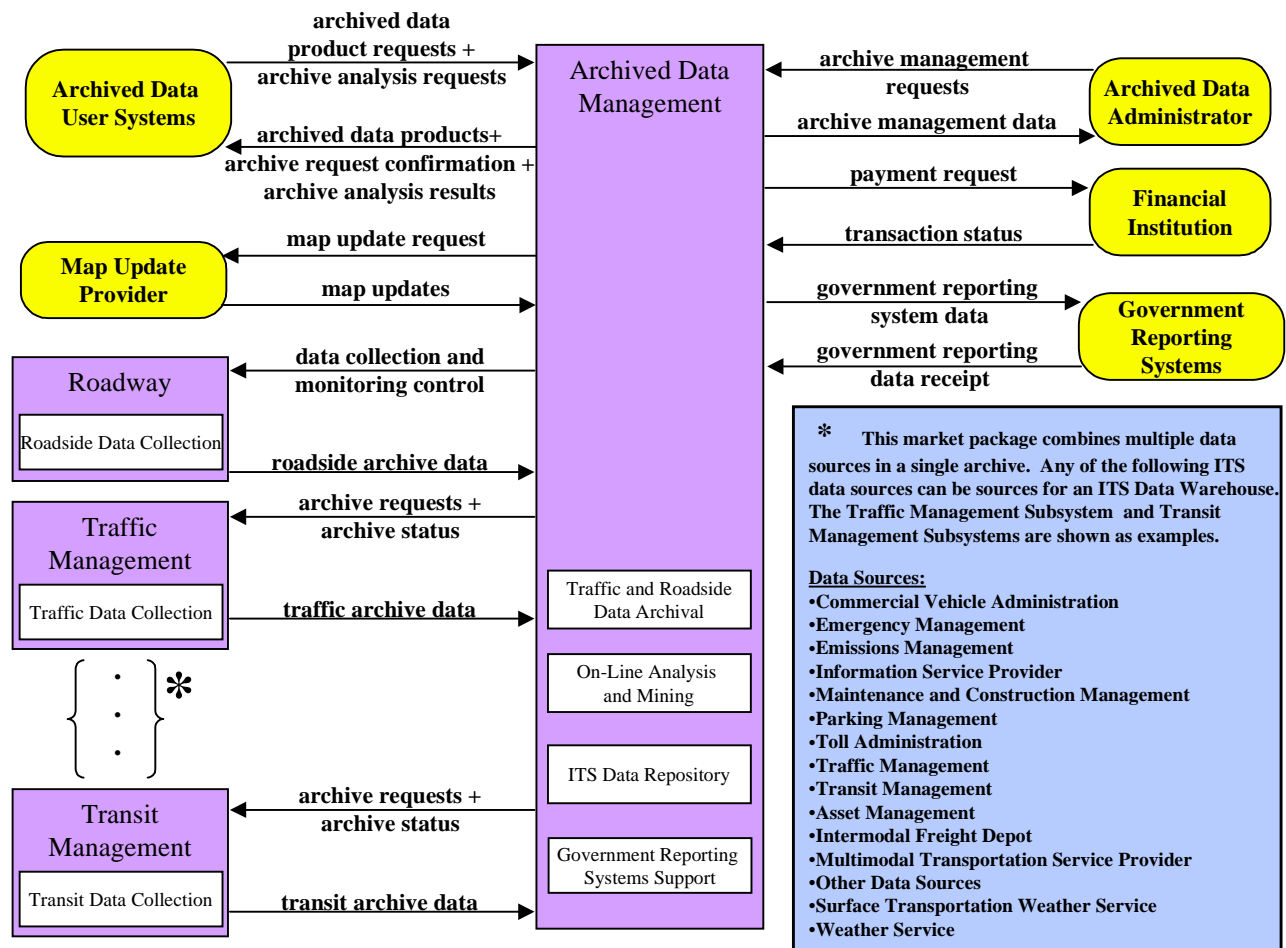
ITS Data Mart (AD1)

This market package provides a focused archive that houses data collected and owned by a single agency, district, private sector provider, research institution, or other organization. This focused archive typically includes data covering a single transportation mode and one jurisdiction that is collected from an operational data store and archived for future use. 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.



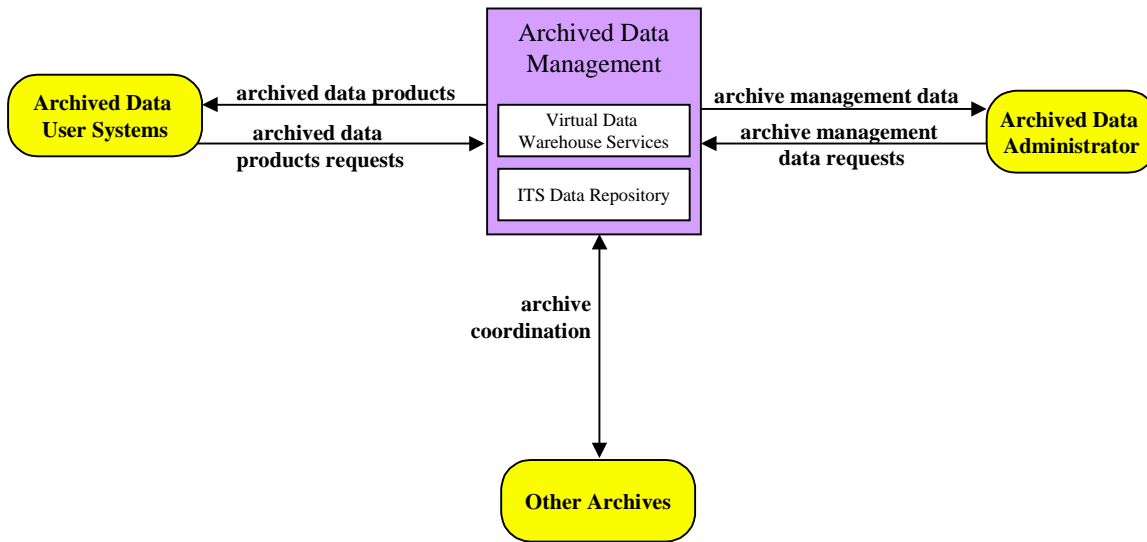
ITS Data Warehouse (AD2)

This market package includes all the data collection and management capabilities provided by the ITS Data Mart, and adds the functionality and interface definitions that allow collection of data from multiple agencies and data sources spanning across modal and jurisdictional boundaries. 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)

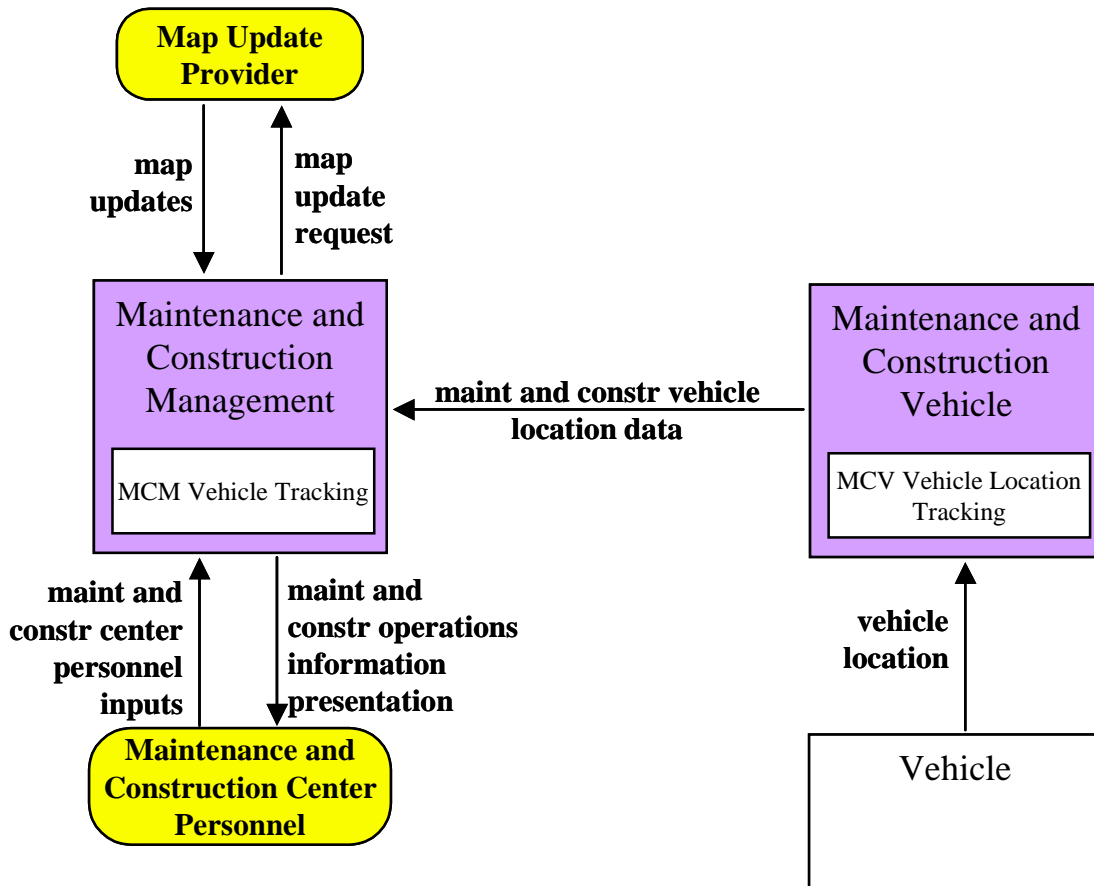
This market package provides the same broad access to multimodal, multidimensional data from varied data sources as in the ITS Data Warehouse Market Package, but provides this access using enhanced interoperability between physically distributed ITS archives that are each locally managed. Requests for 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.



Maintenance and Construction (MC)

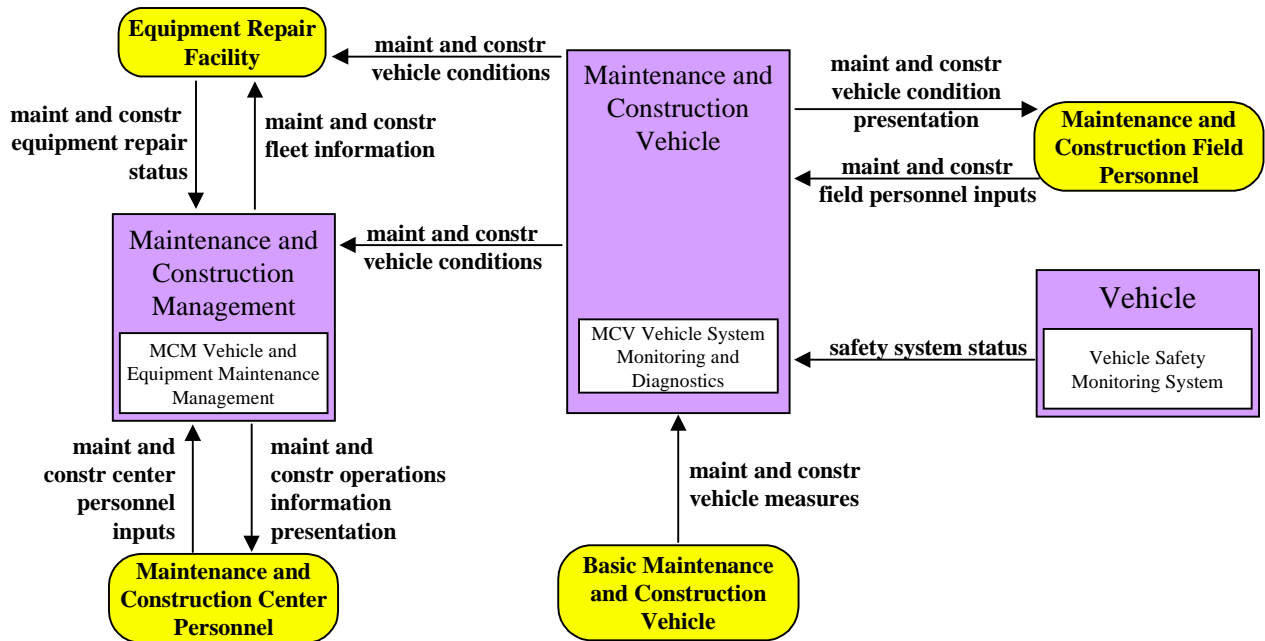
Maintenance and Construction Vehicle Tracking (MC01)

This market package will track the location of maintenance and construction vehicles and other equipment to ascertain the progress of their activities. These activities can include ensuring the correct roads are being plowed and work activity is being performed at the correct locations.



