# *National ITS Architecture Service Packages*

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Prepared for:

Research and Innovation Technology Administration (RITA)
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# Table of Contents

# List of Tables

# List of Figures

# 1 Introduction

Service 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. Service Packages collect together one or more Equipment Packages that must work together to deliver a given transportation service and the Architecture Flows that connect them and other important external systems. In other words, they identify the pieces of the Physical Architecture that are required to implement a particular transportation service. This section outlines the purpose and structure of the Service Package document and describes some of the guiding principles used in developing the Service Packages.

## *1.1 Document Purpose*

This Service Packages document is one of a series of deliverables documenting the National Intelligent Transportation System (ITS) Architecture developed under contract to the U.S. Department of Transportation (DOT). This document defines the Service Packages, provides a series of analyses centered on the Service Packages, and includes a number of examples that illustrate ways Service Packages can be applied in regional and project architecture development activities. Through these definitions, analyses, and examples, the Service Packages document provides a comprehensive review of the Service Packages and how they can be used to plan and implement integrated transportation systems customized to local needs.

This document is intended to serve the transportation professional who is involved in ITS planning and/or implementation and wants to leverage the opportunities presented by the National ITS Architecture. The document, along with the other National ITS Architecture documents, will be of particular interest to those that are developing, or supporting the development of regional ITS systems. This group includes transportation planners, engineers, system integrators, and state and local implementers who are progressing towards integrated ITS implementations.

*What does this Service Packages Document include?*

- A summary of the National ITS Architecture and how Service Packages can be used to relate the Architecture to ITS implementations.
- A description of each of the Service Packages and general information on the problems addressed, potential benefits, and enabling technologies associated with their use.
- A description of the relationships and synergies between Service Packages that can be used to plan cost-effective, time phased deployment of ITS.
- Examples and illustrations of some of the ways that Service Packages can be applied to transportation system planning and project deployment.

*What is not included in this Service Packages Document?*

- A prescribed process for using the Service Packages. Different stakeholders must adapt the general processes identified herein to address prevailing local conditions and requirements.
- A prescription for ownership, financial, and operational responsibilities for each of the Service Package components. The identification of public sector and private sector roles will be dependent on the needs of each community.
- Evaluations of Service Packages. While the document details many of the likely benefits resulting from Service Package implementation and provides some guidance for pre-implementation assessment, the impact of implementing Service Packages will vary depending on local factors such as regional transportation supply and demand, technology choices, operational context, and intensity of deployment.

## *1.2 Guiding Principles*

Wide spread implementation of ITS will depend on a multitude of individual deployment decisions by public agencies and the private sector. The National ITS Architecture preserves choice for each of these implementers by limiting its scope to include only those interfaces and functional descriptions that address key system interoperability issues. This conservative scope allows each implementer to make maximum use of existing assets and provides a variety of evolutionary paths for maturing ITS capabilities based on individual priorities. This conservative scope carries over into the Service Packages, which bundle together the elements of the architecture that apply to representative ITS implementations.

The National ITS Architecture was developed by a diverse group of private companies, public agencies, and technical specialists which represent a microcosm of the range of stakeholders who will ultimately influence the scope and character of future ITS deployments. The Architecture has benefited from participation by public agencies at the national, state, regional, and local levels. The issues that resonate from these organizations include preservation of local autonomy, effective utilization of existing systems as well as those in development, and flexibility to expand the system as local authorities deem appropriate.

These issues were echoed by the private sector with the additional recommendation that utilizing existing infrastructure enables rapid early deployment, reduces risk through utilization of known technologies and organizations, and allows more reliable cost estimation. Leveraging the existing and emerging national communications infrastructure (e.g., the Internet) was a unique idea when the architecture was originally conceived. Today, ITS, like the broader economy, is swept up in the adaptation and use of the Internet for its own business needs.

These considerations resulted in this Service Packages document which is based on several key principles:

- The Service Packages are not a prescription for every region, or even one region. They identify the key ingredients from the Architecture that support representative ITS deployments. The recipe for a particular region must be based on identified needs and available resources. As a result, tailoring a regional ITS architecture derived from the Service Packages is a mandatory step to ensure that the architecture supports specific regional needs.
- A set of basic Service Packages was identified that support the critical needs of public organizations to maintain and improve existing systems. Initial ITS implementations will build on these systems.
- Distinct Service Packages are identified that provide enabling infrastructure that is aimed at the most critical operational problems of today's transportation systems. Early implementations enhance management of the transportation network and form a basis for many of the value-added information services associated with ITS.
- Staged implementation can begin with these "islands" of basic ITS capability that are deployed in response to local needs. Increased travel demand, greater traveler expectations, and evolving needs encourages service expansion and eventual linking of these ITS islands. Geographic expansion will be paralleled by technology growth resulting in new capabilities, new products, and new features. Service Packages are defined to capture these progressions.
- ITS standards provide a unifying framework that will enhance the interoperability of these diverse, locally-responsive ITS implementations. The Service Packages are linked with, and supported by, ITS standards that are required to achieve the interoperability objectives of US DOT for ITS.

## *1.3 Document Structure*

The Service Packages Document begins with a summary of the core physical architecture definition and builds outward to define Service Packages and their potential application in regional and project architecture development. The contents of each of the document sections are summarized in the following paragraphs.

*Section 2. Relating Service Packages to the National ITS Architecture.* This section provides a brief review of the National ITS Architecture and describes how the Service Packages fit in this context. Detailed definitions of all the Service Packages are presented and a discussion of the relationship between Service Packages and the Theory of Operations is provided.

*Section 3. Relating Service Packages to the User Services.* This section relates the Service Packages to the User Services that are the requirements basis for the National ITS Architecture. As might be expected, this is a many-to-many relationship since a single Service Package often includes capabilities that span more than one user service. Also, a single User Service sometimes includes a range of incremental capabilities that are segregated into separate Service Packages.

# 2 Relating Service Packages to the National ITS Architecture

The National ITS Architecture provides a framework for designing transportation systems that implement the ITS User Services. The User Services were developed as part of the National ITS Program Planning process and were the key source requirements for the Architecture development effort. The Architecture defines the functions that must be performed, the Subsystems that provide these functions, and the information that must be exchanged to support these User Services. The Service Packages are directly traceable to both the Architecture Framework and the User Services. This section describes each of the Service Packages and connects the Service Packages to the Architecture Framework and the User Services.

This section introduces the National ITS Architecture definition and relates this definition to the range of ITS services and implementation options that will be considered by implementers. This relationship between Architecture and implementation is presented using a defined set of *Service Packages*.

## *2.1 Relating Service Packages to the Architecture Definition*

Service Packages represent particular groupings of entities defined in the Physical Architecture that correspond to specific transportation services. The Physical Architecture is comprised of transportation, communications, and institutional layers. The transportation layer includes the various transportation-related processing centers, distributed field equipment, vehicle equipment, and other equipment used by travelers to access ITS services. The transportation layer is fully documented in the separate Physical Architecture document. The communication layer provides for the transfer of information between the transportation layer elements. The institutional layer introduces the policies, funding incentives, working arrangements, and jurisdictional structure that support the technical layers of the Architecture.

The Transportation and Communication Layers together are the *Architecture Framework* that coordinates overall system operation by defining interfaces between equipment which may be deployed by different procuring and operating sectors. The Architecture Framework defines what each major transportation system element does and how they interact to provide all user services. This Framework of Subsystems and interfaces is specified in an implementation independent fashion to preserve maximum implementation flexibility.

Figure 2.1-1 provides a high-level view of the Architecture Framework. The figure includes both the transportation and communication layers of the Architecture since it depicts both the Subsystems (transportation layer elements) and the major communications interconnects (communication layer elements) required to support the user services.

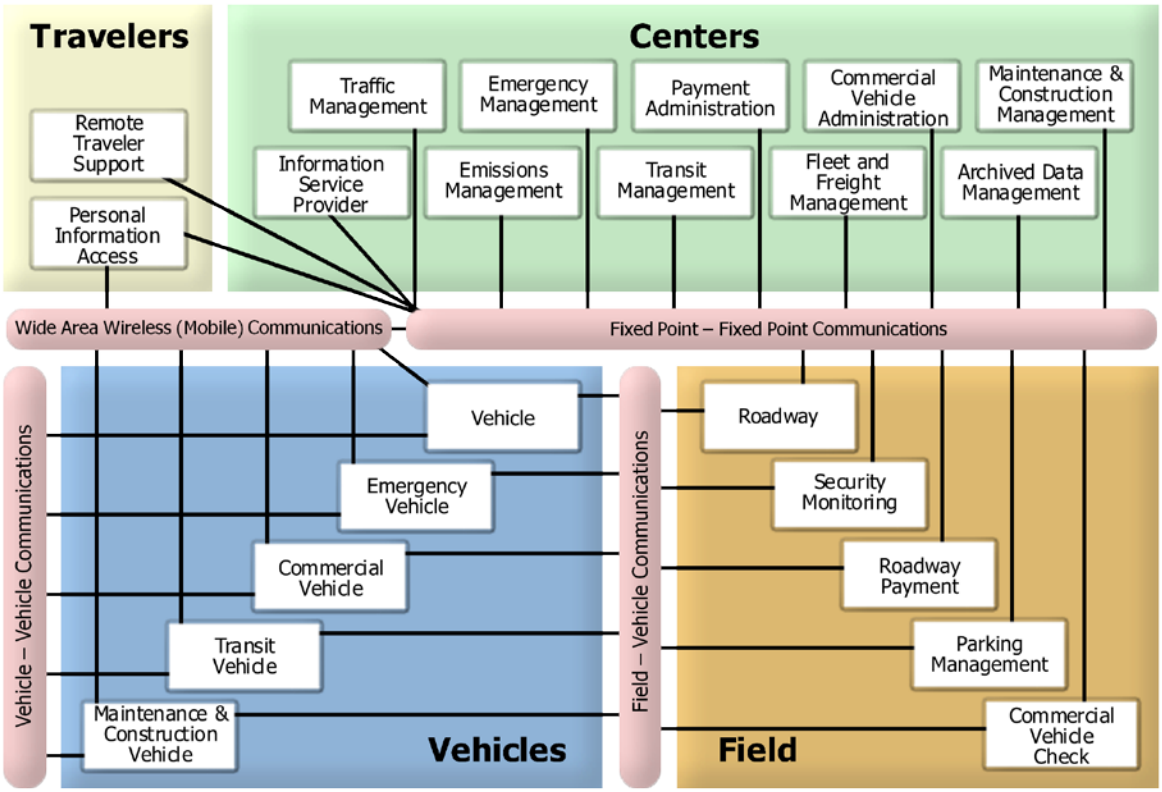


**Figure 2.1-1: National ITS Architecture Subsystems and Communications**

## 2.1.1 Service Packages and Subsystems

The Transportation Layer includes the twenty-two interconnected Subsystems identified in Figure 2.1-1. The selected Subsystems align closely with existing jurisdictional and physical boundaries that underscore the operation and maintenance of current transportation systems. By mirroring the current transportation environment with the identified Subsystems, the Subsystem boundaries identify the likely candidates for interface standardization. The Architecture recognizes these boundaries to minimize the impact associated with adoption of the Architecture. Maximum commonality between existing transportation system boundaries and Architecture boundaries serves to minimize the number of artificial boundaries which are imposed (and constrained) by the Architecture. Complete definitions of the Subsystems and other Physical Architecture entities can be found in the Physical Architecture document.

Before describing how Subsystems combined for a particular Service Package application, an important distinction must be made between the “center” Subsystems and the transportation management “centers” that are familiar to most transportation professionals.

In simplest terms, the center Subsystems are not “brick and mortar”. Each Subsystem is a cohesive set of functional definitions with required interfaces to

other Subsystems. Subsystems are *functionally*, not physically, defined. A regional implementation may include a single physical center that collocates the capabilities from several of the center Subsystems. For instance, a single Transportation Management Center may include Traffic Management Subsystem, Transit Management Subsystem, Emergency Management Subsystem, and Information Service Provider Subsystem capabilities. Conversely, a single Subsystem may be replicated in many different physical centers 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. Figure 2.1-2 provides an indication of the range of ways that center Subsystems may be implemented in physical centers.

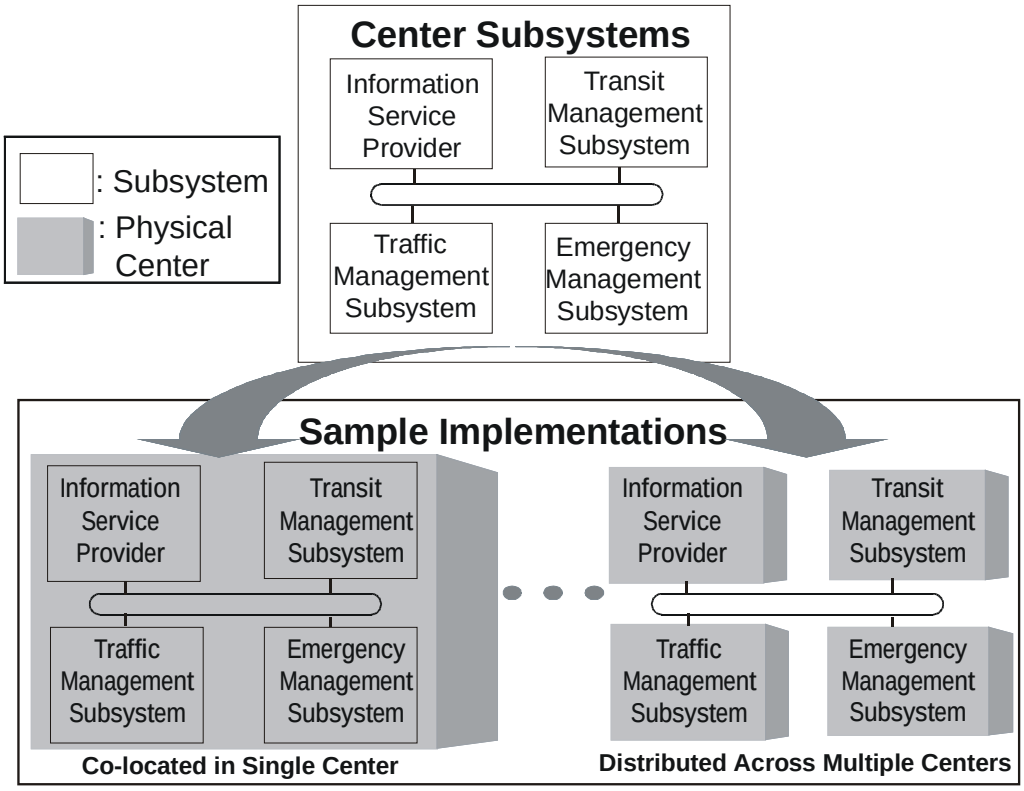


**Figure 2.1-2: Center Subsystems May Be Implemented In Various Regional Configurations**

A Service Package is implemented with a combination of interrelated equipment; this equipment often resides in several different Subsystems within the Architecture Framework and may be operated by different stakeholders. For instance, the Transit Vehicle Tracking Service Package includes vehicle location equipment in the Transit Vehicle Subsystem and a base station element in the Transit Management Subsystem. In this example, all Service Package elements are owned and operated by the same transit stakeholder.

In other cases, the Service Package elements are owned and operated by different stakeholders. Many of the ATIS Service 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.

### 2.1.2 Service Packages and Equipment Packages

To understand and analyze these potential deployment variations, the defined Service Packages must be decomposed to their constituent elements. The portion of the Service Package capabilities that are allocated to each Subsystem are segregated and defined as Equipment Packages to support this additional resolution. An *Equipment Package* represents a set of capabilities that exist in a subsystem.

Since Equipment Packages are both the most detailed elements of the Physical Architecture and associated with specific Service Packages, there is clear traceability between the interface-oriented Architecture Framework and the deployment-oriented Service Packages. Figure 2.1-3 depicts the relationship between Architecture elements and Service Packages.

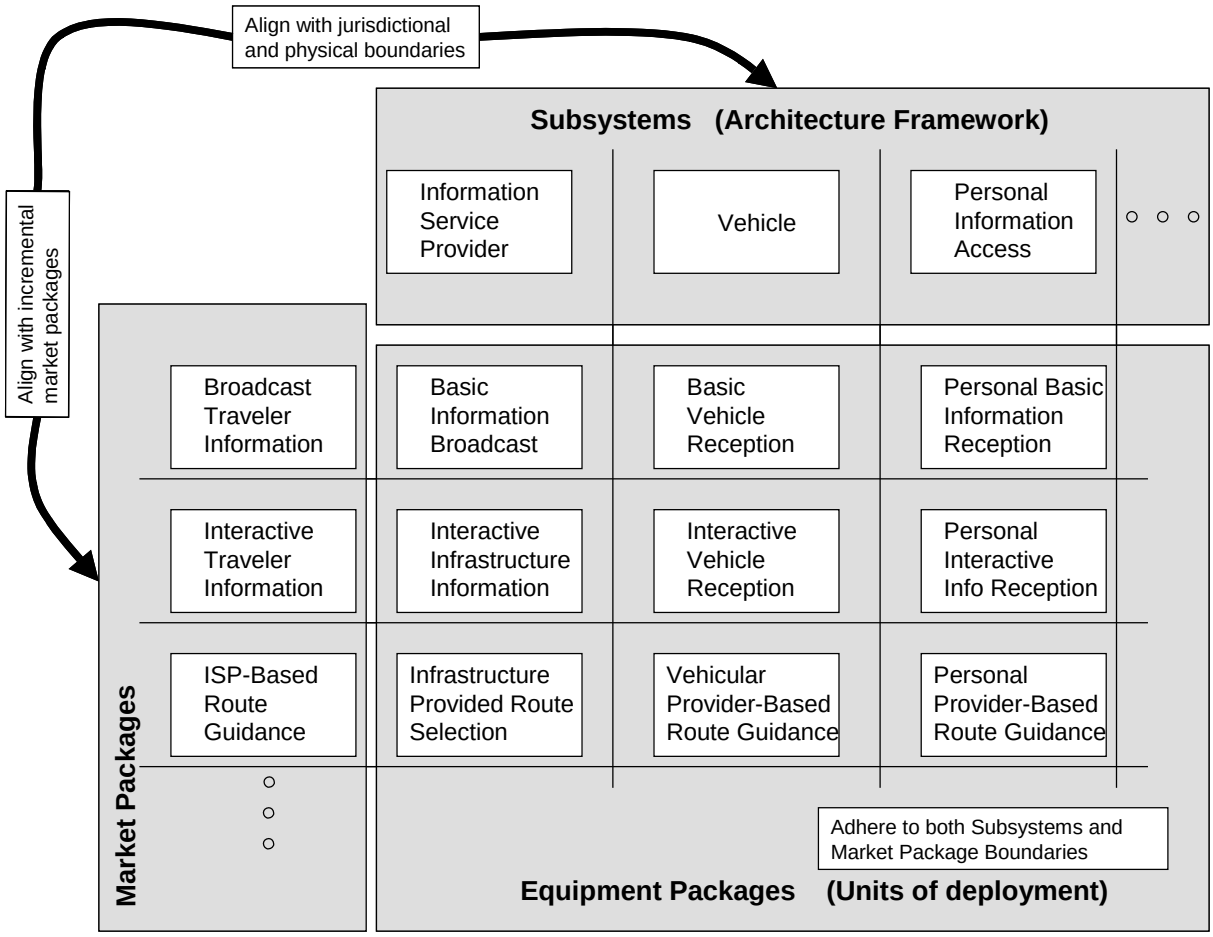


**Figure 2.1-3: Architecture Element Relationships**

Table 2.1-1 provides a complete listing of the Equipment Packages for each valid Service Package/Subsystem combination. In the table, the rows represent the defined Service Packages, the columns represent the Subsystems, and the center section of the table identifies the associated Equipment Packages. Related Service Packages are grouped along the left side so the reader can see the total set of Equipment Packages that make up a particular Service Package deployment. The Physical Architecture deliverable provides detailed specifications for each of the Equipment Packages identified in the table.

***Table 2.1-1: Complete listing of the Equipment Packages for each valid Service Package/Subsystem Combination***

| Service Package | Service Package Name | Archived Data Management | Commercial Vehicle | Commercial Vehicle Administration | Commercial Vehicle Check | Emergency Management | Emergency Vehicle | Emissions Management | Fleet and Freight Management | Information Service Provider | Maintenance and Construction Management | Maintenance and Construction Vehicle | Parking Management | Payment Administration | Personal Information Access | Remote Traveler Support | Roadway | Roadway Payment | Security Monitoring | Traffic Management | Transit Management | Transit Vehicle | Vehicle |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AD1 | ITS Data Mart | Government Reporting Systems Support<br>ITS Data Repository<br>Traffic and Roadside Data Archival | | CV Data Collection | | Emergency Data Collection | | Emissions Data Collection | | ISP Data Collection | MCM Data Collection | | Parking Data Collection | Toll Data Collection | | | Roadway Data Collection<br>Roadway Probe Data Communications | | | Traffic Data Collection | Transit Data Collection | | Vehicle Traffic Probe Support |
| AD2 | ITS Data Warehouse | Government Reporting Systems Support<br>ITS Data Repository<br>On-Line Analysis and Mining<br>Traffic and Roadside Data Archival | | CV Data Collection | | Emergency Data Collection | | Emissions Data Collection | | ISP Data Collection | MCM Data Collection | | Parking Data Collection | Toll Data Collection | | | Roadway Data Collection<br>Roadway Probe Data Communications | | | Traffic Data Collection | Transit Data Collection | | Vehicle Traffic Probe Support |
| AD3 | ITS Virtual Data Warehouse | ITS Data Repository<br>Virtual Data Warehouse Services | | | | | | | | | | | | | | | | | | | | | |
| APTS01 | Transit Vehicle Tracking | | | | | | | | | | | | | | | | | | | | Transit Center Vehicle Tracking | On-board Transit Trip Monitoring | |
| APTS02 | Transit Fixed-Route Operations | | | | | | | | | | | | | | | | | | | | Transit Center Fixed-Route Operations<br>Transit Vehicle Operator Assignment | On-board Schedule Management | |
| APTS03 | Demand Response Transit Operations | | | | | | | | | | | | | | | | | | | | Transit Center Paratransit Operations<br>Transit Vehicle Operator Assignment | On-board Paratransit Operations | |
| APTS04 | Transit Fare Collection Management | | | | | | | | | | | | | | | Remote Transit Fare Management | | | | | Transit Center Fare Management | On-board Transit Fare Management | |
| APTS05 | Transit Security | | | | | Center Secure Area Alarm Support<br>Center Secure Area Sensor Management<br>Center Secure Area Surveillance<br>Emergency Response Management | | | | | | | | | | | Remote Traveler Security<br>Traveler Secure Area Sensor Monitoring<br>Traveler Secure Area Surveillance | | | Field Secure Area Sensor Monitoring<br>Field Secure Area Surveillance | | Transit Center Security | On-board Transit Security | |
| APTS06 | Transit Fleet Management | | | | | | | | | | | | | | | | | | | | Transit Garage Maintenance<br>Transit Vehicle Assignment | On-board Maintenance<br>On-board Schedule Management | |
| APTS07 | Multi-modal Coordination | | | | | | | | | | | | | | | | | | | TMC Multimodal Coordination | Transit Center Multi-Modal Coordination | On-board Schedule Management | |

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| APTS08 | Transit Traveler Information | | | | | | | | | Infrastructure Provided Trip Planning<br>ISP Traveler Data Collection | | | | | Personal Interactive Information Reception | Remote Transit Information Services | | | | | Transit Center Information Services | On-board Transit Information Services | |
| APTS09 | Transit Signal Priority | | | | | | | | | | | | | | | | Roadway Signal Priority | | | TMC Multimodal Coordination<br>TMC Signal Control | Transit Center Signal Priority | On-board Transit Signal Priority | |
| APTS10 | Transit Passenger Counting | | | | | | | | | | | | | | | | | | | | Transit Center Passenger Counting | On-board Passenger Counting | |
| APTS11 | Multimodal Connection Protection | | | | | | | | | Infrastructure Provided Trip Planning | | | | | Personal Trip Planning and Route Guidance | Remote Transit Information Services | | | | | Transit Center Connection Protection | On-board Connection Protection<br>On-board Transit Fare Management | |
| ATIS01 | Broadcast Traveler Information | | | | | | | | | Basic Information Broadcast<br>ISP Traveler Data Collection | | | | | Personal Basic Information Reception | Remote Basic Information Reception | | | | | | | Basic Vehicle Reception |
| ATIS02 | Interactive Traveler Information | | | | | | | | | Interactive Infrastructure Information<br>ISP Traveler Data Collection<br>ISP Traveler Information<br>Alerts Traveler Telephone Information | | | | | Personal Interactive Information Reception | Remote Interactive Information Reception | | | | | | | Interactive Vehicle Reception |
| ATIS03 | Autonomous Route Guidance | | | | | | | | | | | | | | Personal Autonomous Route Guidance<br>Personal Location Determination | | | | | | | | Vehicle Autonomous Route Guidance<br>Vehicle Location Determination |
| ATIS04 | Dynamic Route Guidance | | | | | | | | | Basic Information Broadcast<br>ISP Traveler Data Collection | | | | | Personal Autonomous Route Guidance<br>Personal Basic Information Reception<br>Personal Location Determination | | | | | | | | Basic Vehicle Reception<br>Vehicle Autonomous Route Guidance<br>Vehicle Location Determination |
| ATIS05 | ISP Based Trip Planning and Route Guidance | | | | | | | | | Infrastructure Provided Trip Planning<br>ISP Traveler Data Collection | | | | | Personal Location Determination<br>Personal Trip Planning and Route Guidance | Remote Interactive Information Reception | | | | | | | Vehicle Location Determination<br>Vehicle Trip Planning and Route Guidance |
| ATIS06 | Transportation Operations Data Sharing | | | | | Emergency Transportation Operations Data Collection | | | | ISP Operational Data Repository<br>ISP Traveler Data Collection | MCM Transportation Operations Data Collection | | | | | | | | | TMC Transportation Operations Data Collection | Transit Transportation Operations Data Collection | | |
| ATIS07 | Travel Services Information and Reservation | | | | | | | | | ISP Travel Services Information and Reservation<br>ISP Traveler Data Collection | | | | | Personal Interactive Information Reception | Remote Interactive Information Reception | | | | | | | Interactive Vehicle Reception |
| ATIS08 | Dynamic Ridesharing | | | | | | | | | Infrastructure Provided | | | | | Personal Interactive | Remote Interactive | | | | | | | Vehicle Trip Planning and |