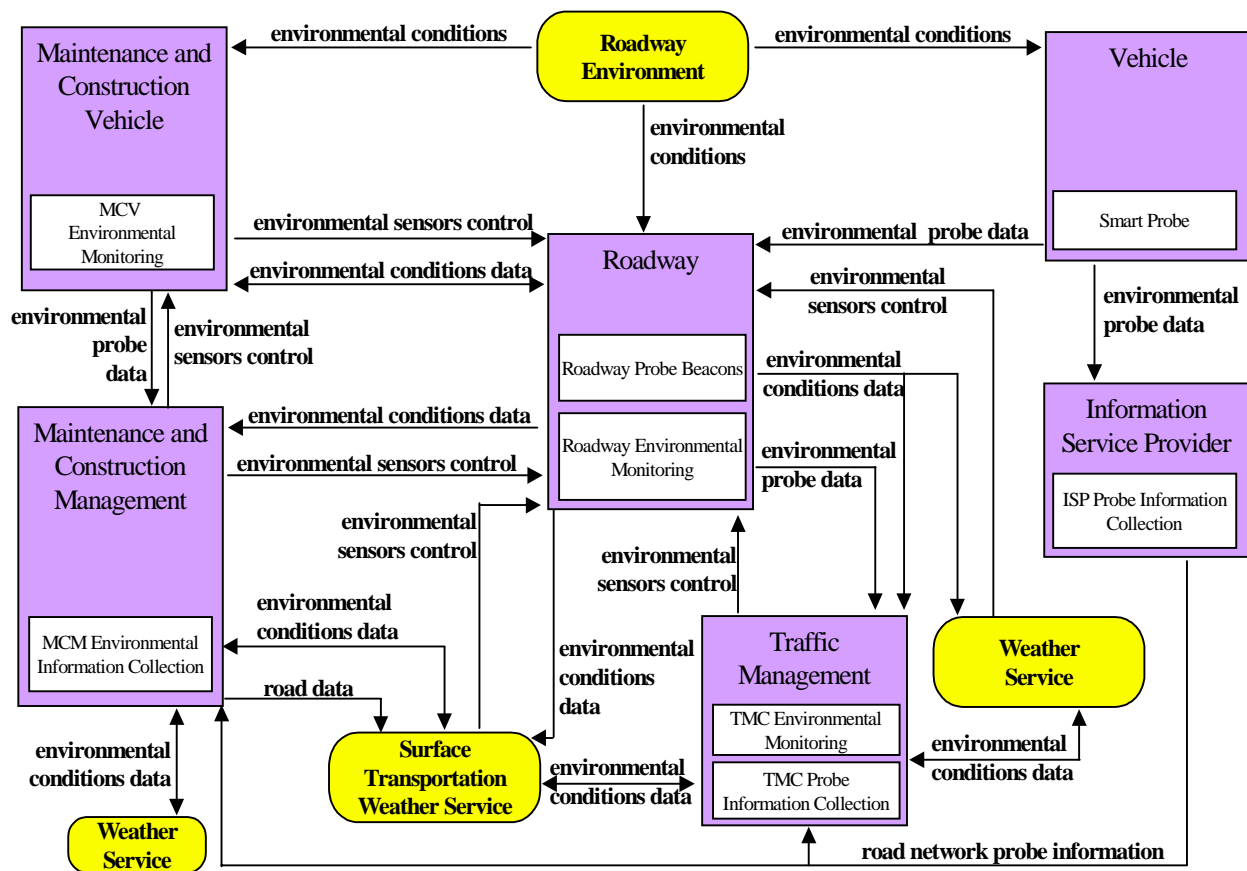
Maintenance and Construction Vehicle Maintenance (MC02)

This market package will automate vehicle maintenance scheduling and manage both routine and corrective maintenance activities on vehicles and other maintenance and construction equipment. It includes on-board sensors capable of automatically performing diagnostics for maintenance and construction vehicles for scheduling vehicle maintenance.



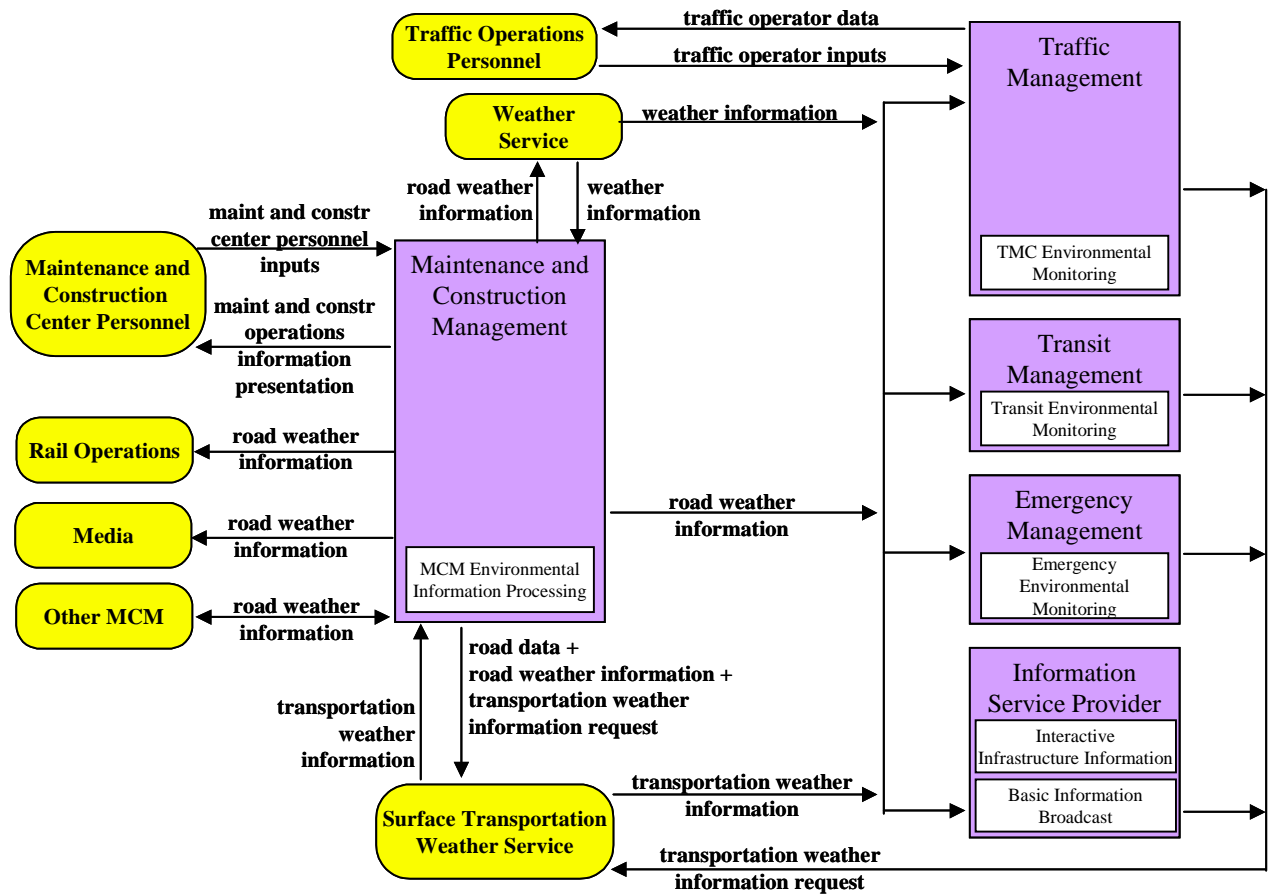
Road Weather Data Collection (MC03)

This market package collects current road and weather conditions using data collected from environmental sensors deployed on and about the roadway (or guideway in the case of transit related rail systems). In addition to fixed sensor stations at the roadside, sensing of the roadway environment can also occur from sensor systems located on Maintenance and Construction Vehicles and on-board sensors provided by auto manufacturers. The collected environmental data is used by the Weather Information Processing and Distribution Market Package to process the information and make decisions on operations.



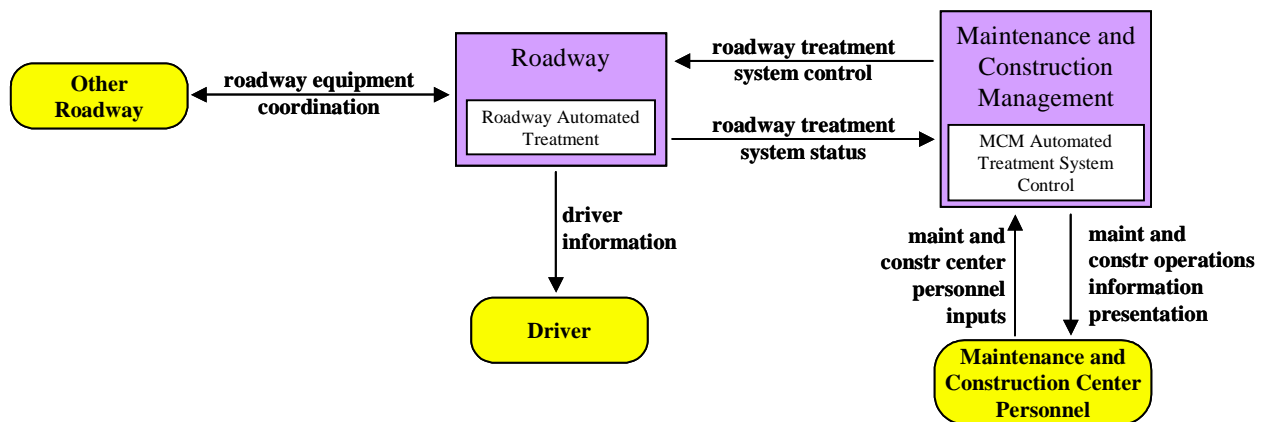
Weather Information Processing and Distribution (MC04)

This market package processes the environmental information collected from the Environmental Collection Market Package. The Weather Information Processing and Distribution Market Package uses the environmental data to detect environmental hazards such as icy road conditions, high winds, dense fog, etc. so system operators and decision support systems can make decision on corrective actions to take. The continuing updates of road condition information and current temperatures can be used by system operators to more effectively deploy road maintenance resources, issue general traveler advisories, support location specific warnings to drivers using the Traffic Information Dissemination Market Package, and aid operators in scheduling work activity or knowing when to resume work activity.