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| | | | | | | | | | | Dynamic Ridesharing Infrastructure Provided Trip Planning<br>ISP Traveler Data Collection | | | | | Information Reception | Information Reception | | | | | | | Route Guidance |
| ATIS09 | In Vehicle Signing | | | | | | On-board EV Incident Management Communication | | | | | MCV Vehicle Safety Monitoring | Parking Short Range Traveler Information Communications | | | | Roadway Equipment Coordination<br>Roadway Short Range Traveler Information Communications | | | TMC In-Vehicle Signing Management | | On-board Transit In Vehicle Signing Communications | Vehicle Short Range Traveler Information Reception |
| ATIS10 | Short Range Communications Traveler Information | | | | | | | | | ISP Short Range Communications Traveler Information Distribution<br>ISP Traveler Data Collection | | | | | | | Roadway Short Range Traveler Information Communications | | | | | | Vehicle Short Range Traveler Information Reception |
| ATMS01 | Network Surveillance | | | | | | | | | | | | | | | | Roadway Basic Surveillance<br>Roadway Equipment Coordination | | | Collect Traffic Surveillance<br>Traffic Equipment Maintenance | | | |
| ATMS02 | Traffic Probe Surveillance | | | | | | | | | ISP Probe Information Collection<br>ISP Traveler Data Collection | | | | | | | Roadway Probe Data Communications | | | TMC Probe Information Collection | | | Vehicle Location Determination<br>Vehicle Traffic Probe Support |
| ATMS03 | Traffic Signal Control | | | | | | | | | | | | | | | | Field Management Stations Operation<br>Roadway Basic Surveillance<br>Roadway Equipment Coordination<br>Roadway Signal Controls | | | Collect Traffic Surveillance<br>TMC Signal Control<br>Traffic Equipment Maintenance | | | |
| ATMS04 | Traffic Metering | | | | | | | | | | | | | | | | Roadway Basic Surveillance<br>Roadway Equipment Coordination<br>Roadway Traffic Information Dissemination<br>Roadway Traffic Metering | | | Collect Traffic Surveillance<br>TMC Traffic Information Dissemination<br>TMC Traffic Metering<br>Traffic Equipment Maintenance | | | |
| ATMS05 | HOV Lane Management | | | | | | | | | | | | | | | | Roadway Equipment Coordination<br>Roadway HOV Control | | | Collect Traffic Surveillance<br>TMC HOV Lane Management | | | Vehicle Traffic Probe Support |
| ATMS06 | Traffic Information Dissemination | | | | | | | | | | | | | | | | Roadway Equipment Coordination<br>Roadway Traffic Information Dissemination | | | TMC Traffic Information Dissemination | | | |
| ATMS07 | Regional Traffic Management | | | | | | | | | | | | | | | | | | | TMC Regional Traffic Management<br>TMC Signal Control<br>TMC Traffic Metering | | | |

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| ATMS08 | Traffic Incident Management System | | | | | Emergency Response Management Incident Command | On-board EV Incident Management Communication | | | | MCM Incident Management | | | | | | Roadway Equipment Coordination Roadway Incident Detection | | | TMC Incident Detection TMC Incident Dispatch Coordination/Communication | | | |
| ATMS09 | Transportation Decision Support and Demand Management | | | | | | | | | | | | | | | | | | | TMC Demand Management Coordination TMC Traffic Management Decision Support TMC Traffic Network Performance Evaluation | Transit Center Multi-Modal Coordination | | |
| ATMS10 | Electronic Toll Collection | | | | | | | | Fleet Administration | Infrastructure Provided Trip Planning ISP Traveler Data Collection | | | | Toll Administration | | | | Toll Plaza Toll Collection | | | | | Vehicle Toll/Parking Interface |
| ATMS11 | Emissions Monitoring and Management | | | | | | | Emissions Data Management | | | | | | | | | Roadway Emissions Monitoring Roadway Equipment Coordination | | | | | | Vehicle On-board Diagnostics System |
| ATMS12 | Roadside Lighting System Control | | | | | | | | | | | | | | | | Roadside Lighting System Control | | | TMC Lighting System Control | | | |
| ATMS13 | Standard Railroad Grade Crossing | | | | | | | | | | | | | | | | Standard Rail Crossing | | | HRI Traffic Management | | | |
| ATMS14 | Advanced Railroad Grade Crossing | | | | | | | | | | | | | | | | Advanced Rail Crossing | | | HRI Traffic Management | | | |
| ATMS15 | Railroad Operations Coordination | | | | | | | | | | | | | | | | | | | Rail Operations Coordination | | | |
| ATMS16 | Parking Facility Management | | | | | | | | | | | | Parking Electronic Payment Parking Management | | | | | | | | | | Vehicle Toll/Parking Interface |
| ATMS17 | Regional Parking Management | | | | | | | | | | | | Parking Coordination | | | | | | | | | | |
| ATMS18 | Reversible Lane Management | | | | | | | | | | | | | | | | Roadway Equipment Coordination Roadway Reversible Lanes | | | TMC Reversible Lane Management | | | |
| ATMS19 | Speed Warning and Enforcement | | | | | | | | | | MCM Speed Monitoring and Warning | | | | | | Roadway Equipment Coordination Roadway Speed Monitoring and Warning | | | TMC Speed Monitoring and Warning | | | |
| ATMS20 | Drawbridge Management | | | | | | | | | | | | | | | | Multimodal Crossing Control | | | TMC Multimodal Crossing Management | | | |
| ATMS21 | Roadway Closure Management | | | | | Emergency Response Management | On-Board EV Barrier System Control | | | | MCM Work Zone Management | MCV Barrier System Control | | | | | Field Barrier System Control Roadway Basic Surveillance Roadway Equipment Coordination Roadway Traffic Information Dissemination Roadway Work Zone Traffic Control | | | Barrier System Management Collect Traffic Surveillance TMC Traffic Information Dissemination | | | |
| ATMS22 | Variable Speed | | | | | | | | | | | | | | | | Roadway Basic | | | Collect Traffic Surveillance | | | |

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| | Limits | | | | | | | | | | | | | | | | Surveillance Roadway Equipment Coordination<br>Roadway Traffic Information Dissemination<br>Roadway Variable Speed Limits | | | TMC Traffic Information Dissemination<br>TMC Variable Speed Limits<br>Traffic Equipment Maintenance | | | |
| ATMS23 | Dynamic Lane Management and Shoulder Use | | | | | | | | | | | | | | | | Roadway Basic Surveillance<br>Roadway Dynamic Lane Management and Shoulder Use<br>Roadway Equipment Coordination | | | Collect Traffic Surveillance<br>TMC Dynamic Lane Management and Shoulder Use<br>Traffic Equipment Maintenance | | | Vehicle Traffic Probe Support |
| ATMS24 | Dynamic Roadway Warning | | | | | | | | | | | | | | | | Roadway Basic Surveillance<br>Roadway Equipment Coordination<br>Roadway Warning | | | Collect Traffic Surveillance<br>TMC Roadway Warning<br>Traffic Equipment Maintenance | | | |
| ATMS25 | VMT Road User Payment | | | | | | | | | ISP Traveler Data Collection | | | | Center VMT Payment Administration | Personal Interactive Information Reception | Remote Interactive Information Reception | | Roadway VMT Payment | | | | | Vehicle VMT Payment Collection |
| ATMS26 | Mixed Use Warning Systems | | | | | | | | | | | | | | | | Roadway Mixed Use Sensing<br>Roadway Warning | | | TMC Roadway Warning<br>TMC Signal Control | | | |
| AVSS01 | Vehicle Safety Monitoring | | | | | | | | | | | | | | | | | | | | | | Vehicle Safety Monitoring System |
| AVSS02 | Driver Safety Monitoring | | | | | | | | | | | | | | | | | | | | | | Driver Safety Monitoring System |
| AVSS03 | Longitudinal Safety Warning | | | | | | | | | | | | | | | | | | | | | | Vehicle Location Determination<br>Vehicle Longitudinal Warning System |
| AVSS04 | Lateral Safety Warning | | | | | | | | | | | | | | | | | | | | | | Vehicle Lateral Warning System |
| AVSS05 | Intersection Safety Warning | | | | | | | | | | | | | | | | Roadway Equipment Coordination<br>Roadway Intersection Safety Warning | | | | | | Vehicle Intersection Safety Warning<br>Vehicle Location Determination |
| AVSS06 | Pre-Crash Restraint Deployment | | | | | | | | | | | | | | | | | | | | | | Vehicle Pre-Crash Safety Systems<br>Vehicle Warning System |
| AVSS07 | Driver Visibility Improvement | | | | | | | | | | | | | | | | | | | | | | Driver Visibility Improvement System |
| AVSS08 | Advanced Vehicle | | | | | | | | | | | | | | | | | | | | | | Vehicle |

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| | Longitudinal Control | | | | | | | | | | | | | | | | | | | | | | Location Determination<br>Vehicle Longitudinal Control |
| AVSS09 | Advanced Vehicle Lateral Control | | | | | | | | | | | | | | | | | | | | | | Vehicle Lateral Control |
| AVSS10 | Intersection Collision Avoidance | | | | | | | | | | | | | | | | Roadway Equipment Coordination<br>Roadway Intersection Safety Warning | | | | | | Vehicle Intersection Control<br>Vehicle Location Determination |
| AVSS11 | Automated Vehicle Operations | | | | | | | | | | | | | | | | Roadway Automated Vehicle Operations | | | TMC Automated Vehicle Operations | | | Vehicle Automated Operations |
| AVSS12 | Cooperative Vehicle Safety Systems | | | | | | | | | | | | | | | | Roadway Equipment Coordination<br>Roadway Safety Warning System | | | | | | Vehicle Warning System |
| CVO01 | Carrier Operations and Fleet Management | | On-board Trip Monitoring | | | | | | Fleet Administration | | | | | | | | | | | | | | |
| CVO02 | Freight Administration | | On-board Cargo Monitoring<br>On-board CV Safety and Security<br>On-board Trip Monitoring | | Roadside Safety and Security Inspection | | | | Commercial Vehicle and Freight Security<br>Fleet Administration<br>Freight Administration and Management | | | | | | | | | | | | | | |
| CVO03 | Electronic Clearance | | On-board CV Electronic Data | CV Information Exchange<br>CV Safety and Security Administration | Citation and Accident Electronic Recording<br>Roadside Electronic Screening | | | | | | | | | | | | | | | | | | |
| CVO04 | CV Administrative Processes | | | Credentials and Taxes Administration<br>CV Information Exchange | | | | | Fleet Administration<br>Fleet Credentials and Taxes Management and Reporting | | | | | | | | | | | | | | |
| CVO05 | International Border Electronic Clearance | | On-board CV Electronic Data | CV Information Exchange<br>CV Safety and Security Administration<br>International CV Administration | International Border Crossing<br>Roadside Electronic Screening | | | | Freight Administration and Management | | | | | | | | | | | | | | |
| CVO06 | Weigh-In-Motion | | On-board CV Electronic Data | | Roadside WIM | | | | | | | | | | | | | | | | | | |
| CVO07 | Roadside CVO Safety | | On-board CV Electronic Data<br>On-board CV Safety and Security | Credentials and Taxes Administration<br>CV Information Exchange<br>CV Safety and Security Administration | Citation and Accident Electronic Recording<br>Roadside Electronic Screening<br>Roadside | | | | Fleet Administration<br>Fleet Maintenance Management | | | | | | | | | | | | | | |

| Service Package | Service Package Name | Archived Data Management | Commercial Vehicle | Commercial Vehicle Administration | Commercial Vehicle Check | Emergency Management | Emergency Vehicle | Emissions Management | Fleet and Freight Management | Information Service Provider | Maintenance and Construction Management | Maintenance and Construction Vehicle | Parking Management | Payment Administration | Personal Information Access | Remote Traveler Support | Roadway | Roadway Payment | Security Monitoring | Traffic Management | Transit Management | Transit Vehicle | Vehicle |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Safety and Security Inspection | | | | | | | | | | | | | | | | | | |
| CVO08 | On-board CVO Safety | | On-board Cargo Monitoring<br>On-board CV Safety and Security | CV Information Exchange<br>CV Safety and Security Administration | Citation and Accident Electronic Recording<br>Roadside Safety and Security Inspection | | | | Fleet Administration<br>Fleet Maintenance Management | | | | | | | | | | | | | | |
| CVO09 | CVO Fleet Maintenance | | On-board Trip Monitoring | | | | | | Fleet Maintenance Management | | | | | | | | | | | | | | |
| CVO10 | HAZMAT Management | | On-Board Cargo Monitoring | | | Emergency Commercial Vehicle Response<br>Mayday Support | | | Commercial Vehicle and Freight Security<br>Fleet HAZMAT Management | | | | | | | | | | | | | | Vehicle Mayday I/F |
| CVO11 | Roadside HAZMAT Security Detection and Mitigation | | | Credentials and Taxes Administration | Roadside HAZMAT detection | Emergency Commercial Vehicle Response | | | | | | | | | | | | | | | | | |
| CVO12 | CV Driver Security Authentication | | On-board Driver Authentication | | Roadside Safety and Security Inspection | Emergency Commercial Vehicle Response | | | Manage CV Driver Identification | | | | | | | | | | | | | | |
| CVO13 | Freight Assignment Tracking | | On-board Cargo Monitoring<br>On-board Driver Authentication<br>On-board Trip Monitoring | | | | | | Commercial Vehicle and Freight Security<br>Fleet Administration<br>Freight Administration and Management | | | | | | | | | | | | | | |
| EM01 | Emergency Call-Taking and Dispatch | | | | | Emergency Call-Taking<br>Emergency Dispatch | On-board EV En Route Support | | | | | | | | | | | | | | | | |
| EM02 | Emergency Routing | | | | | Emergency Routing | On-board EV En Route Support | | | | | | | | | | Roadway Signal Preemption | | | TMC Incident Dispatch Coordination/Communication<br>TMC Signal Control | | | |
| EM03 | Mayday and Alarms Support | | | | | Center Secure Area Alarm Support<br>Center Secure Area Surveillance<br>Mayday Support | | | | | | | | | Personal Location Determination<br>Personal Mayday I/F | Remote Traveler Security<br>Traveler Secure Area Surveillance | | | | | | | Vehicle Location Determination<br>Vehicle Mayday I/F |
| EM04 | Roadway Service Patrols | | | | | Service Patrol Management | On-board EV En Route Support<br>On-board EV Incident Management Communication | | | | | | | | | | | | | | | | |
| EM05 | Transportation Infrastructure Protection | | | | | Center Secure Area Sensor Management<br>Center Secure Area Surveillance | On-Board EV Barrier System Control | | | | | | | | | Traveler Secure Area Sensor Monitoring<br>Traveler Secure Area Surveillance | Field Barrier System Control<br>Field Safeguard System Control | | Field Secure Area Sensor Monitoring<br>Field Secure Area Surveillance | Barrier System Management<br>Safeguard System Management<br>TMC Incident Dispatch Coordination/Communication | | | Vehicle Secure Area Access System |
| EM06 | Wide-Area Alert | | | | | Emergency | | | | ISP Emergency | MCM Incident | | | Toll Operator | Personal Basic | Remote Basic | Roadway Traffic | Toll Plaza | | TMC Incident Dispatch | Transit Center | | Basic Vehicle |