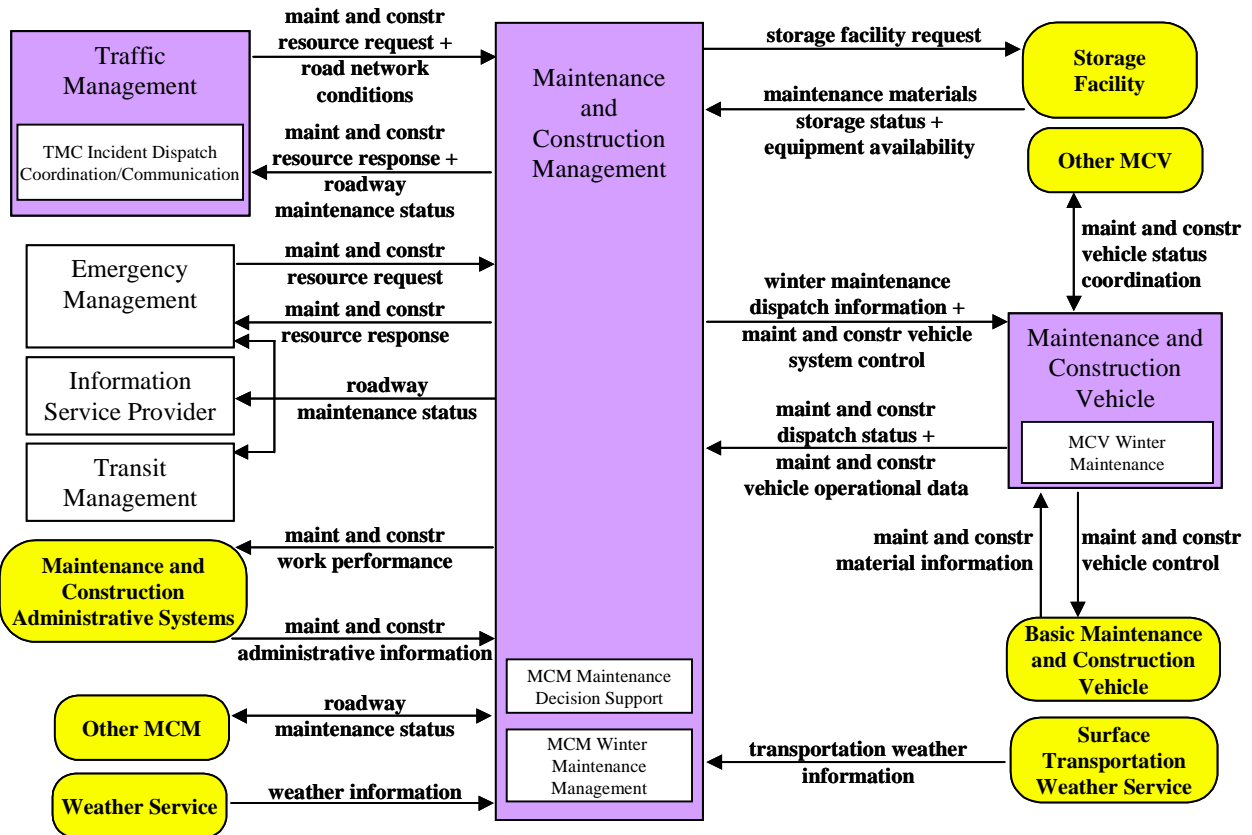
Roadway Automated Treatment (MC05)

This market package will support systems that automatically treat a roadway section based on environmental or atmospheric conditions. Treatments can be in the form of fog dispersion, anti-icing chemicals, etc. The market package includes the environmental sensors that detect adverse conditions, the automated treatment system itself, and driver information systems (e.g., dynamic message signs) that warn drivers when the treatment system is activated.



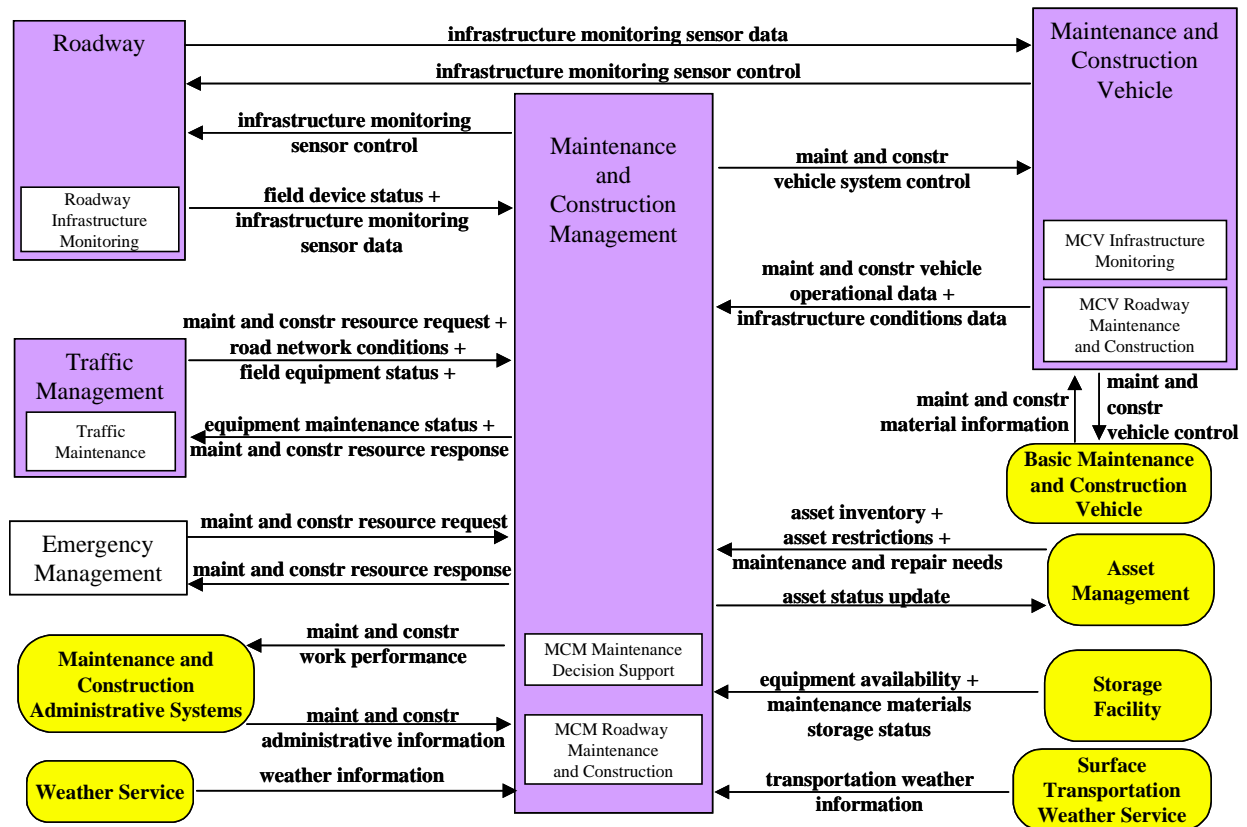
Winter Maintenance (MC06)

This market package supports winter road maintenance in the form of snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on information received from various weather sources. Environmental conditions are also detected from environmental sensors and maintenance and construction vehicle on-board sensors.



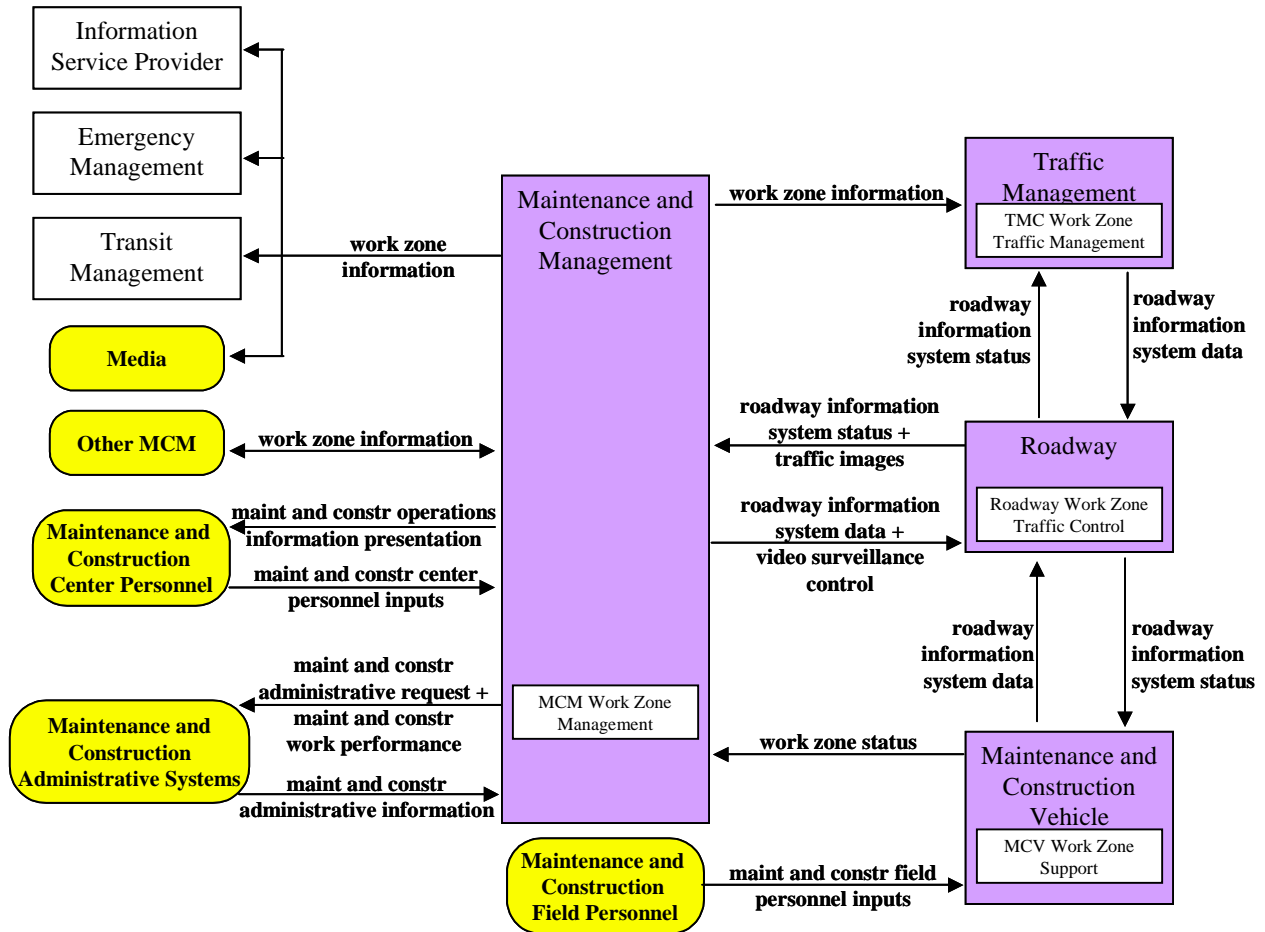
Roadway Maintenance and Construction (MC07)

This market package supports numerous services for scheduled and unscheduled maintenance and construction on a roadway system or right-of-way. Maintenance services would include landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment on the roadway (e.g., signs, traffic controllers, traffic detectors, dynamic message signs, traffic signals, CCTV, etc.). Environmental conditions information is also received from various weather sources to aid in scheduling maintenance and construction activities.



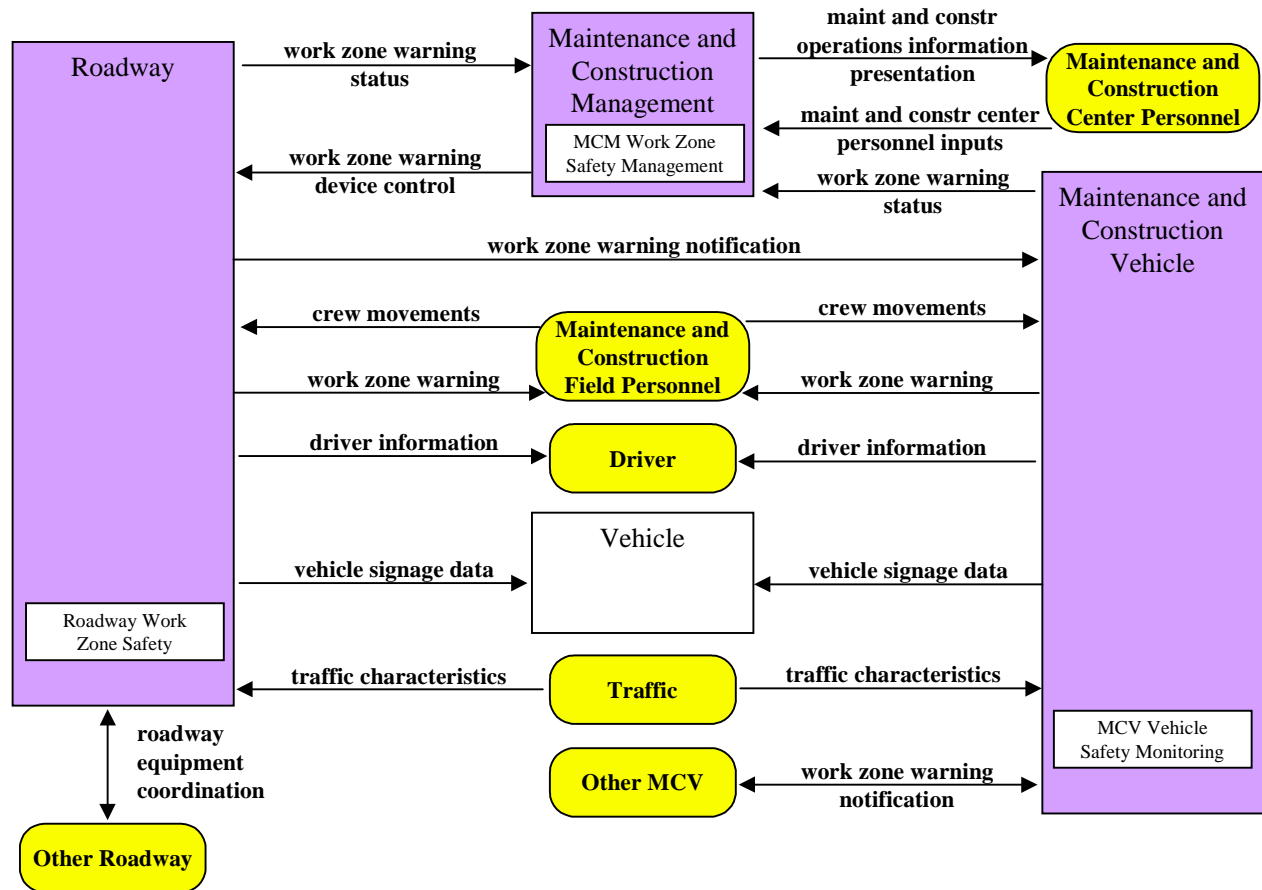
Work Zone Management (MC08)

This market package directs activity in work zones, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., ISP, TM, other maintenance and construction centers) for better coordination management. Work zone speeds and delays are provided to the motorist prior to the work zones.



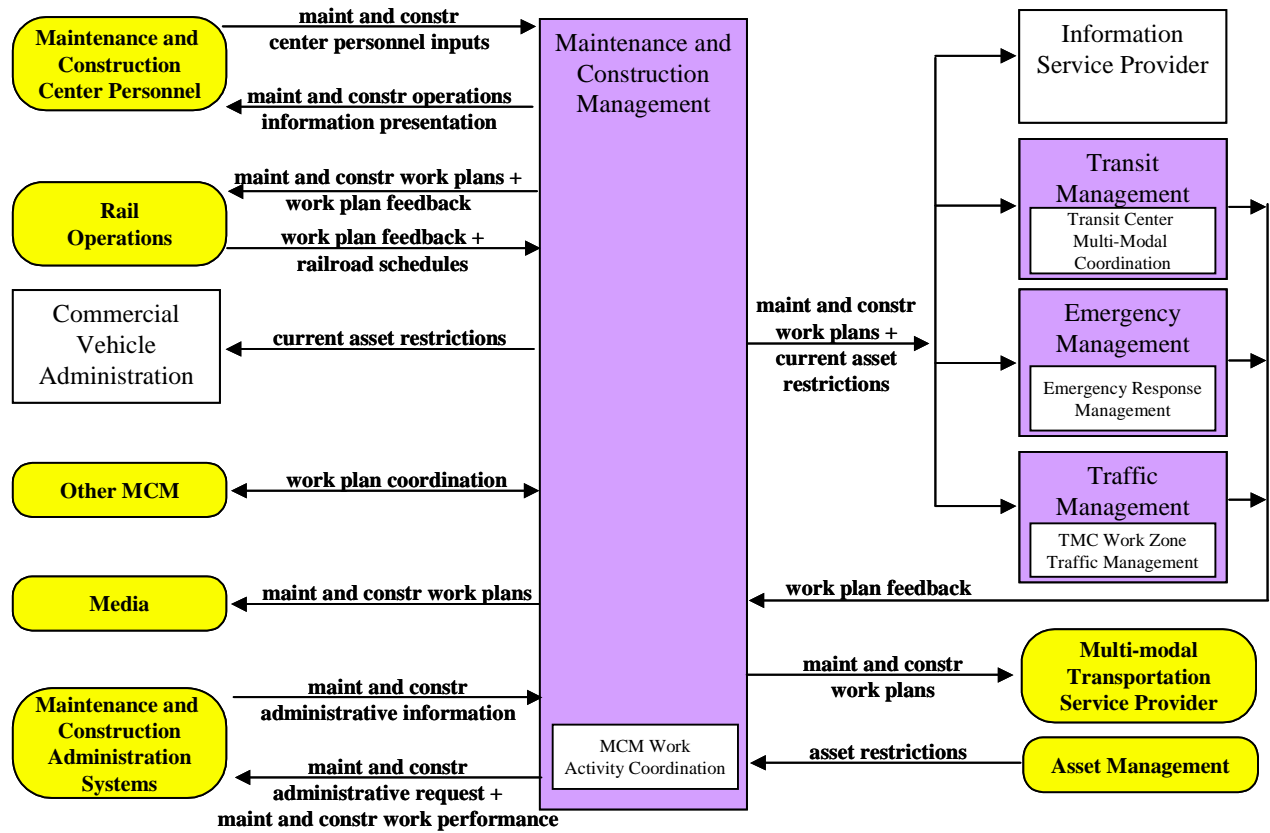
Work Zone Safety Monitoring (MC09)

This market package includes systems that improve work crew safety and reduce collisions between the motoring public and maintenance and construction vehicles. This market package detects vehicle intrusions in work zones and warns crew workers and drivers of imminent encroachment or other potential safety hazards. Crew movements are also monitored so that the crew can be warned of movement beyond the designated safe zone. The market package supports both stationary and mobile work zones. The intrusion detection and alarm systems may be colocated or distributed, allowing systems that detect safety issues far upstream from a work zone (e.g., detection of overdimension vehicles before they enter the work zone).



Maintenance and Construction Activity Coordination (MC10)

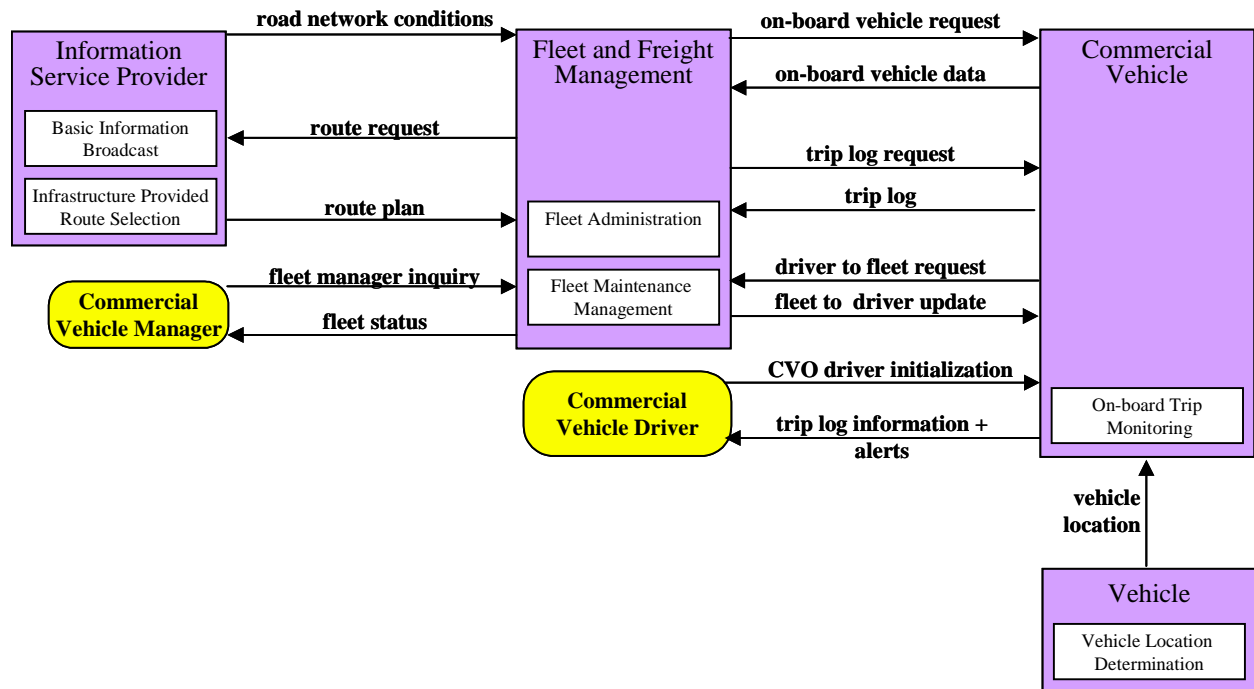
This market package supports the dissemination of maintenance and construction activity to centers which can utilize it as part of their operations, or to the Information Service Providers who can provide the information to travelers.



Commercial Vehicle Operations: CVO

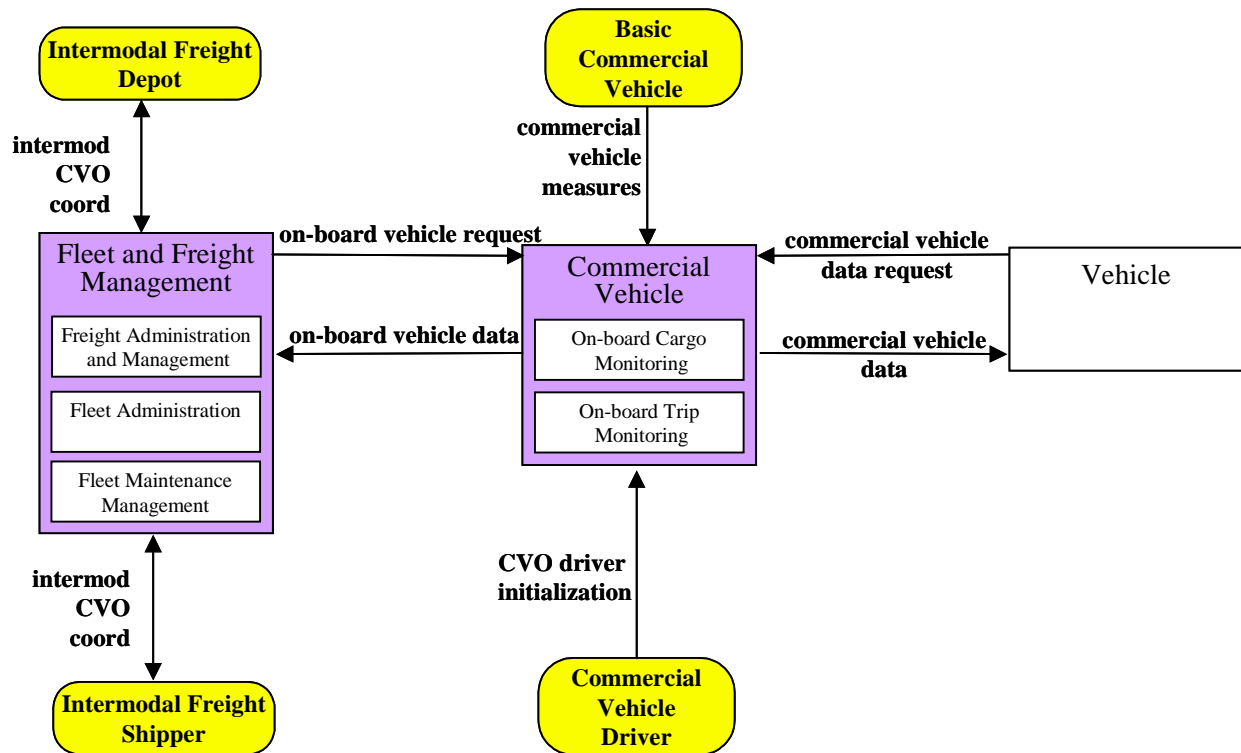
Fleet Administration (CVO1)

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 with connectivity to intermodal transportation providers using the existing wireline infrastructure.