| Service Package | Service Package Name | Archived Data Management | Commercial Vehicle | Commercial Vehicle Administration | Commercial Vehicle Check | Emergency Management | Emergency Vehicle | Emissions Management | Fleet and Freight Management | Information Service Provider | Maintenance and Construction Management | Maintenance and Construction Vehicle | Parking Management | Payment Administration | Personal Information Access | Remote Traveler Support | Roadway | Roadway Payment | Security Monitoring | Traffic Management | Transit Management | Transit Vehicle | Vehicle |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Early Warning System | | | | Traveler Information<br>ISP Traveler Data Collection<br>Traveler Telephone Information | Management | | | Alert | Information Reception | Information Reception<br>Remote Transit Information Services | Information Dissemination | Toll Collection | | Coordination/Communication<br>TMC Traffic Information Dissemination | Information Services<br>Transit Center Security | | Reception |
| EM07 | Early Warning System | | | | | Center Secure Area Sensor Management<br>Center Secure Area Surveillance<br>Emergency Early Warning System<br>Emergency Environmental Monitoring | | | | | MCM Incident Management | | | | | | | | Field Secure Area Sensor Monitoring<br>Field Secure Area Surveillance | TMC Incident Detection | Transit Center Security | | |
| EM08 | Disaster Response and Recovery | | | | | Emergency Response Management<br>Incident Command | | | | | MCM Incident Management<br>MCM Roadway Maintenance and Construction | | | | | | | | | TMC Incident Dispatch Coordination/Communication | Transit Center Security | | |
| EM09 | Evacuation and Reentry Management | | | | | Emergency Evacuation Support | | | | | MCM Incident Management | | | | | | | | | TMC Evacuation Support | Transit Evacuation Support | | |
| EM10 | Disaster Traveler Information | | | | | Emergency Evacuation Support<br>Emergency Response Management | | | | ISP Emergency Traveler Information<br>ISP Traveler Data Collection<br>Traveler Telephone Information | | | | | Personal Basic Information Reception<br>Personal Interactive Information Reception | Remote Basic Information Reception<br>Remote Interactive Information Reception | | | | | | Basic Vehicle Reception<br>Interactive Vehicle Reception |
| MC01 | Maintenance and Construction Vehicle and Equipment Tracking | | | | | | | | | | MCM Vehicle Tracking | MCV Vehicle Location Tracking | | | | | | | | | | | |
| MC02 | Maintenance and Construction Vehicle Maintenance | | | | | | | | | | MCM Vehicle and Equipment Maintenance Management | MCV Vehicle System Monitoring and Diagnostics | | | | | | | | | | | Vehicle Safety Monitoring System |
| MC03 | Road Weather Data Collection | | | | | | | | | | MCM Environmental Information Collection | MCV Environmental Monitoring | | | | | Roadway Environmental Monitoring | | | TMC Environmental Monitoring | | | |
| MC04 | Weather Information Processing and Distribution | | | | | Emergency Environmental Monitoring | | | | ISP Traveler Data Collection | MCM Environmental Information Processing | | | | | | | | | TMC Environmental Monitoring | Transit Environmental Monitoring | | |
| MC05 | Roadway Automated Treatment | | | | | | | | | | MCM Automated Treatment System Control | | | | | | Roadway Automated Treatment<br>Roadway Equipment Coordination<br>Roadway Traffic Information Dissemination | | | | | | |
| MC06 | Winter Maintenance | | | | | | | | | | MCM Maintenance Decision Support | MCV Winter Maintenance | | | | | | | | TMC Incident Dispatch Coordination/Communication | | | |

| Service Package | Service Package Name | Archived Data Management | Commercial Vehicle | Commercial Vehicle Administration | Commercial Vehicle Check | Emergency Management | Emergency Vehicle | Emissions Management | Fleet and Freight Management | Information Service Provider | Maintenance and Construction Management | Maintenance and Construction Vehicle | Parking Management | Payment Administration | Personal Information Access | Remote Traveler Support | Roadway | Roadway Payment | Security Monitoring | Traffic Management | Transit Management | Transit Vehicle | Vehicle |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | MCM Winter Maintenance Management | | | | | | | | | | | | |
| MC07 | Roadway Maintenance and Construction | | | | | | | | | | MCM Maintenance Decision Support<br>MCM Roadway Maintenance and Construction | MCV Roadway Maintenance and Construction | | | | | Roadway Field Device Monitoring | | | Traffic Equipment Maintenance | | | |
| MC08 | Work Zone Management | | | | | | | | | | MCM Work Zone Management | MCV Barrier System Control<br>MCV Work Zone Support | | | | | Roadway Work Zone Traffic Control | | | TMC Work Zone Traffic Management | | | |
| MC09 | Work Zone Safety Monitoring | | | | | | | | | | MCM Work Zone Safety Management | MCV Vehicle Safety Monitoring | | | | | Roadway Equipment Coordination<br>Roadway Work Zone Safety | | | | | | |
| MC10 | Maintenance and Construction Activity Coordination | | | | | Emergency Response Management | | | | | MCM Work Activity Coordination | | | | | | | | | TMC Work Zone Traffic Management | Transit Center Multi-Modal Coordination | | |
| MC11 | Environmental Probe Surveillance | | | | | | | | | ISP Probe Information Collection | MCM Environmental Information Collection | | | | | | Roadway Probe Data Communications | | | | | | Vehicle Environmental Probe Support |
| MC12 | Infrastructure Monitoring | | | | | | | | | | MCM Infrastructure Monitoring | MCV Infrastructure Monitoring | | | | | Roadway Infrastructure Monitoring<br>Roadway Probe Data Communications | | | | | | Vehicle Environmental Probe Support |

## *2.2 The National ITS Architecture Service Packages*

The Architecture definition summarized in the previous section is intended to be extremely accommodating.

- Its breadth supports the complete range of ITS services from basic signal control improvements to automated highway systems.
- Its scalability supports implementations suitable for major metropolitan areas as well as remote rural areas.
- Its technological neutrality ensures that it will remain viable in the future and receptive to technology changes.

This high degree of flexibility is necessary since the Architecture must accommodate the range of possible ITS implementations across the United States over a twenty year timeframe. Unfortunately, this flexibility also complicates the task of determining which pieces of the Architecture are applicable and how they can best be applied in addressing a particular community's current and future transportation needs (see figure 2.2-1).

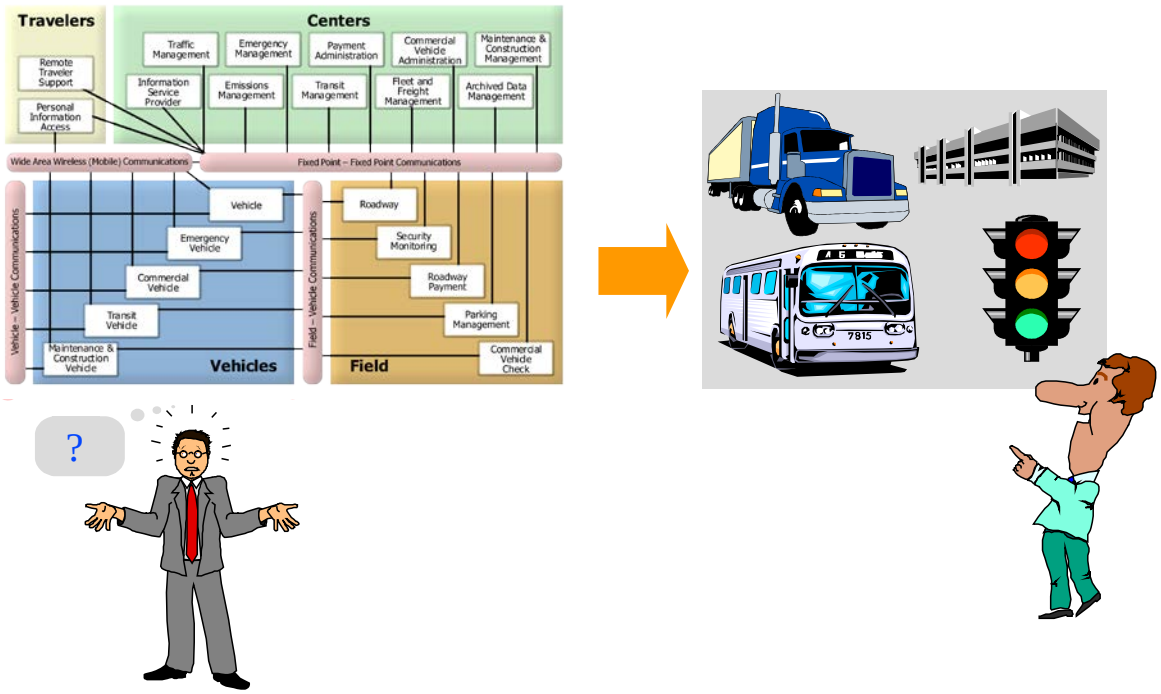



**Figure 2.2-1: Translating Architecture to Implementation through Service Packages**

To provide visibility into the service options that will be considered by ITS planners and implementers, a set of *Service Packages* have been defined. The Service 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. They address the specific service requirements of traffic managers, transit operators, travelers, and other ITS stakeholders. The Service Packages were defined with enough granularity to support specific benefits analyses.

Several different Service Packages are defined in each major application area which provides a palette of service options at various costs. Service Packages are also structured to segregate services that are likely to encounter technical or non-technical challenges from lower risk services. This approach allows the identification of a subset of the Service Packages that are likely early deployments. At the other end of the spectrum, several of the Service Packages represent advanced products or services that will not be available for some time. Many of the Service Packages are also incremental so that more advanced packages can be efficiently implemented by building on common elements that were deployed earlier with more basic packages.

The complete set of Service Packages are identified in Table 2.2-1. In order to more accurately specify Service Packages in tables, each is given an abbreviation indicating the general class of stakeholder and an index (e.g., ATMS01 is a Service Package primarily of interest to transportation managers). The following describes the acronyms used in Table 2.2-1.

ATMS – Advanced Traffic Management Systems
APTS – Advanced Public Transportation Systems
ATIS – Advanced Traveler Information Systems
CVO – Commercial Vehicle Operations
EM – Emergency Management
AD – Archived Data
MCO – Maintenance and Construction Management
AVSS – Advanced Vehicle Safety Systems

***Table 2.2-1: Service Packages Summary***

| Service Package | Service Package Name |
|---|---|
| AD1 | ITS Data Mart |
| AD2 | ITS Data Warehouse |
| AD3 | ITS Virtual Data Warehouse |
| APTS01 | Transit Vehicle Tracking |
| APTS02 | Transit Fixed-Route Operations |
| APTS03 | Demand Response Transit Operations |
| APTS04 | Transit Fare Collection Management |
| APTS05 | Transit Security |
| APTS06 | Transit Fleet Management |

| Service Package | Service Package Name |
|---|---|
| APTS07 | Multi-modal Coordination |
| APTS08 | Transit Traveler Information |
| APTS09 | Transit Signal Priority |
| APTS10 | Transit Passenger Counting |
| APTS11 | Multimodal Connection Protection |
| ATIS01 | Broadcast Traveler Information |
| ATIS02 | Interactive Traveler Information |
| ATIS03 | Autonomous Route Guidance |
| ATIS04 | Dynamic Route Guidance |
| ATIS05 | ISP Based Trip Planning and Route Guidance |
| ATIS06 | Transportation Operations Data Sharing |
| ATIS07 | Travel Services Information and Reservation |
| ATIS08 | Dynamic Ridesharing |
| ATIS09 | In Vehicle Signing |
| ATIS10 | Short Range Communications Traveler Information |
| ATMS01 | Network Surveillance |
| ATMS02 | Traffic Probe Surveillance |
| ATMS03 | Traffic Signal Control |
| ATMS04 | Traffic Metering |
| ATMS05 | HOV Lane Management |
| ATMS06 | Traffic Information Dissemination |
| ATMS07 | Regional Traffic Management |
| ATMS08 | Traffic Incident Management System |
| ATMS09 | Transportation Decision Support and Demand Management |
| ATMS10 | Electronic Toll Collection |
| ATMS11 | Emissions Monitoring and Management |
| ATMS12 | Roadside Lighting System Control |
| 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 Warning and Enforcement |
| ATMS20 | Drawbridge Management |
| ATMS21 | Roadway Closure Management |
| ATMS22 | Variable Speed Limits |
| ATMS23 | Dynamic Lane Management and Shoulder Use |
| ATMS24 | Dynamic Roadway Warning |
| ATMS25 | VMT Road User Payment |
| ATMS26 | Mixed Use Warning Systems |
| AVSS01 | Vehicle Safety Monitoring |
| AVSS02 | Driver Safety Monitoring |

| Service Package | Service Package Name |
|---|---|
| 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 Vehicle Operations |
| AVSS12 | Cooperative Vehicle Safety Systems |
| CVO01 | Carrier Operations and Fleet Management |
| 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 |
| CVO11 | Roadside HAZMAT Security Detection and Mitigation |
| CVO12 | CV Driver Security Authentication |
| CVO13 | Freight Assignment Tracking |
| EM01 | Emergency Call-Taking and Dispatch |
| EM02 | Emergency Routing |
| EM03 | Mayday and Alarms Support |
| EM04 | Roadway Service Patrols |
| EM05 | Transportation Infrastructure Protection |
| EM06 | Wide-Area Alert |
| EM07 | Early Warning System |
| EM08 | Disaster Response and Recovery |
| EM09 | Evacuation and Reentry Management |
| EM10 | Disaster Traveler Information |
| MC01 | Maintenance and Construction Vehicle and Equipment 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 |

The deployment oriented Service Packages are traceable to the interface-oriented Architecture definition. Once a particular Service Package is selected for implementation, the required Subsystems, Equipment Packages, and interface

requirements are readily identified due to this traceability. This approach allows the planner or implementer to first consider service needs and later concentrate on those pieces of the Architecture necessary to provide the selected service.