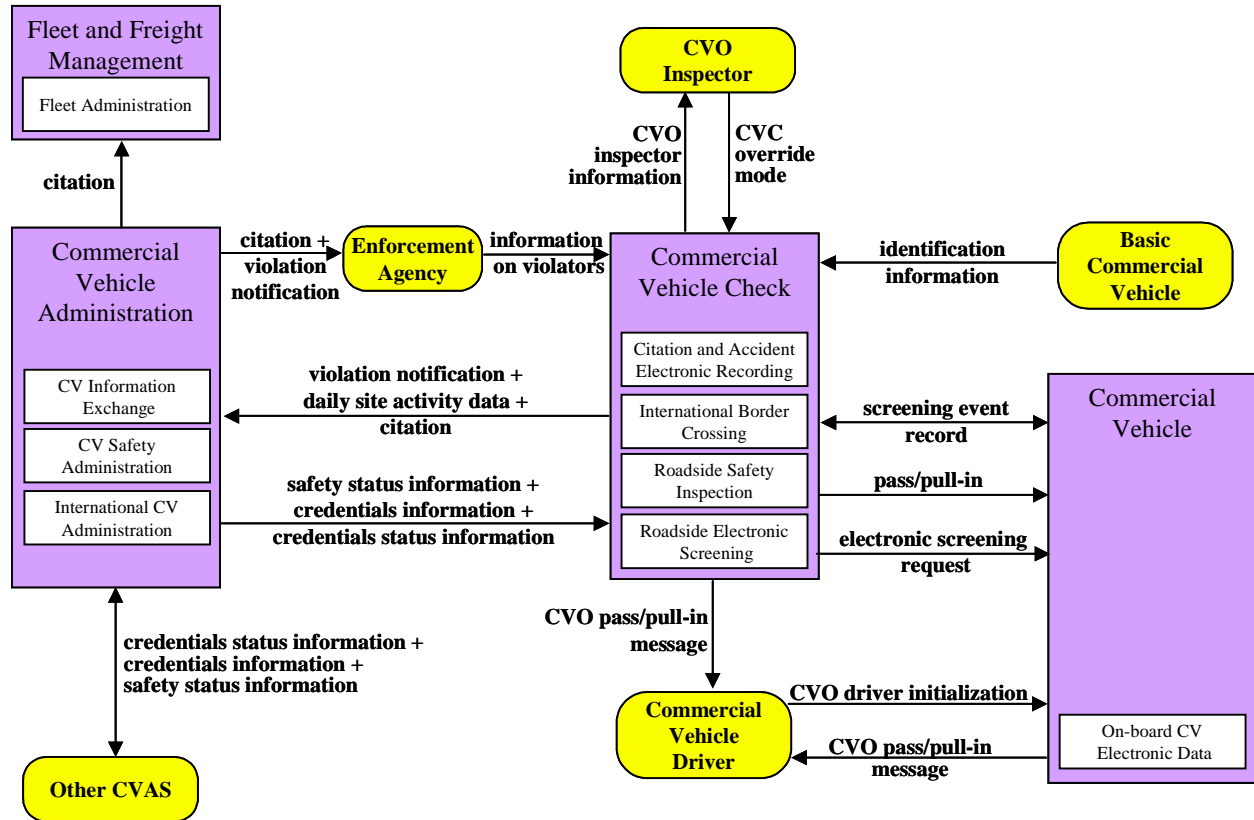
Freight Administration (CVO2)

This market package tracks cargo and the cargo condition. This information is communicated with the Fleet and Freight Management Subsystem via the existing wireless infrastructure. Interconnections are provided to intermodal shippers and intermodal freight depots for tracking the cargo from source to destination.



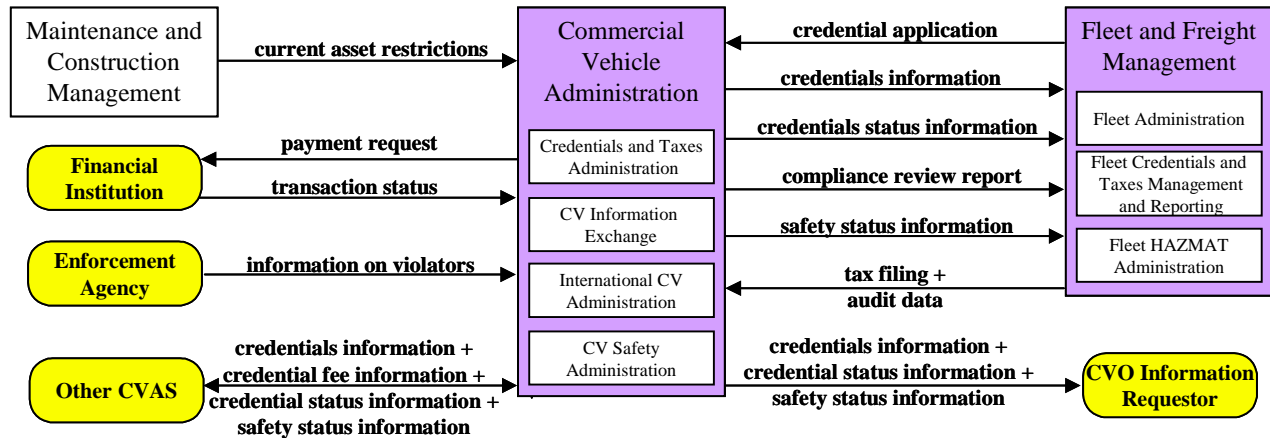
Electronic Clearance (CVO3)

This market package provides for automated clearance at roadside check facilities. The roadside check facility communicates with the Commercial Vehicle Administration subsystem over wireline 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, computer workstation processing hardware, software, and databases.



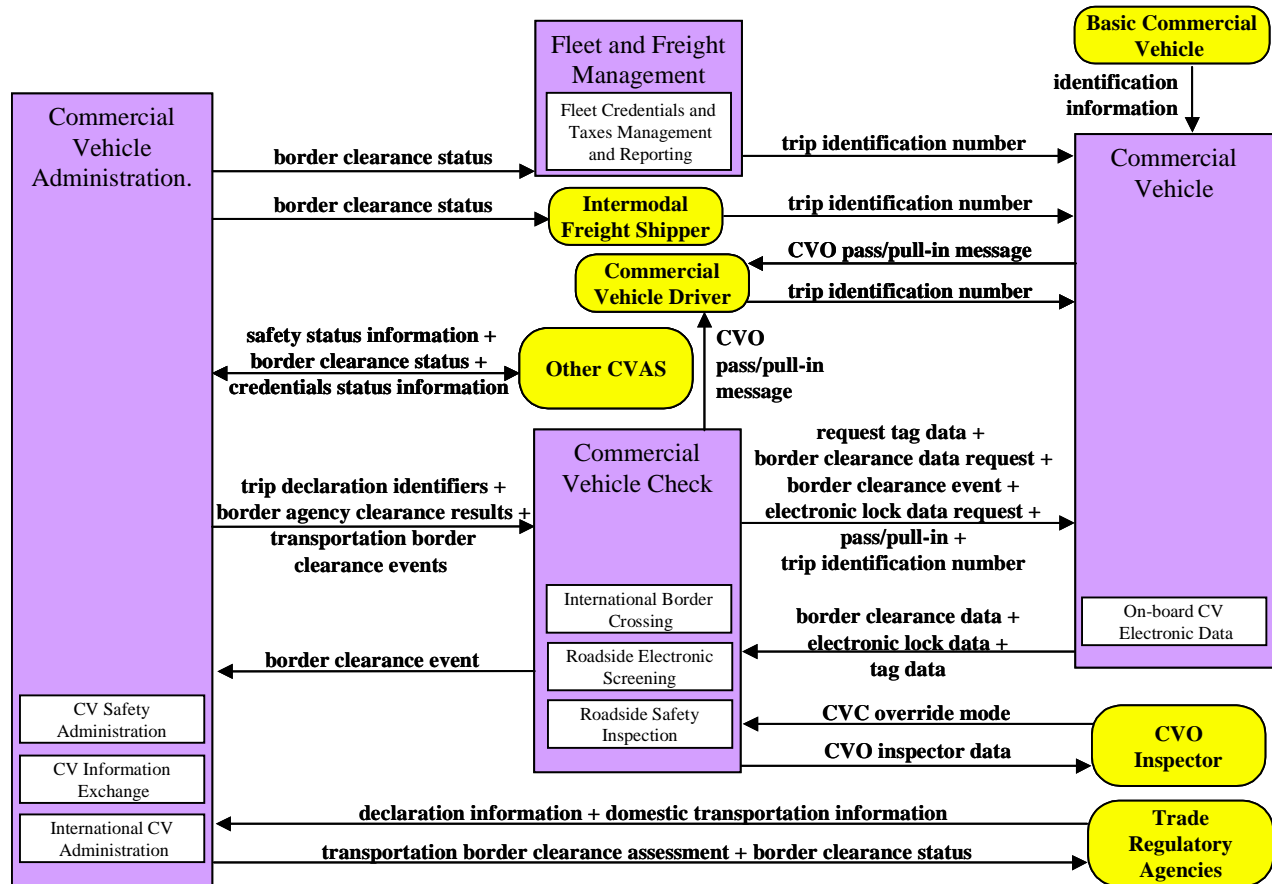
CV Administrative Processes (CVO04)

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. 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.



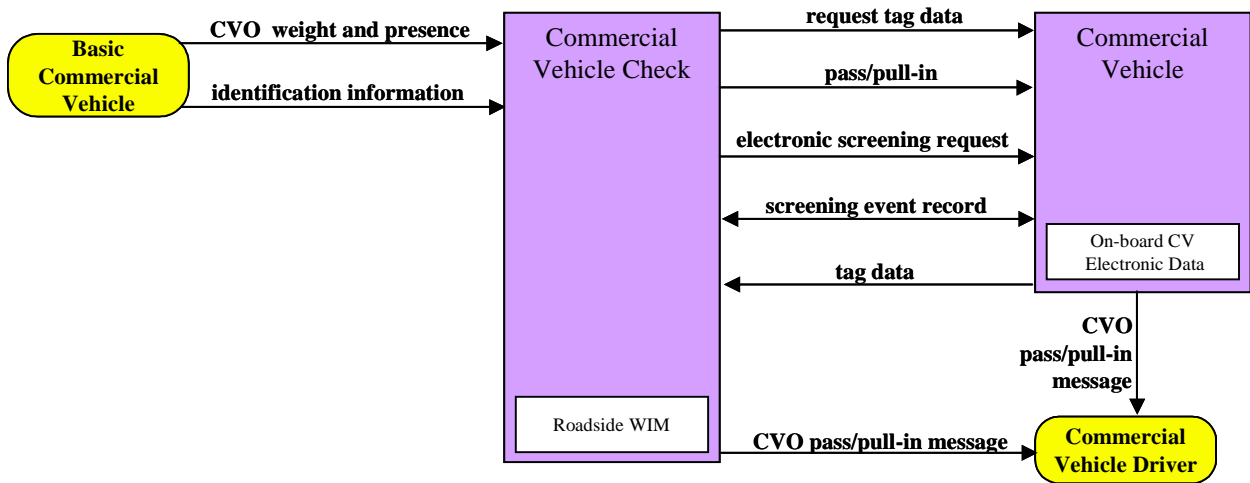
International Border Electronic Clearance (CVO05)

This market package provides for automated clearance specific to international border crossings. This package augments the electronic clearance package by allowing interface with customs related functions and permitting NAFTA required entry and exit from the US to Canada and Mexico.



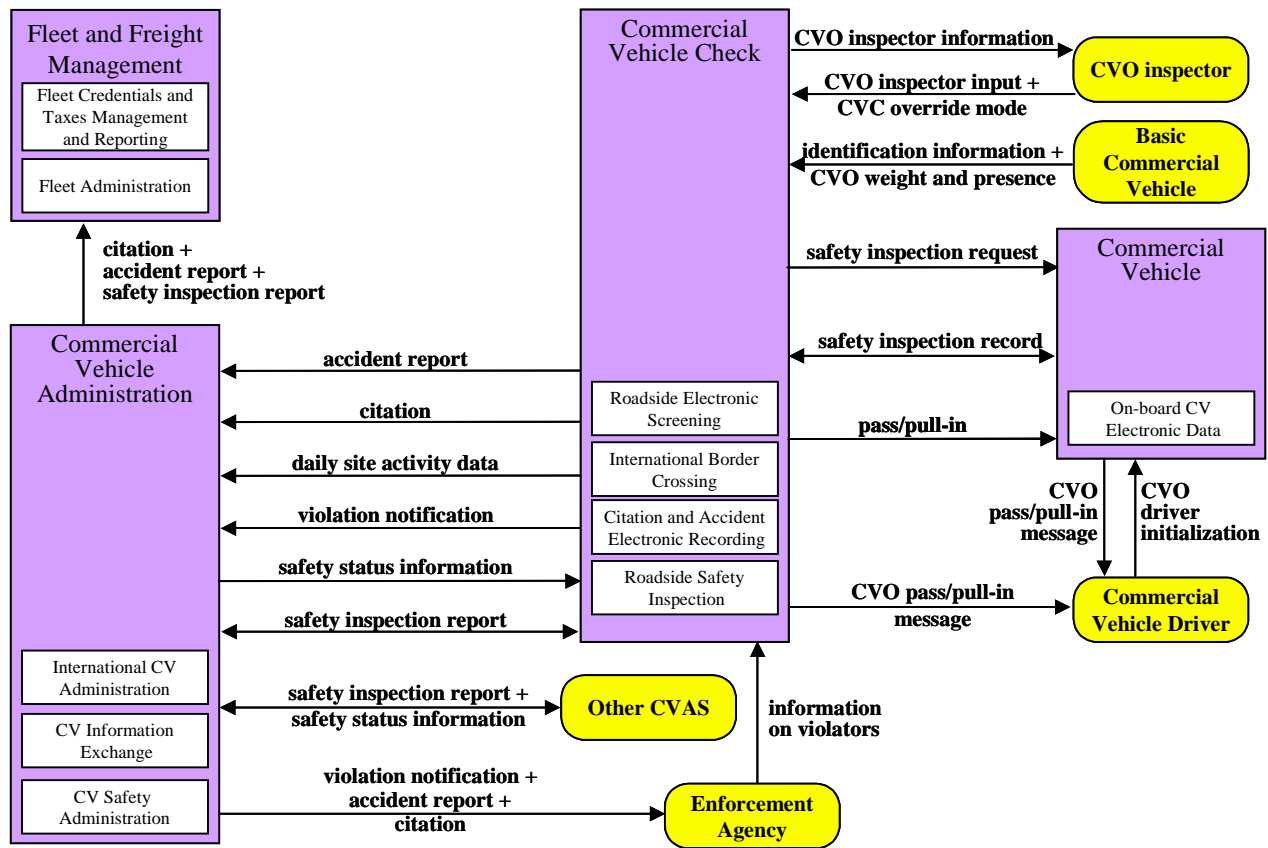
Weigh-In-Motion (CVO06)

This market package provides for high speed weigh-in-motion with or without AVI attachment. Primarily this market package provides the roadside with additional equipment, either fixed or removable. If the equipment is fixed, then it is thought to be an addition to the electronic clearance and would work in conjunction with the AVI and AVC equipment in place.



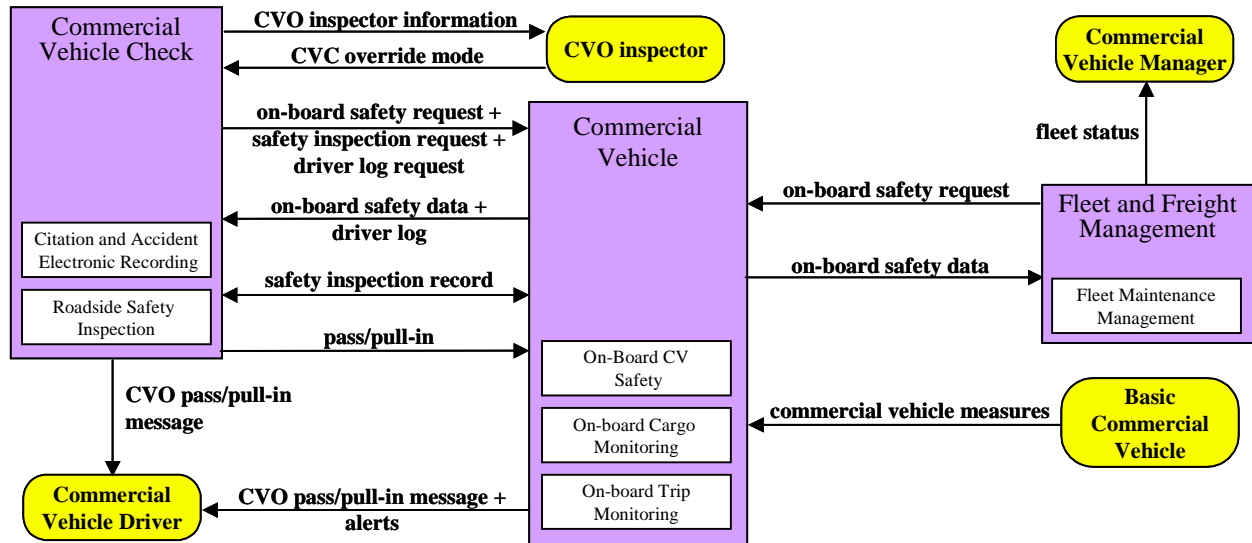
Roadside CVO Safety (CVO07)

This market package provides for automated roadside safety monitoring and reporting. It automates commercial vehicle safety inspections at the Commercial Vehicle Check roadside element. The capabilities for performing the safety inspection are shared between this market package and the On-Board CVO Safety Market Package which enables a variety of implementation options. The basic option, directly supported by this market package, facilitates safety inspection of vehicles that have been pulled in, perhaps as a result of the automated screening process provided by the Electronic Clearance Market Package. In this scenario, only basic identification data and status information is read from the electronic tag on the commercial vehicle. The identification data from the tag enables access to additional safety data maintained in the infrastructure which is used to support the safety inspection, and may also inform the pull-in decision if system timing requirements can be met. More advanced implementations, supported by the On-Board CVO Safety market package, utilize additional vehicle safety monitoring and reporting capabilities in the commercial vehicle to augment the roadside safety check.



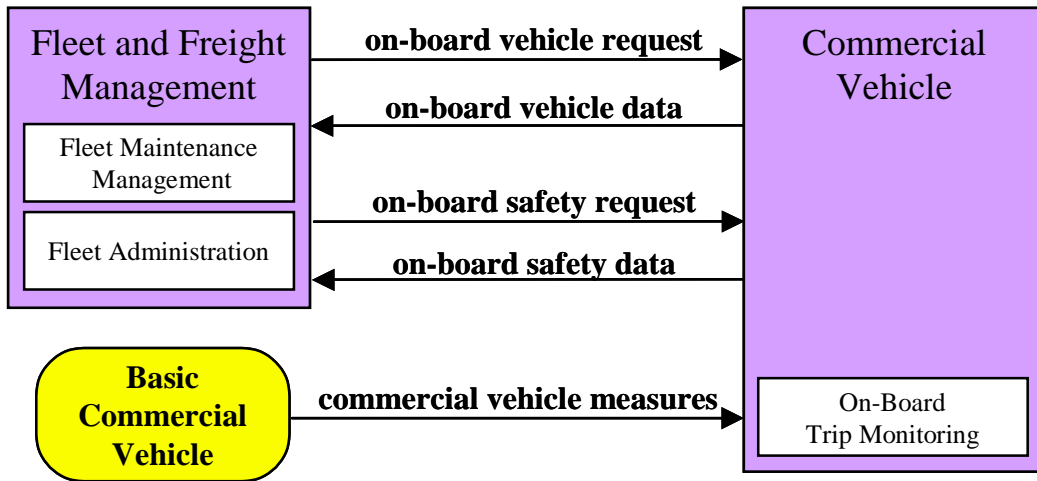
On-board CVO Safety (CVO08)

This market package provides for on-board commercial vehicle safety monitoring and reporting. It is an enhancement of the Roadside CVO Safety Market Package and includes roadside support for reading on-board safety data via tags. This market package uses the same communication links as the Roadside CVO Safety Market Package, and provides the commercial vehicle with a wireless link (data and possibly voice) to the Fleet and Freight Management and the Emergency Management Subsystems. Safety warnings are provided to the driver as a priority with secondary requirements to notify the Fleet and Freight Management and Commercial Vehicle Check roadside elements.



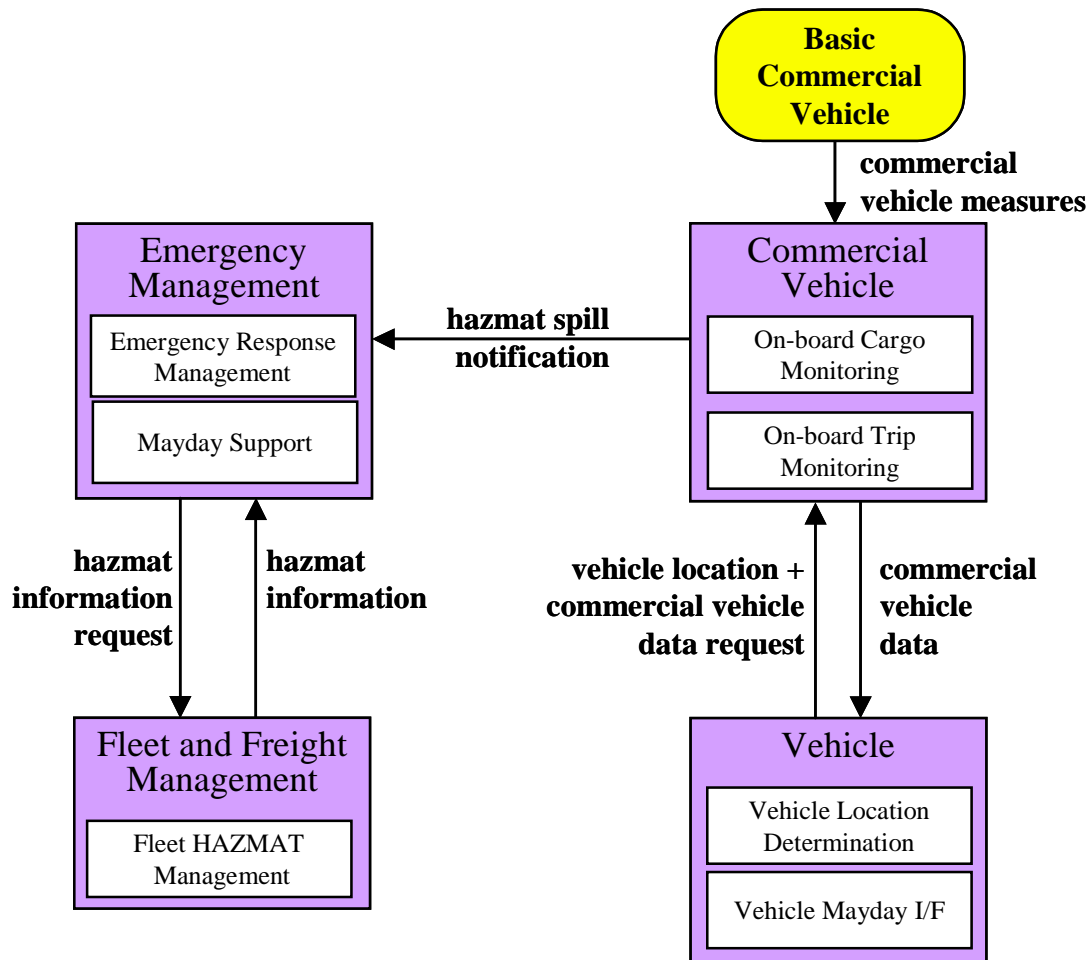
CVO Fleet Maintenance (CVO09)

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. Records of vehicle mileage, repairs, and safety violations are maintained to assure safe vehicles on the highway.