It is important to note that the Service Packages are illustrative rather than prescriptive. The actual implementation variations that are possible across the country are myriad and cannot be enumerated through a finite set of packages. The Service Packages are tools that allow this document to discuss incremental deployment of ITS services in a manner that is relevant to the underlying Architecture definition.

The remainder of this section defines each of the Service Packages in more detail. A description of the service offered by each Service Package is provided. Tables provide the included Equipment Packages and Subsystems, the Associated Planning Factors and Goals and the Associated Objectives and Performance Measures, The Service Package graphic is provided that identifies how the Architecture Framework supports the Service Package. Where several major implementation options are supported by the Service Package, these are also identified and differentiated in the descriptions.

Figure 2.2-2 provides a legend to assist in interpretation of the Service Package diagrams.

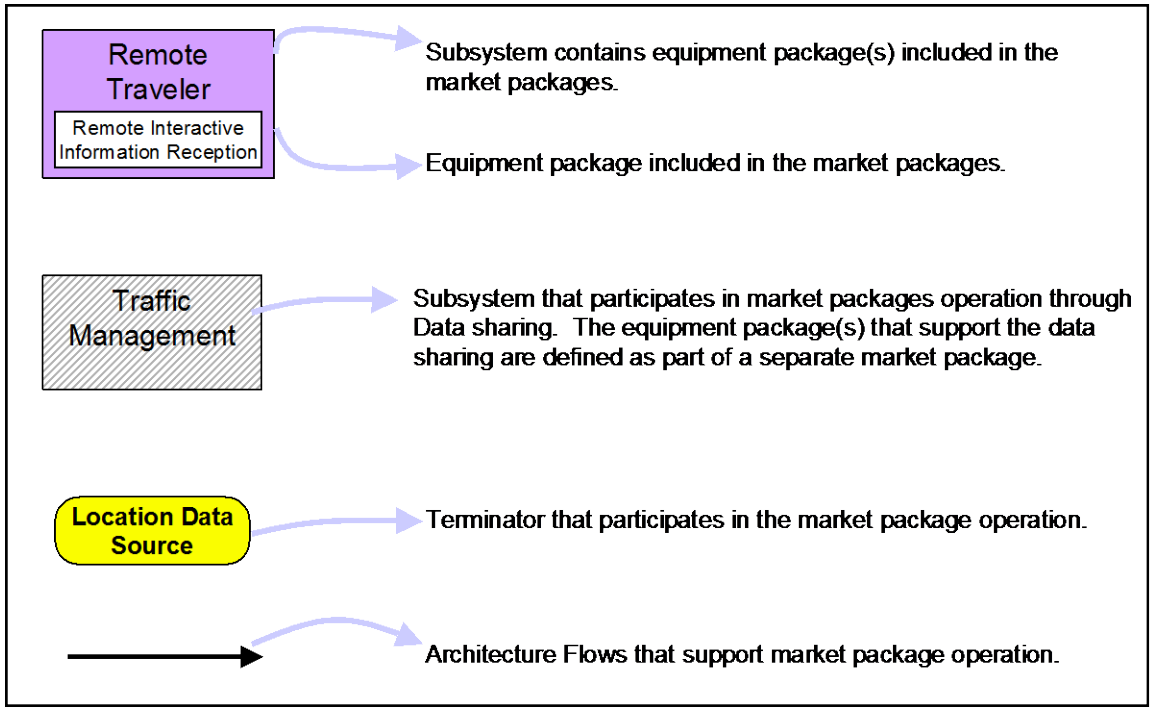



**Figure 2.2-2: Service Package Diagram Elements**

In addition to the information provided in this document, each Service Package is associated with the applicable ITS applications of the US DOT ITS Knowledge Resources. The Knowledge Resources are a collection of benefits, costs and lessons learned for over 170 ITS applications. On the National Architecture Website, for each Service Package links are provided to the ITS Knowledge Resources pages of the related applications on the Service Package page under the ITS Applications tab. These links allow users to readily determine the benefits, costs and lessons learned of Service Packages.

Also, the Theory of Operations of the National ITS Architecture describes the operation of each Service Package using transaction set diagrams that illustrate the sequence of information exchange (or an example of the sequence of information exchange) between architecture entities to implement the service. The Theory of Operations is available in the Theory of Operations document or on the National Architecture website on the Service Package pages under the Transaction Set tab.

## 2.2.1 Traffic Management Service Packages

### Network Surveillance (ATMS01)

This service package includes traffic detectors, other surveillance equipment, the supporting field equipment, and fixed-point to fixed-point 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 service 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.

Table 2.2.1-1: ATMS01 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Roadway Basic Surveillance | Roadway |
| Roadway Equipment Coordination | Roadway |
| Collect Traffic Surveillance | Traffic Management |
| Traffic Equipment Maintenance | Traffic Management |

Table 2.2.1-2: ATMS01 Associated Planning Factors and Goals

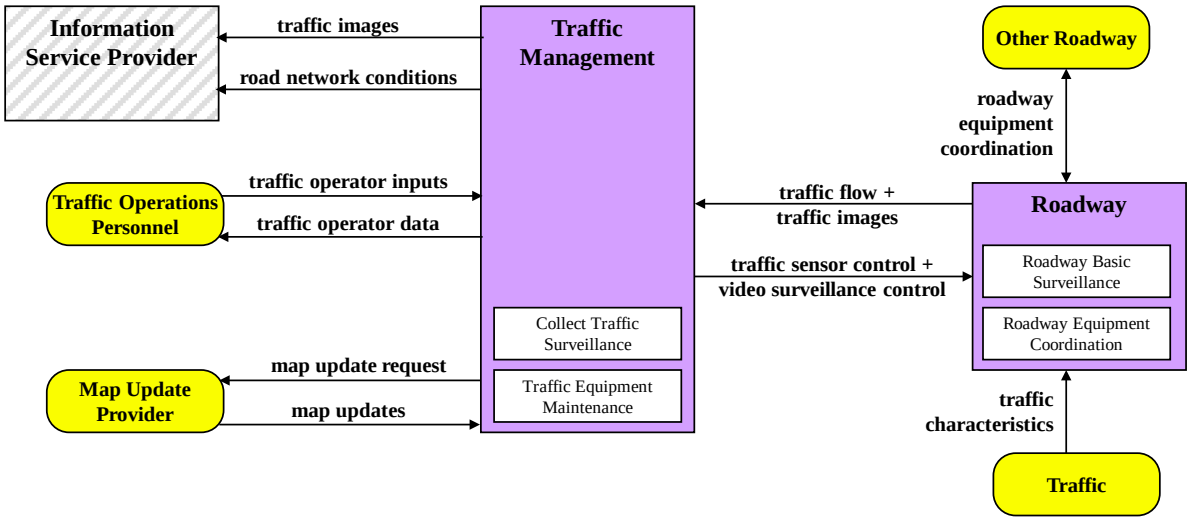
| MetroFactor | Goal |
|---|---|
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.1-3: ATMS01 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Arterial Management: Traffic Monitoring and Data Collection | X percent of major and minor arterials are equipped and operating with arterial link traffic data detection stations (appropriate technology) per Z distance by year Y. | Percent of major and minor arterials equipped and operating with arterial link traffic data detection stations (appropriate technology) per Z distance. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Arterial Management: Traffic Monitoring and Data Collection | X percent of major and minor arterials are equipped and operating with closed circuit television (CCTV) cameras per Z distance by year Y. | Percent of major and minor arterials equipped and operating with closed circuit television (CCTV) cameras per Z distance. |
| Freeway Management: Transportation Management Centers | Increase the level of transportation management center (TMC) field hardware (cameras, variable message signs, electronic toll tag readers, ITS applications, etc.) by X percent by year Y. | Total amount of TMC equipment. |
| Freeway Management: Transportation Management Centers | Increase the percent of regional transportation system monitored by the TMC for real-time performance. | Percent of regional transportation system monitored by the TMC for real-time performance. |
| Special Event Management: Use of Technology | Increase the percent of major special events using ITS-related assets (e.g., roadside cameras, dynamic message signs, vehicle speed detectors) to detect and manage special event entry/exit bottlenecks and incidents by X percent in Y years. | Percent of special events using ITS-related assets to detect and manage incidents/bottlenecks at entry/exit routes of the events. |
| Traveler Information: Data Collection and Sharing on Travel Conditions | Increase the percent of modes in the region that share their traveler information with other modes in the region to 100 percent by Y year. | Percent of modes in the region that share their traveler information with other modes. |
| Traveler Information: Data Collection and Sharing on Travel Conditions | Increase the percent of the transportation system in which travel conditions can be detected remotely via CCTV, speed detectors, etc. to X percent by Y year. | Percent of the transportation system in which travel conditions can be detected remotely via CCTV, speed detectors, etc. |
| Traveler Information: Data Collection and Sharing on Travel Conditions | Increase the percent of transportation facilities whose owners share their traveler information with other agencies in the region to X percent by Y year. | Percent of transportation facilities whose owners share their traveler information with other agencies in the region. |

**ATMS01 – Network Surveillance**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Traffic Probe Surveillance (ATMS02)

This service package provides an alternative approach for surveillance of the roadway network. Two general implementation paths are supported by this service package: 1) wide-area wireless communications between the vehicle and center is used to communicate vehicle operational information and status directly to the center, and 2) dedicated short range communications between passing vehicles and the roadside is used to provide equivalent information to the center. 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 service package enables transportation operators and traveler information providers 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, on-board equipment, data reduction software, and fixed-point to fixed-point links between centers 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, such as the ability to identify and filter out-of-bounds or extreme data reports.

Table 2.2.1-4: ATMS02 Included Equipment Packages and Subsystems

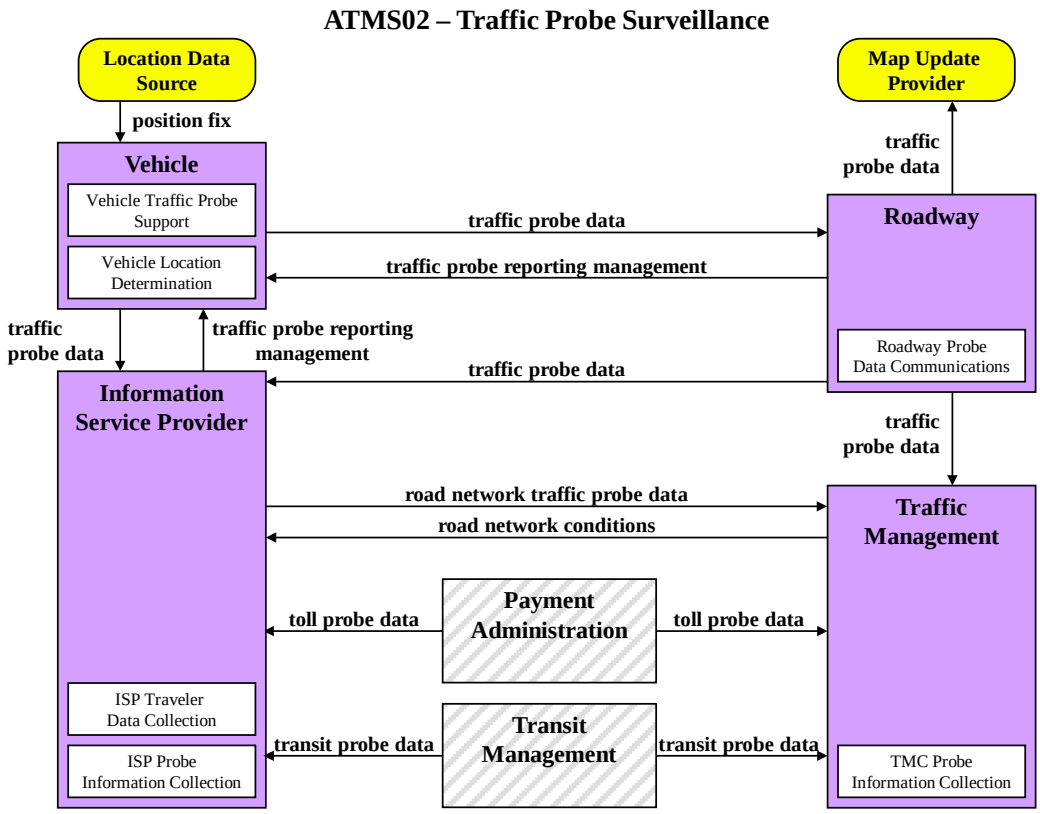
| Equipment Package Name | Subsystem |
|---|---|
| | |
| ISP Probe Information Collection | Information Service Provider |
| ISP Traveler Data Collection | Information Service Provider |
| Roadway Probe Data Communications | Roadway |
| TMC Probe Information Collection | Traffic Management |
| Vehicle Location Determination | Vehicle |
| Vehicle Traffic Probe Support | Vehicle |

Table 2.2.1-5: ATMS02 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.1-6: ATMS02 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Arterial Management: Traffic Monitoring and Data Collection | Field data collection is conducted either through floating car studies or other methods at least once every Y years on major signalized arterials and X years on minor signalized arterials. | Number of field data collection studies performed every Y and X years on major and minor signalized arterials, respectively. |
| Freeway Management: Transportation Management Centers | Increase the percent of regional transportation system monitored by the TMC for real-time performance. | Percent of regional transportation system monitored by the TMC for real-time performance. |




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Traffic Signal Control (ATMS03)

This service package provides the central control and monitoring equipment, communication links, and the signal control equipment that support traffic control at signalized intersections. A range of traffic signal control systems are represented by this service package ranging from fixed-schedule control systems to fully traffic responsive systems that dynamically adjust control plans and strategies based on current traffic conditions and priority requests. This service package is generally an intra-jurisdictional package. Systems that achieve coordination across jurisdictions by using a common time base or other strategies that do not require real time coordination would also be represented by this package. Coordination of traffic signal systems using real-time communications is covered in the ATMS07-Regional Traffic Management service package. This service package is consistent with typical traffic signal control systems.