HAZMAT Management (CVO10)

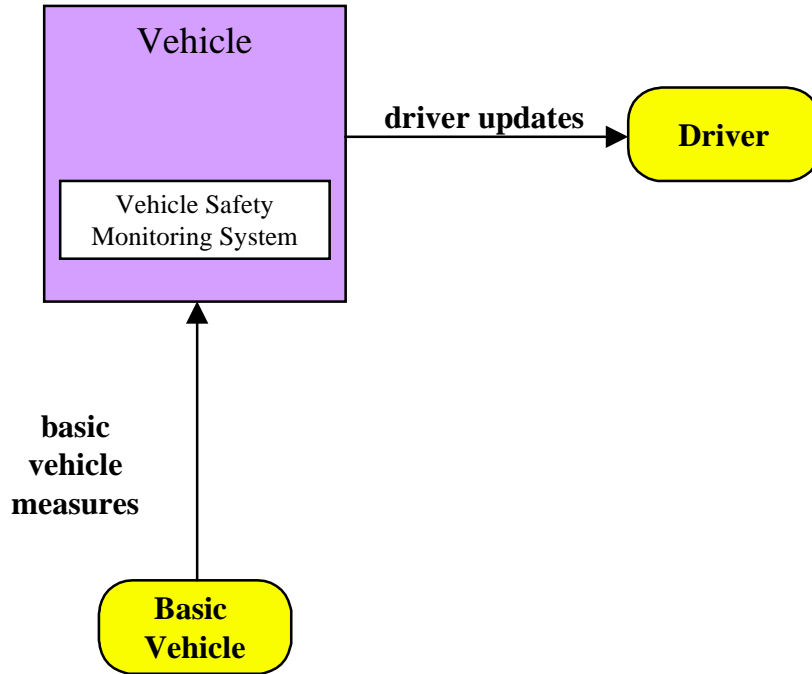
This market package integrates incident management capabilities with commercial vehicle tracking to assure effective treatment of HAZMAT material and incidents. HAZMAT tracking is performed by the Fleet and Freight Management Subsystem. The Emergency Management subsystem is notified by the Commercial Vehicle if an incident occurs and coordinates the response. The response is tailored based on information that is provided as part of the original incident notification or derived from supplemental information provided by the Fleet and Freight Management Subsystem. The latter information can be provided prior to the beginning of the trip or gathered following the incident depending on the selected policy and implementation.



Advanced Vehicle Safety System: AVSS

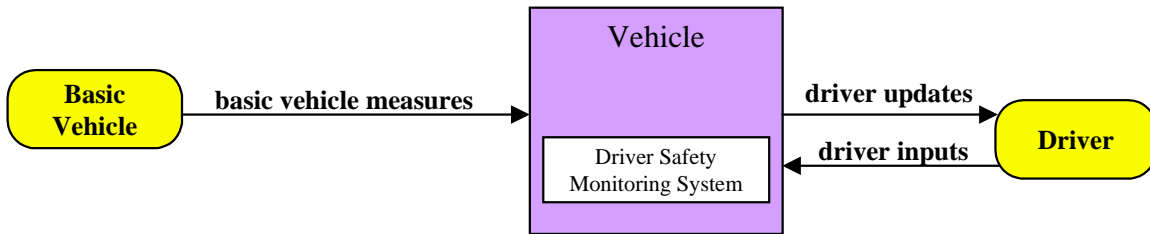
Vehicle Safety Monitoring (AVSS1)

This market package will diagnose critical components of the vehicle and warn the driver of potential dangers. On-board sensors will determine the vehicle's condition and performance, determine on-board safety data and display information.



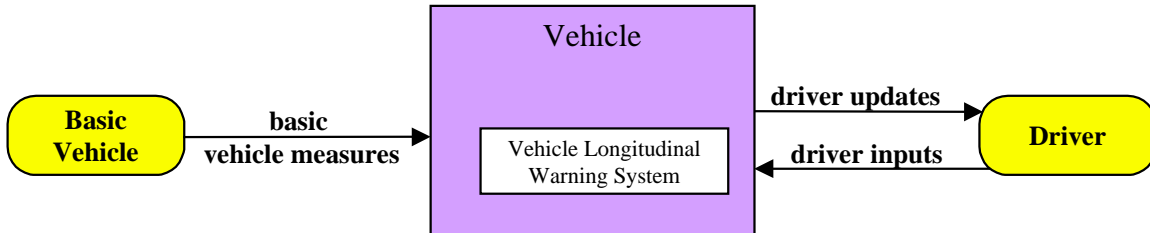
Driver Safety Monitoring (AVSS2)

This market package will determine the driver's condition, and warn the driver of potential dangers. On-board sensors will determine the driver's condition and performance, determine on-board safety data and display information.



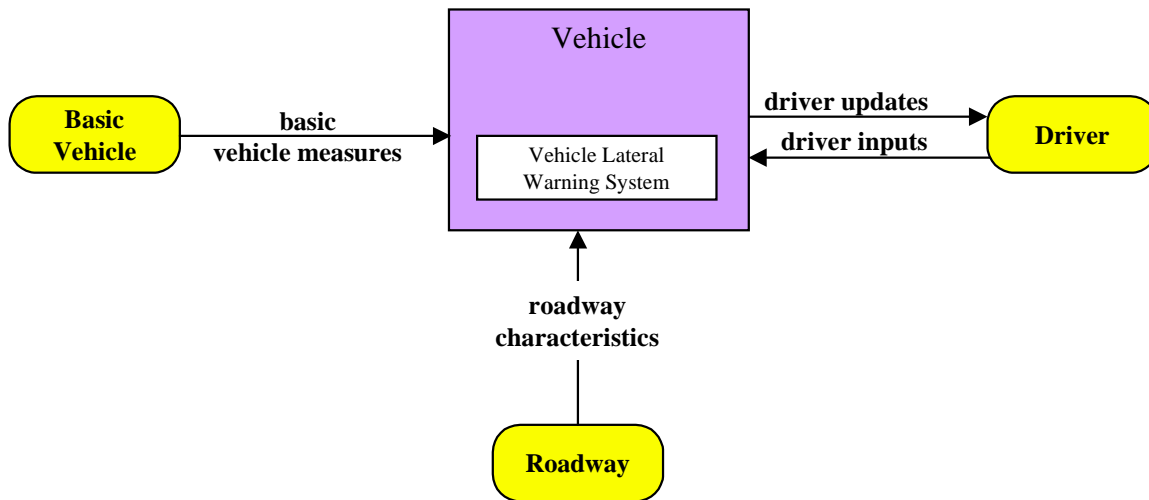
Longitudinal Safety Warning (AVSS3)

This market package allows for longitudinal warning. It utilizes safety sensors and collision sensors. It requires on-board sensors to monitor the areas in front of and behind the vehicle and present warnings to the driver about potential hazards.



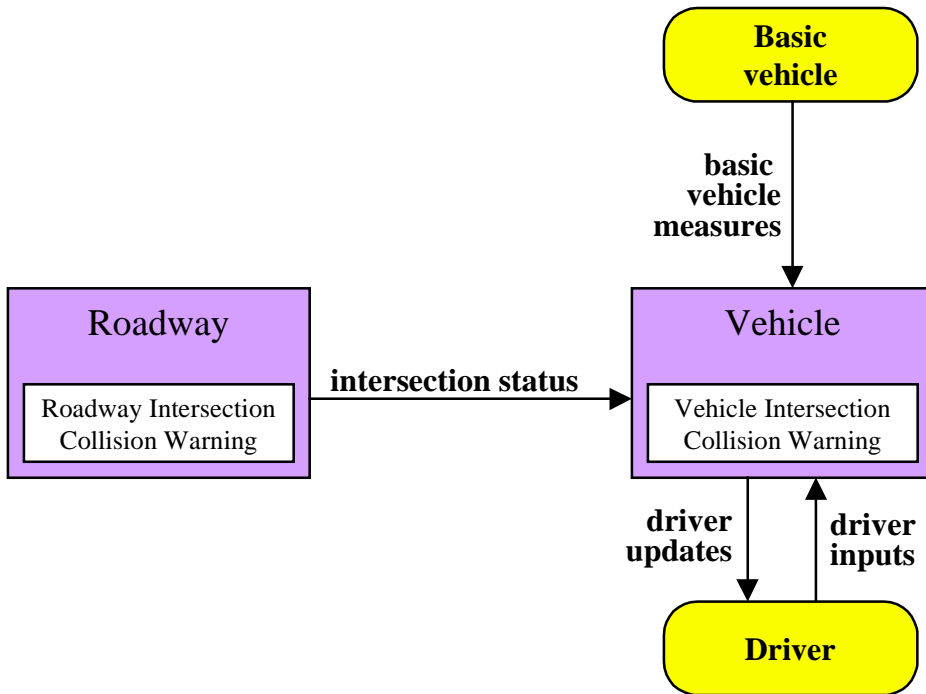
Lateral Safety Warning (AVSS4)

This market package allows for lateral warning. It utilizes safety sensors and collision sensors. It requires on-board sensors to monitor the areas to the sides of the vehicle and present warnings to the driver about potential hazards.



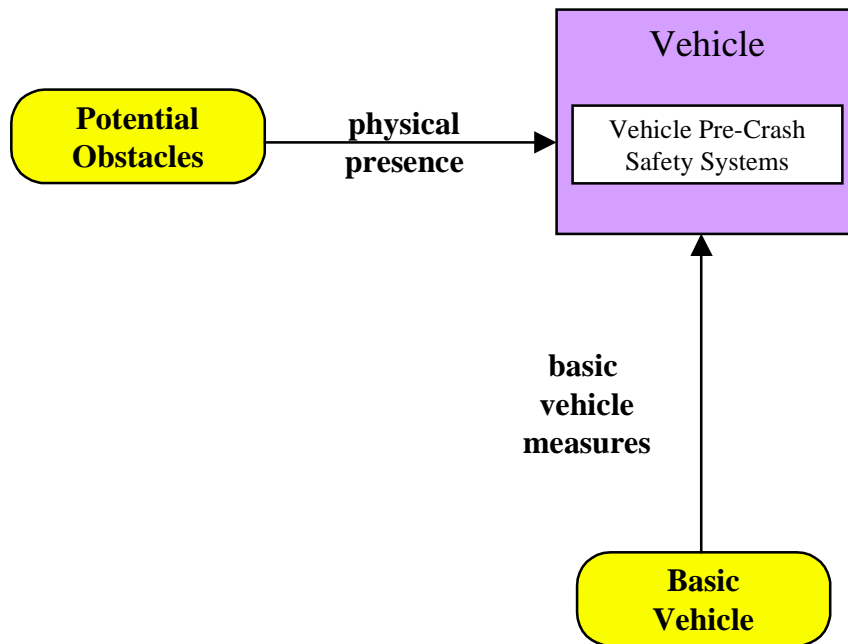
Intersection Safety Warning (AVSS5)

This market package will determine the probability of a collision in an equipped intersection (either highway-highway or highway-rail) and provide timely warnings to drivers in response to hazardous conditions. Monitors in the roadway infrastructure assess vehicle locations and speeds near an intersection. Using this information, a warning is determined and communicated to the approaching vehicle using a short range communications system. Information can be provided to the driver through the market package ATIS9--In-Vehicle Signing.



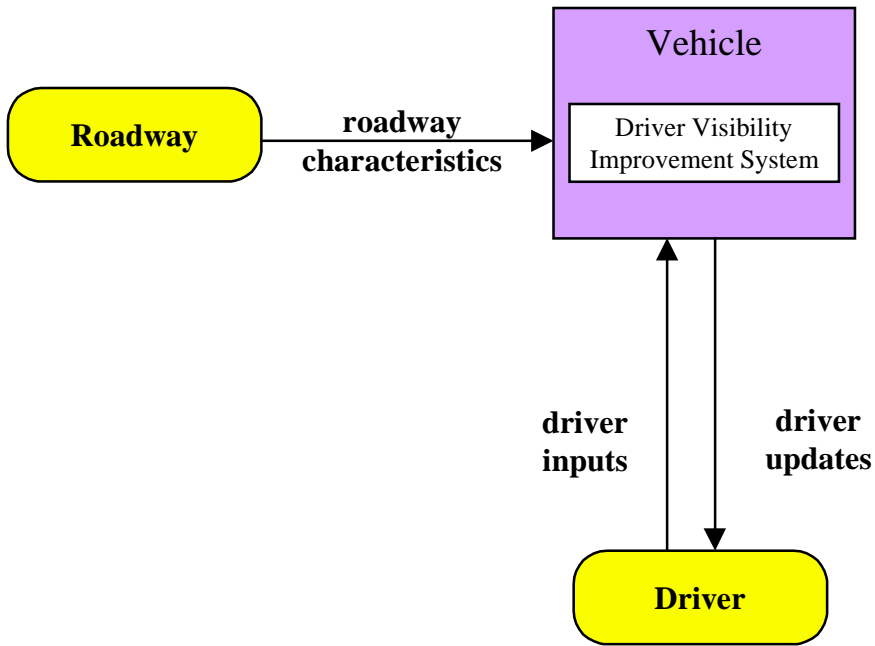
Pre-Crash Restraint Deployment (AVSS6)

This market package provides in-vehicle sensors to monitor the vehicle's local environment, determine collision probability and deploy a pre-crash safety system. It will include on-board sensors to measure lateral and longitudinal gaps and together with weather and roadway conditions will determine lateral and longitudinal collision probability. It will have the mechanism to deploy a pre-crash safety system.