Table 2.2.1-7: ATMS03 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Field Management Stations Operation | Roadway |
| Roadway Basic Surveillance | Roadway |
| Roadway Equipment Coordination | Roadway |
| Roadway Signal Controls | Roadway |
| Collect Traffic Surveillance | Traffic Management |
| TMC Signal Control | Traffic Management |
| Traffic Equipment Maintenance | Traffic Management |

Table 2.2.1-8: ATMS03 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns; | Reduce environmental impacts |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.1-9: ATMS03 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Arterial Management: Delay | Decrease the seconds of control delay per vehicles on arterial roads by X percent in Y years. (Control delay is defined as the portion of the total delay attributed to traffic signal operation for signalized intersections). | Control delay seconds per vehicle. |
| Arterial Management: Delay | Increase the miles of arterials in the region operating at level of service (LOS) Z by X percent in Y years. | Percent of arterial miles in region operating at LOS Z. |
| Arterial Management: Reliability | Reduce buffer index on arterials during peak and off-peak periods by X percent in Y years. | The buffer index (represents the extra time (buffer) travelers add to their average travel time when planning trips in order to arrive on-time 95 percent of the time). |
| Arterial Management: Reliability | Reduce delay associated with incidents on arterials by X percent by year Y. | Hours of delay associated with incidents. |
| Arterial Management: Traffic Monitoring and Data Collection | X percent of intersections in the region are equipped and operating with traffic signals that enable real-time monitoring and management of traffic flows by year Y. | Percent of intersections in the region equipped and operating with traffic signals that enable real-time monitoring and management of traffic flows. |
| Arterial Management: Traffic Signal Management | Crash data for all arterials in the region is reviewed every X years to determine if signal adjustments can be made to address a safety issue. | Number of years between reviews of crash data on all arterials for possible signal timing impacts. |
| Arterial Management: Traffic Signal Management | Increase the number of intersections running in a coordinated, closed-loop, or adaptive system by X percent in Y years. | Number of intersections running in a coordinated, closed-loop, or adaptive system. |
| Arterial Management: Traffic Signal Management | Maintain a program of evaluating X percent of signals for retiming every Y years. | Number of traffic signals evaluated for retiming. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Arterial Management: Traffic Signal Management | Special timing plans are available for use during freeway incidents, roadway construction activities, or other special events for X miles of arterials in the region by year Y. | Number of miles of arterials that have at least one special timing plan for incidents, construction, or events. |
| Special Event Management: Entry/Exit Travel Times | Reduce average time to clear event's exiting queue by X percent in Y years. | Average time to clear event's exiting queue by year per event. |
| Special Event Management: Entry/Exit Travel Times | Reduce average travel time into and out of the event by X percent in Y years. | Average travel time away from selected special events to a set of locations over a year. |
| Special Event Management: Entry/Exit Travel Times | Reduce average travel time into and out of the event by X percent in Y years. | Average travel time to selected special events from a set of locations in the area over a year. |
| Special Event Management: Entry/Exit Travel Times | Reduce buffer time index for travelers to multiple similar special events by X percent in Y years. | Buffer time index for travelers to multiple similar special events. |
| Special Event Management: Entry/Exit Travel Times | Reduce non-special event VMT in the event area during events by X percent in Y years. | Non-special event VMT in the event area during events over a year. |
| Special Event Management: Use of Technology | Implement special event traffic signal timing plans at X percent of major special events each year beginning in year Y. | Percent of major special events each year in which a special event traffic signal timing plan was implemented. |
| Special Event Management: Use of Technology | Increase the percent of major special events using ITS-related assets (e.g., roadside cameras, dynamic message signs, vehicle speed detectors) to detect and manage special event entry/exit bottlenecks and incidents by X percent in Y years. | Percent of special events using ITS-related assets to detect and manage incidents/bottlenecks at entry/exit routes of the events. |
| System Efficiency: Cost of Congestion | Reduce the annual monetary cost of congestion per capita for the next X years. | Cost (in dollars) of congestion or delay per capita. |

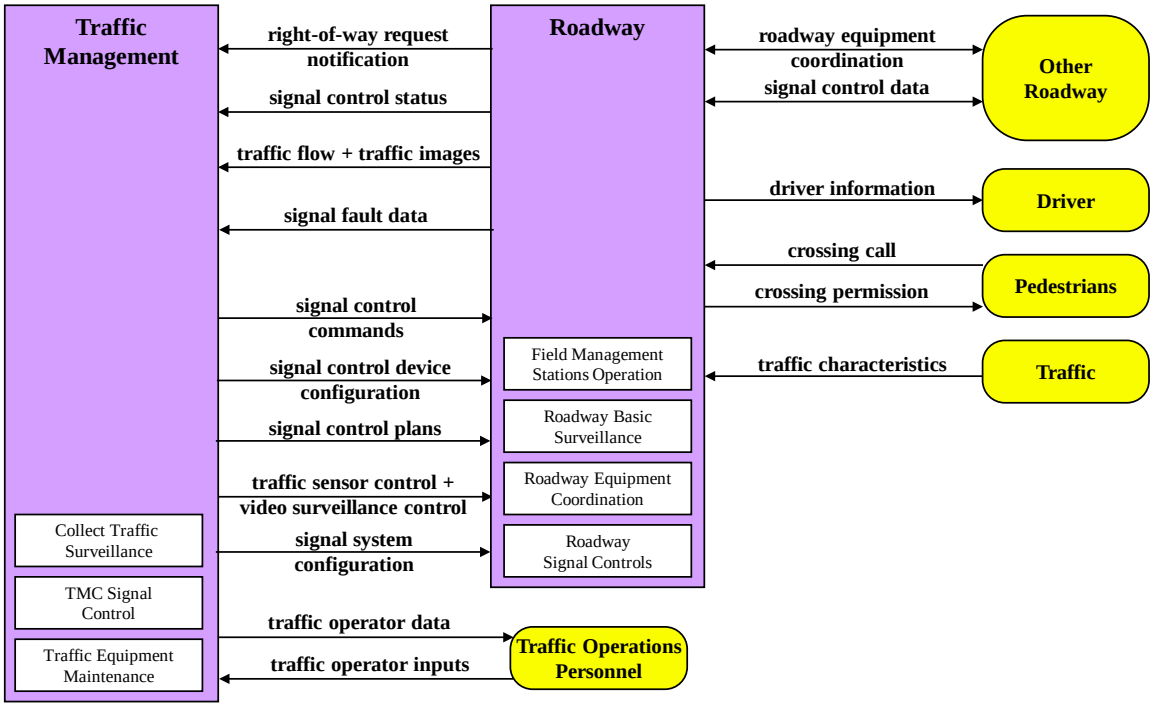
| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay per driver. |
| System Efficiency: Duration of Congestion | Reduce the number of hours per day that the top 20 most congested roadways experience recurring congestion by X percent by year Y. | Hours per day at LOS F or V/C > 1.0 (or other threshold). |
| System Efficiency: Energy Consumption | Reduce excess fuel consumed due to congestion by X percent by year Y. | Excess fuel consumed (total or per capita). |
| System Efficiency: Energy Consumption | Reduce total energy consumption per capita for transportation by X percent by year Y. | Total energy consumed per capita for transportation. |
| System Efficiency: Energy Consumption | Reduce total fuel consumption per capita for transportation by X percent by year Y. | Total fuel consumed per capita for transportation. |
| System Efficiency: Extent of Congestion | Maintain the rate of growth in facility miles experiencing recurring congestion as less than the population growth rate (or employment growth rate). | Percent of lane-miles (or rail) operating at LOS F or V/C > 1.0 |
| System Efficiency: Extent of Congestion | Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period by X percent by year Y. | Percent of lane-miles (or rail) operating at LOS F or V/C > 1.0 |
| System Efficiency: Extent of Congestion | Reduce the share of major intersections operating at LOS Z by X percent by year Y. | Percent of intersections operating at LOS F or V/C > 1.0 |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Intensity of Congestion (Travel Time Index) | Reduce the regional average travel time index by X percent per year. | Travel time index (the average travel time during the peak period, using congested speeds, divided by the off-peak period travel time, using posted or free-flow speeds). |
| System Efficiency: Travel Time | Annual rate of change in regional average commute travel time will not exceed regional rate of population growth through the year Y. | Average commute trip travel time (minutes). |
| System Efficiency: Travel Time | Improve average travel time during peak periods by X percent by year Y. | Average travel time during peak periods (minutes). |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by all transient events such as traffic incidents, special events, and work zones. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by scheduled events, work zones, or system maintenance by x hours in y years. | Travel time delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by unscheduled disruptions to travel. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Planning Time Index | Reduce the average planning time for (specific routes in region) by X minutes over the next Y years. | The planning time index represents the time that must be added to travel time at free-flow speeds or the posted speed limit to ensure on time arrivals for 95 percent of the trips. Planning time = 95th percentile travel time (minutes) – Travel time at free-flow speed or posted speed limit. Average planning time index or planning time can be computed using a weighted average over person miles traveled. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Planning Time Index | Reduce the average planning time index for (specific routes in region) by X (no units) over the next Y years. | The planning time index represents the time that must be added to travel time at free-flow speeds or the posted speed limit to ensure on time arrivals for 95 percent of the trips. Planning time = 95th percentile travel time (minutes) – Travel time at free-flow speed or posted speed limit. Average planning time index or planning time can be computed using a weighted average over person miles traveled. |
| System Reliability: Travel Time 90th/95th Percentile | Reduce the 90th (or 95th) percentile travel times for each route selected by X percent over Y years. | 95th or 90th percentile travel times for selected routes. |
| System Reliability: Travel Time 90th/95th Percentile | Reduce the average of the 90th (or 95th) percentile travel times for (a group of specific travel routes or trips in the region) by X minutes in Y years. | 95th or 90th percentile travel times for selected routes. |
| System Reliability: Travel Time Buffer Index | Decrease the average buffer index for (multiple routes or trips) by X percent over Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Travel Time Buffer Index | Decrease the buffer index for (specific travel routes) by X percent over the next Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Travel Time Buffer Index | Reduce the average buffer time needed to arrive on-time for 95 percent of trips on (specified routes) by X minutes over Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Variability | Reduce the variability of travel time on specified routes by X percent during peak and off-peak periods by year Y. | Variance of travel time. Variance is the sum of the squared deviations from the mean. This can also be calculated as the standard deviation of travel time. Standard deviation is the square root of variance. |
| Transit Operations and Management: Transit Signal Priority | Decrease delay by X percent per year by increasing the use of queue jumping and automated vehicle location. | Travel time delay on routes with queue jumping and automated vehicle location in use. |
| Transit Operations and Management: Transit Signal Priority | Decrease system-wide signal delay on transit routes by X percent per year. | System-wide signalized stop delay on transit routes. |
| Travel Weather Management: Signal Timing Plans | Special timing plans are available for use during inclement weather conditions for X miles of arterials in the region by year Y. | Number of miles of arterials that have at least one special timing plan for inclement weather events. |

**ATMS03 – Traffic Signal Control**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Traffic Metering (ATMS04)

This service package provides central monitoring and control, communications, and field equipment that support metering of traffic. It supports the complete range of metering strategies including ramp, interchange, and mainline metering. This package incorporates the instrumentation included in the Network Surveillance service package (traffic sensors are used to measure traffic flow and queues) to support traffic monitoring so responsive and adaptive metering strategies can be implemented. Also included is configurable field equipment to provide information to drivers approaching a meter, such as advance warning of the meter, its operational status (whether it is currently on or not, how many cars per green are allowed, etc.), lane usage at the meter (including a bypass lane for HOVs) and existing queue at the meter.

Table 2.2.1-10: ATMS04 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Roadway Basic Surveillance | Roadway |
| Roadway Equipment Coordination | Roadway |
| Roadway Traffic Information Dissemination | Roadway |
| Roadway Traffic Metering | Roadway |
| Collect Traffic Surveillance | Traffic Management |
| TMC Traffic Information Dissemination | Traffic Management |
| TMC Traffic Metering | Traffic Management |
| Traffic Equipment Maintenance | Traffic Management |

Table 2.2.1-11: ATMS04 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns; | Reduce environmental impacts |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.1-12: ATMS04 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Freeway Management: Efficiency | Reduce the number of person hours (or vehicle hours) of delay experienced by travelers on the freeway system. | Hours of delay (vehicle-hours or person-hours). |
| Freeway Management: Efficiency | Reduce the number of person hours (or vehicle hours) of delay experienced by travelers on the freeway system. | Hours of delay per capita or driver. |
| Freeway Management: Efficiency | Reduce the share of freeway miles at Level of Service (LOS) X by Y by year Z. | Miles at LOS X or V/C > 1.0 (or other threshold). |
| Freeway Management: Ramp Management | Increase the number freeway ramps currently metered by X percent by year Y. | Total number of ramp meters (by year of installation). |
| Freeway Management: Ramp Management | Increase the percent of freeway interchanges operating at LOS Z or higher during peak periods by X percent by year Y. | Percent of interchanges operating at LOS Z or above during peak periods (per year). |
| Freeway Management: Ramp Management | Reduce the number of congestion-inducing incidents occurring at freeway ramps by X percent by year Y. | Total number of congestion-inducing incidents at freeway interchanges during peak period (per year). |
| Freeway Management: Reliability | Reduce buffer index on the freeway system during peak and off-peak periods by X percent in Y years. | The buffer index (represents the extra time (buffer) travelers add to their average travel time when planning trips in order to arrive on-time 95 percent of the time). |
| Freeway Management: Reliability | Reduce delay associated with incidents on the freeway system by X percent by year Y. | Hours of delay associated with incidents. |
| Freeway Management: Transportation Management Centers | Increase the level of transportation management center (TMC) field hardware (cameras, variable message signs, electronic toll tag readers, ITS applications, etc.) by X percent by year Y. | Total amount of TMC equipment. |

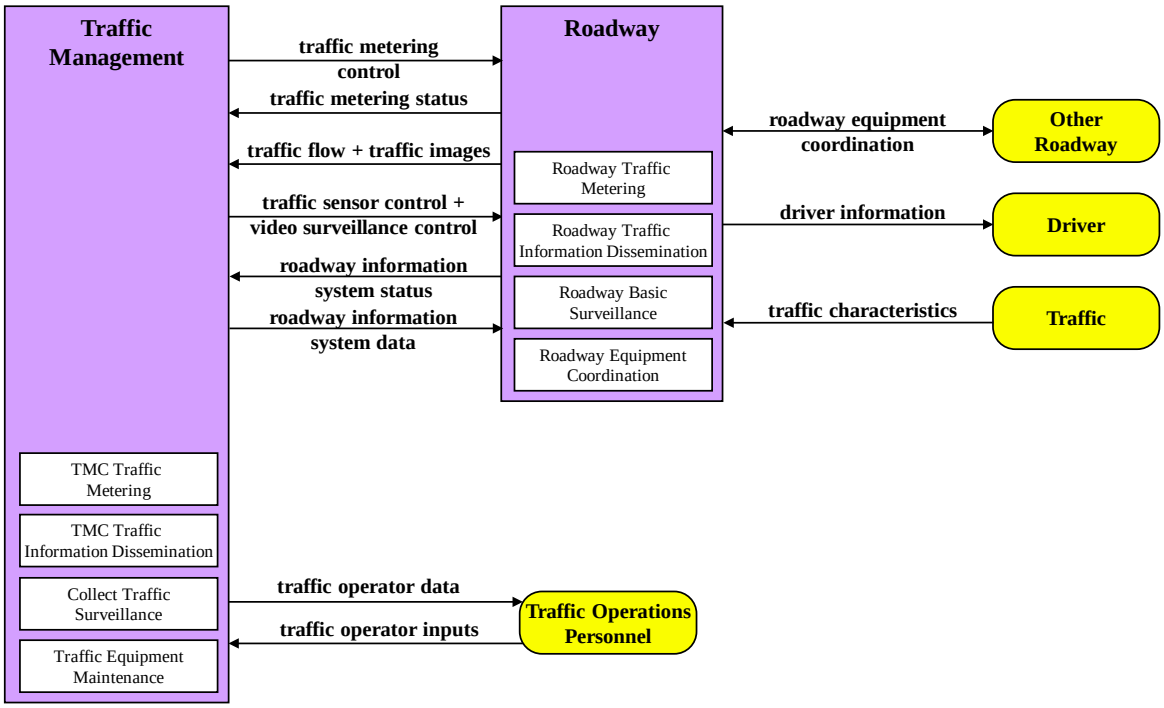
| Objective Category | Objective | Performance Measure |
|---|---|---|
| Special Event Management: Entry/Exit Travel Times | Reduce non-special event VMT in the event area during events by X percent in Y years. | Non-special event VMT in the event area during events over a year. |
| System Efficiency: Cost of Congestion | Reduce the annual monetary cost of congestion per capita for the next X years. | Cost (in dollars) of congestion or delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay per driver. |
| System Efficiency: Duration of Congestion | Reduce the daily hours of recurring congestion on major freeways from X to Y by year Z. | Hours per day at LOS F or V/C > 1.0 (or other threshold). |
| System Efficiency: Duration of Congestion | Reduce the number of hours per day that the top 20 most congested roadways experience recurring congestion by X percent by year Y. | Hours per day at LOS F or V/C > 1.0 (or other threshold). |
| System Efficiency: Energy Consumption | Reduce excess fuel consumed due to congestion by X percent by year Y. | Excess fuel consumed (total or per capita). |
| System Efficiency: Energy Consumption | Reduce total energy consumption per capita for transportation by X percent by year Y. | Total energy consumed per capita for transportation. |
| System Efficiency: Energy Consumption | Reduce total fuel consumption per capita for transportation by X percent by year Y. | Total fuel consumed per capita for transportation. |
| System Efficiency: Extent of Congestion | Maintain the rate of growth in facility miles experiencing recurring congestion as less than the population growth rate (or employment growth rate). | Percent of lane-miles (or rail) operating at LOS F or V/C > 1.0 |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Extent of Congestion | Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period by X percent by year Y. | Percent of lane-miles (or rail) operating at LOS F or V/C > 1.0 |
| System Efficiency: Intensity of Congestion (Travel Time Index) | Reduce the regional average travel time index by X percent per year. | Travel time index (the average travel time during the peak period, using congested speeds, divided by the off-peak period travel time, using posted or free-flow speeds). |
| System Efficiency: Travel Time | Annual rate of change in regional average commute travel time will not exceed regional rate of population growth through the year Y. | Average commute trip travel time (minutes). |
| System Efficiency: Travel Time | Improve average travel time during peak periods by X percent by year Y. | Average travel time during peak periods (minutes). |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by all transient events such as traffic incidents, special events, and work zones. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by scheduled events, work zones, or system maintenance by x hours in y years. | Travel time delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by unscheduled disruptions to travel. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Planning Time Index | Reduce the average planning time for (specific routes in region) by X minutes over the next Y years. | The planning time index represents the time that must be added to travel time at free-flow speeds or the posted speed limit to ensure on time arrivals for 95 percent of the trips. Planning time = 95th percentile travel time (minutes) – Travel time at free-flow speed or posted speed limit. Average planning time index or planning time can be computed using a weighted average over person miles traveled. |
| System Reliability: Planning Time Index | Reduce the average planning time index for (specific routes in region) by X (no units) over the next Y years. | The planning time index represents the time that must be added to travel time at free-flow speeds or the posted speed limit to ensure on time arrivals for 95 percent of the trips. Planning time = 95th percentile travel time (minutes) – Travel time at free-flow speed or posted speed limit. Average planning time index or planning time can be computed using a weighted average over person miles traveled. |
| System Reliability: Travel Time 90th/95th Percentile | Reduce the 90th (or 95th) percentile travel times for each route selected by X percent over Y years. | 95th or 90th percentile travel times for selected routes. |
| System Reliability: Travel Time 90th/95th Percentile | Reduce the average of the 90th (or 95th) percentile travel times for (a group of specific travel routes or trips in the region) by X minutes in Y years. | 95th or 90th percentile travel times for selected routes. |
| System Reliability: Travel Time Buffer Index | Decrease the average buffer index for (multiple routes or trips) by X percent over Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Travel Time Buffer Index | Decrease the buffer index for (specific travel routes) by X percent over the next Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Travel Time Buffer Index | Reduce the average buffer time needed to arrive on-time for 95 percent of trips on (specified routes) by X minutes over Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Variability | Reduce the variability of travel time on specified routes by X percent during peak and off-peak periods by year Y. | Variance of travel time. Variance is the sum of the squared deviations from the mean. This can also be calculated as the standard deviation of travel time. Standard deviation is the square root of variance. |

**ATMS04 – Traffic Metering**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## HOV Lane Management (ATMS05)

This service 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.

Table 2.2.1-13: ATMS05 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Roadway Equipment Coordination | Roadway |
| Roadway HOV Control | Roadway |
| Collect Traffic Surveillance | Traffic Management |
| TMC HOV Lane Management | Traffic Management |
| Vehicle Traffic Probe Support | Vehicle |

Table 2.2.1-14: ATMS05 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns; | Reduce environmental impacts |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

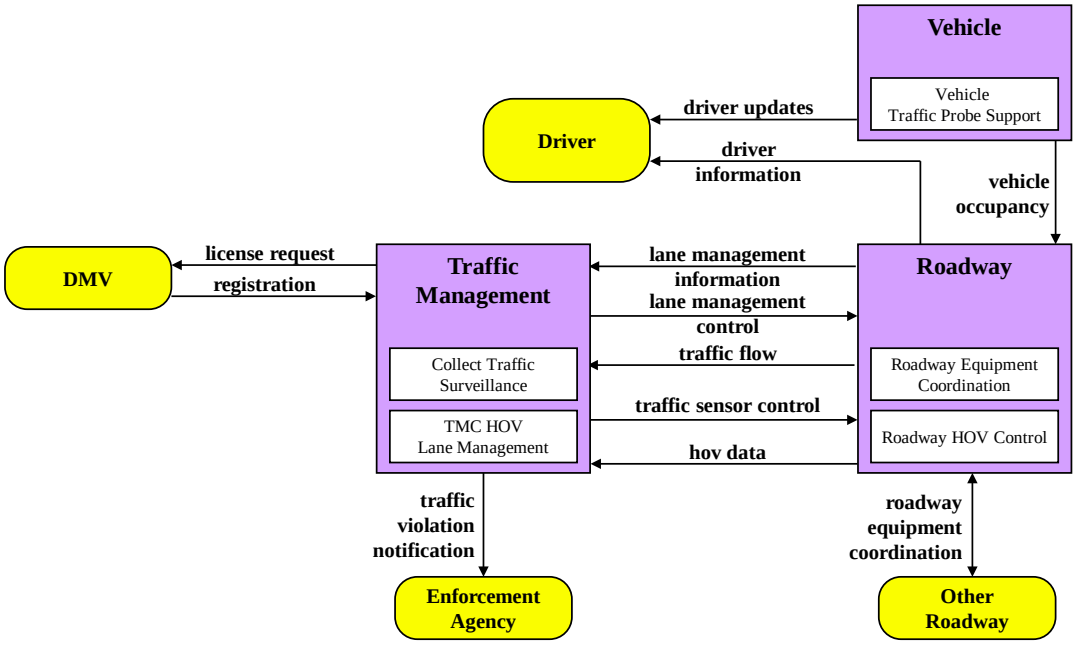
Table 2.2.1-15: ATMS05 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Freeway Management: HOV Lanes | Ensure that all HOV lanes carry a throughput of at least Y persons per hour. | Vehicle volume and persons per hour per lane. |
| Freeway Management: HOV Lanes | Ensure that all HOV lanes operate at no less than 50 mph during their hours of operation. | Minimum and Average speeds in HOV lanes. |
| Freeway Management: HOV Lanes | Ensure that all HOV lanes operate with a volume of at least X vehicles per hour. | Vehicle volume and persons per hour per lane. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Freeway Management: HOV Lanes | Increase the average vehicle occupancy rate in HOV lanes to X by year Y. | Vehicle volume and persons per hour per lane. |
| Freeway Management: HOV Lanes | Increase the compliance rate for HOV lanes to X by year Y. | Number of vehicles violating HOV restrictions. |
| Freeway Management: HOV Lanes | Increase the number of HOV lane miles from X to Y by year Z. | Total number of HOV lane miles in a region. |
| Freeway Management: HOV Lanes | Provide options for reliable travel times for carpools and transit on at least X percent of the freeway network by year Y. | Share of freeway network with HOV lanes. |
| Freeway Management: Managed Lanes | Ensure that all managed lanes (e.g., HOV lanes, HOT lanes) carry a throughput of at least Y persons per hour. | Passenger volumes in managed lanes. |
| Freeway Management: Managed Lanes | Ensure that all managed lanes (e.g., HOV lanes, HOT lanes) operate at no less than 50 mph during their hours of operation. | Average speeds in managed lanes. |
| Freeway Management: Managed Lanes | Ensure that all managed lanes (e.g., HOV lanes, HOT lanes) operate with a volume of at least X vehicles per hour. | Vehicle volumes in managed lanes. |
| Freeway Management: Managed Lanes | Increase the miles of managed lanes in the region from X to Y by year Z. | Miles of managed lanes. |
| Freeway Management: Managed Lanes | Provide options for reliable travel times for certain types of travel (e.g., transit, carpools, trucks, etc.) on at least X percent of the freeway network by year Y. | Share of freeway network with managed lanes (by class of traveler). |
| System Efficiency: Cost of Congestion | Reduce the annual monetary cost of congestion per capita for the next X years. | Cost (in dollars) of congestion or delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay per driver. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Duration of Congestion | Reduce the daily hours of recurring congestion on major freeways from X to Y by year Z. | Hours per day at LOS F or V/C > 1.0 (or other threshold). |
| System Efficiency: Duration of Congestion | Reduce the number of hours per day that the top 20 most congested roadways experience recurring congestion by X percent by year Y. | Hours per day at LOS F or V/C > 1.0 (or other threshold). |
| System Efficiency: Energy Consumption | Reduce excess fuel consumed due to congestion by X percent by year Y. | Excess fuel consumed (total or per capita). |
| System Efficiency: Energy Consumption | Reduce total energy consumption per capita for transportation by X percent by year Y. | Total energy consumed per capita for transportation. |
| System Efficiency: Energy Consumption | Reduce total fuel consumption per capita for transportation by X percent by year Y. | Total fuel consumed per capita for transportation. |
| System Efficiency: Extent of Congestion | Maintain the rate of growth in facility miles experiencing recurring congestion as less than the population growth rate (or employment growth rate). | Percent of lane-miles (or rail) operating at LOS F or V/C > 1.0 |
| System Efficiency: Extent of Congestion | Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period by X percent by year Y. | Percent of lane-miles (or rail) operating at LOS F or V/C > 1.0 |
| System Efficiency: Extent of Congestion | Reduce the share of major intersections operating at LOS Z by X percent by year Y. | Percent of intersections operating at LOS F or V/C > 1.0 |
| System Efficiency: Intensity of Congestion (Travel Time Index) | Reduce the regional average travel time index by X percent per year. | Travel time index (the average travel time during the peak period, using congested speeds, divided by the off-peak period travel time, using posted or free-flow speeds). |
| System Efficiency: Travel Time | Annual rate of change in regional average commute travel time will not exceed regional rate of population growth through the year Y. | Average commute trip travel time (minutes). |
| System Efficiency: Travel Time | Improve average travel time during peak periods by X percent by year Y. | Average travel time during peak periods (minutes). |
| System Efficiency: Vehicle Miles Traveled | Reduce vehicle miles traveled per capita by X percent by year Y. | Average VMT per capita per day, per week, or per year. |