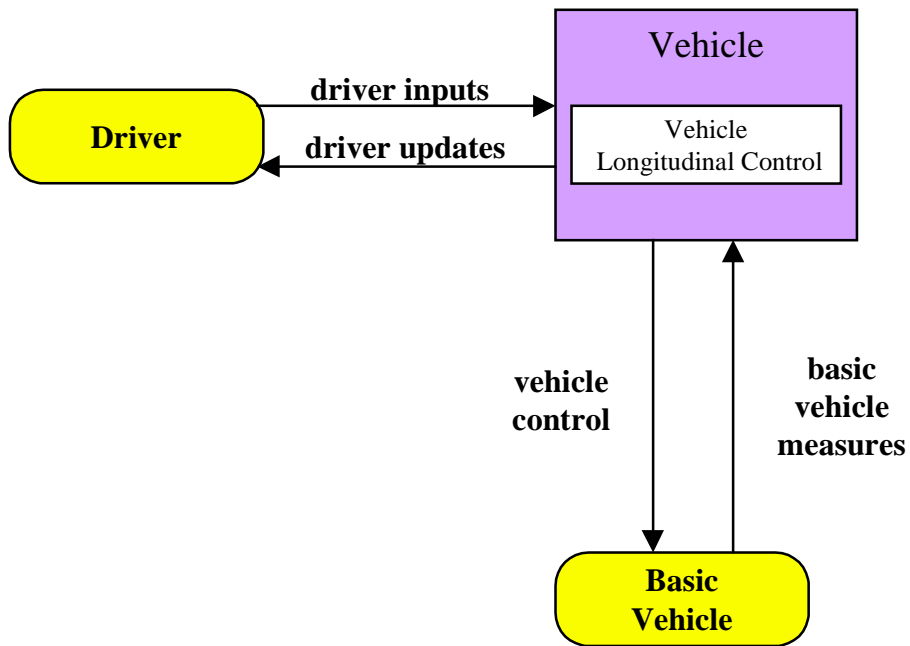
Driver Visibility Improvement (AVSS7)

This market package will enhance driver visibility using an enhanced vision system. On-board display hardware is needed



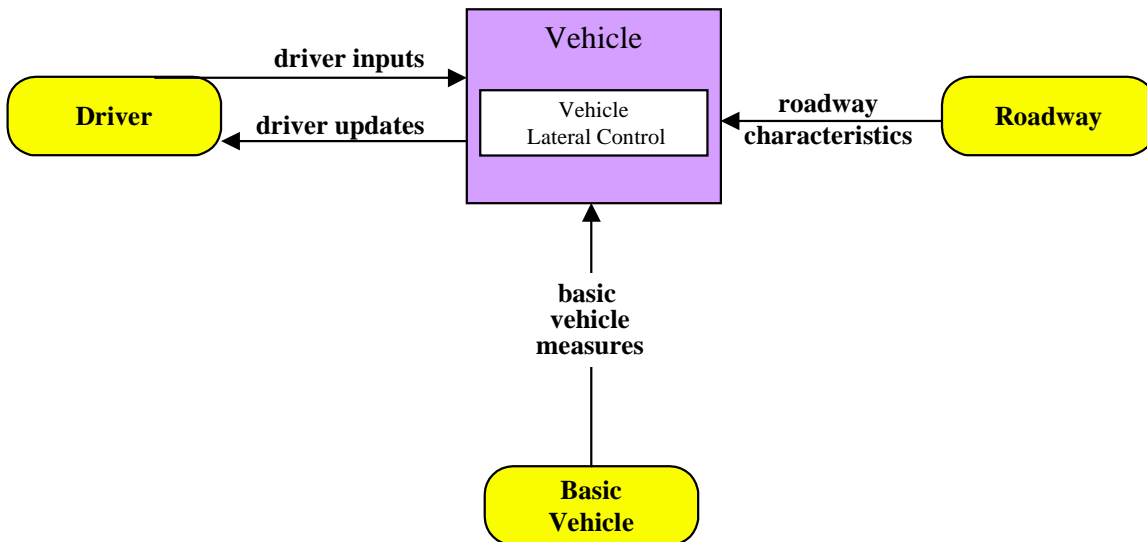
Advanced Vehicle Longitudinal Control (AVSS8)

This market package automates the speed and headway control functions on board the vehicle. It utilizes safety sensors and collision sensors combined with vehicle dynamics processing to control the throttle and brakes. It requires on-board sensors to measure longitudinal gaps and a processor for controlling the vehicle speed.



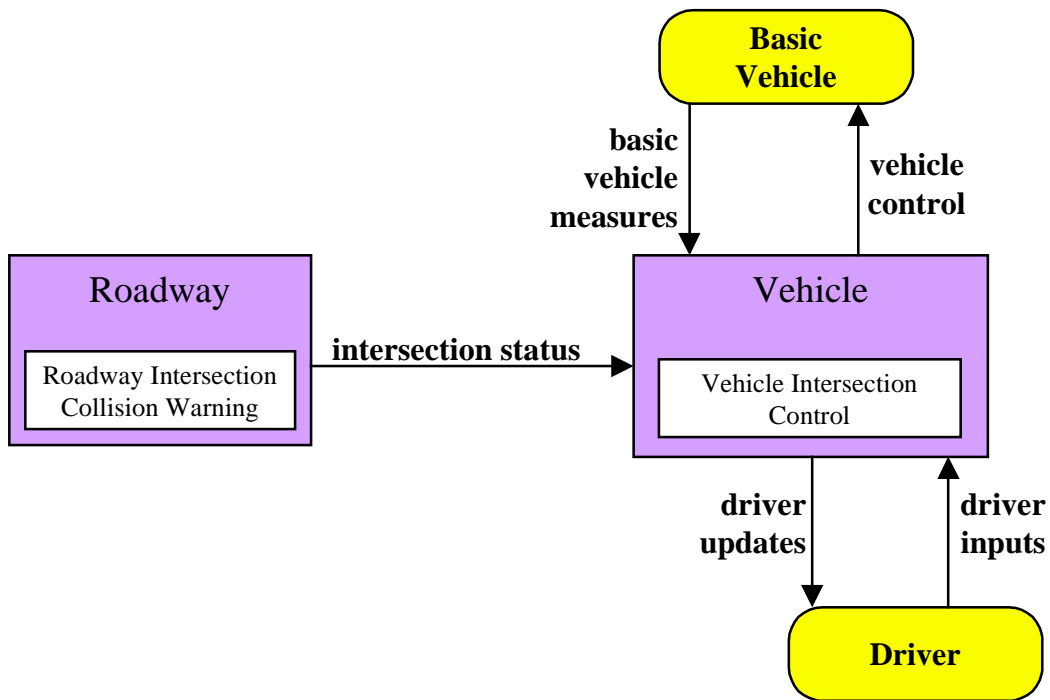
Advanced Vehicle Lateral Control (AVSS9)

This market package automates the steering control on board the vehicle. It utilizes safety sensors and collision sensors combined with vehicle dynamics processing to control the steering. It requires on-board sensors to measure lane position and lateral deviations and a processor for controlling the vehicle steering.



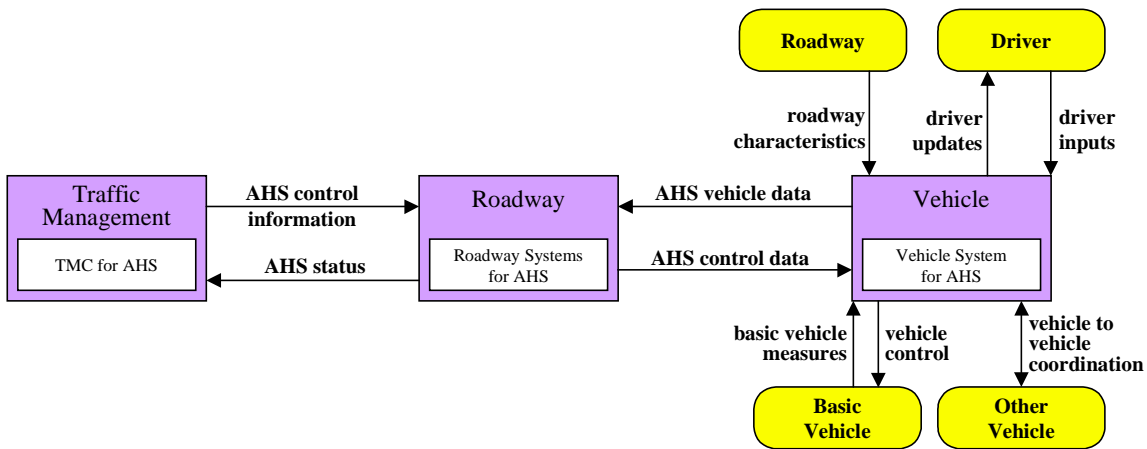
Intersection Collision Avoidance (AVSS10)

This market package will determine the probability of an intersection collision and provide timely warnings to approaching vehicles so that avoidance actions can be taken. This market package builds on the Intersection Collision Warning infrastructure and in-vehicle equipment and adds equipment in the vehicle that can take control of the vehicle in emergency situations. The same monitors in the roadway infrastructure are needed to assess vehicle locations and speeds near an intersection. This information is determined and communicated to the approaching vehicle using a short range communications system. The vehicle uses this information to develop control actions which alter the vehicle's speed and steering control and potentially activate its pre-crash safety system.



Automated Highway System (AVSS11)

This market package enables “hands-off” operation of the vehicle on the automated portion of the highway system. Implementation requires lateral lane holding, vehicle speed and steering control, and Automated Highway System check-in and checkout. This market package currently supports a balance in intelligence allocation between infrastructure and the vehicle pending selection of a single operational concept by the AHS consortium.





List of Acronyms

AD	Archived Data
ADUS	Archived Data User Service
APTS	Advanced Public Transportation Systems
ATIS	Advanced Traveler Information System
ATMS	Advanced Traffic Management System
AVI	Automated Vehicle Identification
AVL	Automated Vehicle Locator
AVSS	Advanced Vehicle Safety Systems
CAD	Computer Aided Dispatch
Caltrans	California Department of Transportation
CCTV	Closed Circuit Television
CVISN	Commercial Vehicle Information Systems & Networks
CVO	Commercial Vehicle Operations
CHP	California Highway Patrol
CMS	Changeable Message Sign
DOT	Department of Transportation
EM	Emergency Management
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FSP	Freeway Service Patrol
FTA	Federal Transit Authority
HAR	Highway Advisory Radio
HOV	High Occupancy Vehicles
ISP	Information Service Provider
ITS	Intelligent Transportation System(s)
MCO	Maintenance & Construction Operations
MOU	Memorandum of Understanding
MPO	Metropolitan Planning Organization
RCTC	Riverside County Transportation Commission
RTA	Riverside Transit Authority
RWIS	Road Weather Information System
SANBAG	San Bernardino Association of Governments
SCAG	Southern California Association of Governments
TMC	Traffic Management Center
TMC	Transportation Management Center
TOC	Traffic Operations Center
TOC	Transportation Operations Center