**ATMS05 – HOV Lane Management**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Traffic Information Dissemination (ATMS06)

This service package provides driver information using roadway equipment such as dynamic message signs or highway advisory radio. A wide range of information can be disseminated including traffic and road conditions, closure and detour information, travel restrictions, incident information, and emergency alerts and driver advisories. This package provides information to drivers at specific equipped locations on the road network. 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, Emergency Management, and Information Service Providers. A link to the Maintenance and Construction Management subsystem allows real time information on road/bridge closures and restrictions due to maintenance and construction activities to be disseminated. The sharing of transportation operations data described in this service package also supports other services like ATMS09- Traffic Decision Support and Demand Management.

Table 2.2.1-16: ATMS06 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Roadway Equipment Coordination | Roadway |
| Roadway Traffic Information Dissemination | Roadway |
| TMC Traffic Information Dissemination | Traffic Management |

Table 2.2.1-17: ATMS06 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns; | Reduce environmental impacts |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.1-18: ATMS06 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Arterial Management: Reliability | Reduce buffer index on arterials during peak and off-peak periods by X percent in Y years. | The buffer index (represents the extra time (buffer) travelers add to their average travel time when planning trips in order to arrive on-time 95 percent of the time). |
| Arterial Management: Reliability | Reduce delay associated with incidents on arterials by X percent by year Y. | Hours of delay associated with incidents. |
| Emergency/Incident Management: Person Hours of Delay | Reduce the person hours (or vehicle hours) of total delay associated with traffic incidents by X percent over Y years. | Person hours (or vehicle hours) of delay associated with traffic incidents. |
| Emergency/Incident Management: Traveler Information | Reduce the time between recovery from incident and removal of traveler alerts for that incident. | Time between recovery from incident and removal of traveler alerts. |
| Emergency/Incident Management: Traveler Information | Reduce time between incident/emergency verification and posting a traveler alert to traveler information outlets (e.g., variable message signs, agency website, 511 system) by X minutes in Y years. | Time to alert motorists of an incident/emergency. |
| Emergency/Incident Management: Use of Technology | Increase number of ITS-related assets (e.g., roadside cameras, dynamic message signs, vehicle speed detectors) in use for incident and emergency detection by X in Y years. | Number of ITS-related assets in use for incident detection. |
| Emergency/Incident Management: Use of Technology | Increase number of regional road miles covered by ITS-related assets (e.g., roadside cameras, dynamic message signs, vehicle speed detectors) in use for incident detection by X percent in Y years. | Number of regional roadway miles covered by ITS-related assets in use for incident detection. |
| Freeway Management: Efficiency | Reduce the number of person hours (or vehicle hours) of delay experienced by travelers on the freeway system. | Hours of delay (vehicle-hours or person-hours). |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Freeway Management: Efficiency | Reduce the number of person hours (or vehicle hours) of delay experienced by travelers on the freeway system. | Hours of delay per capita or driver. |
| Freeway Management: Efficiency | Reduce the share of freeway miles at Level of Service (LOS) X by Y by year Z. | Miles at LOS X or V/C > 1.0 (or other threshold). |
| Freeway Management: Reliability | Reduce buffer index on the freeway system during peak and off-peak periods by X percent in Y years. | The buffer index (represents the extra time (buffer) travelers add to their average travel time when planning trips in order to arrive on-time 95 percent of the time). |
| Freeway Management: Reliability | Reduce delay associated with incidents on the freeway system by X percent by year Y. | Hours of delay associated with incidents. |
| Freeway Management: Transportation Management Centers | Increase the level of transportation management center (TMC) field hardware (cameras, variable message signs, electronic toll tag readers, ITS applications, etc.) by X percent by year Y. | Total amount of TMC equipment. |
| Freight Management: Detours and Routing | Provide freight operators with traveler alerts and alternate routes in the case of incidents, special events, weather, construction, and severe congestion at choke points on X percent of freight-significant routes by year Y. | Percent of freight-significant routes where traveler alerts and alternate route information is provided in the case of incidents, special events, weather, construction, and severe congestion at choke points. |
| Freight Management: Travel Time Reliability | Reduce buffer index on regional freight routes during peak and off-peak periods by X percent in Y years. | Buffer Index on regional freight routes during peak and off-peak period. |
| Special Event Management: Traveler Information | Increase the methods of effectively disseminating special event information to travelers by X percent in Y years (e.g., media releases, highway advisory radio, dynamic message signs, commercial AM and FM radio). | Number of effective methods to disseminate special event information to travelers. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Special Event Management: Traveler Information | Increase the percentage of planned special events (with attendance above Z) with information on anticipated and actual travel conditions being disseminated to the traveling public at least X hours prior to the event. | Percent of special events with expected attendance over Z that traveler information is disseminated at least X hours prior to the event. |
| Special Event Management: Use of Technology | Increase the percent of major special events using ITS-related assets (e.g., roadside cameras, dynamic message signs, vehicle speed detectors) to detect and manage special event entry/exit bottlenecks and incidents by X percent in Y years. | Percent of special events using ITS-related assets to detect and manage incidents/bottlenecks at entry/exit routes of the events. |
| System Efficiency: Cost of Congestion | Reduce the annual monetary cost of congestion per capita for the next X years. | Cost (in dollars) of congestion or delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay per driver. |
| System Efficiency: Duration of Congestion | Reduce the daily hours of recurring congestion on major freeways from X to Y by year Z. | Hours per day at LOS F or V/C > 1.0 (or other threshold). |
| System Efficiency: Duration of Congestion | Reduce the number of hours per day that the top 20 most congested roadways experience recurring congestion by X percent by year Y. | Hours per day at LOS F or V/C > 1.0 (or other threshold). |
| System Efficiency: Energy Consumption | Reduce excess fuel consumed due to congestion by X percent by year Y. | Excess fuel consumed (total or per capita). |
| System Efficiency: Energy Consumption | Reduce total energy consumption per capita for transportation by X percent by year Y. | Total energy consumed per capita for transportation. |
| System Efficiency: Energy Consumption | Reduce total fuel consumption per capita for transportation by X percent by year Y. | Total fuel consumed per capita for transportation. |

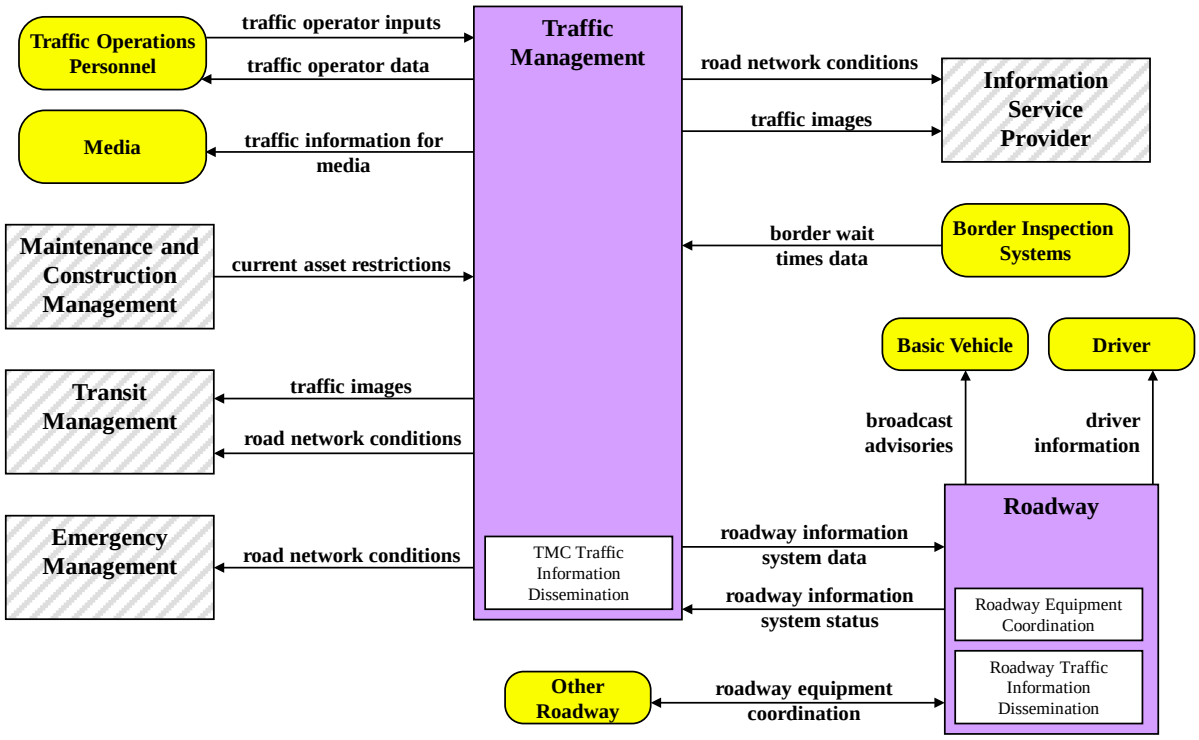
| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Extent of Congestion | Maintain the rate of growth in facility miles experiencing recurring congestion as less than the population growth rate (or employment growth rate). | Percent of lane-miles (or rail) operating at LOS F or V/C > 1.0 |
| System Efficiency: Extent of Congestion | Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period by X percent by year Y. | Percent of lane-miles (or rail) operating at LOS F or V/C > 1.0 |
| System Efficiency: Extent of Congestion | Reduce the share of major intersections operating at LOS Z by X percent by year Y. | Percent of intersections operating at LOS F or V/C > 1.0 |
| System Efficiency: Intensity of Congestion (Travel Time Index) | Reduce the regional average travel time index by X percent per year. | Travel time index (the average travel time during the peak period, using congested speeds, divided by the off-peak period travel time, using posted or free-flow speeds). |
| System Efficiency: Travel Time | Annual rate of change in regional average commute travel time will not exceed regional rate of population growth through the year Y. | Average commute trip travel time (minutes). |
| System Efficiency: Travel Time | Improve average travel time during peak periods by X percent by year Y. | Average travel time during peak periods (minutes). |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by all transient events such as traffic incidents, special events, and work zones. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by scheduled events, work zones, or system maintenance by x hours in y years. | Travel time delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by unscheduled disruptions to travel. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Planning Time Index | Reduce the average planning time for (specific routes in region) by X minutes over the next Y years. | The planning time index represents the time that must be added to travel time at free-flow speeds or the posted speed limit to ensure on time arrivals for 95 percent of the trips. Planning time = 95th percentile travel time (minutes) – Travel time at free-flow speed or posted speed limit. Average planning time index or planning time can be computed using a weighted average over person miles traveled. |
| System Reliability: Planning Time Index | Reduce the average planning time index for (specific routes in region) by X (no units) over the next Y years. | The planning time index represents the time that must be added to travel time at free-flow speeds or the posted speed limit to ensure on time arrivals for 95 percent of the trips. Planning time = 95th percentile travel time (minutes) – Travel time at free-flow speed or posted speed limit. Average planning time index or planning time can be computed using a weighted average over person miles traveled. |
| System Reliability: Travel Time 90th/95th Percentile | Reduce the 90th (or 95th) percentile travel times for each route selected by X percent over Y years. | 95th or 90th percentile travel times for selected routes. |
| System Reliability: Travel Time 90th/95th Percentile | Reduce the average of the 90th (or 95th) percentile travel times for (a group of specific travel routes or trips in the region) by X minutes in Y years. | 95th or 90th percentile travel times for selected routes. |
| System Reliability: Travel Time Buffer Index | Decrease the average buffer index for (multiple routes or trips) by X percent over Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Travel Time Buffer Index | Decrease the buffer index for (specific travel routes) by X percent over the next Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Travel Time Buffer Index | Reduce the average buffer time needed to arrive on-time for 95 percent of trips on (specified routes) by X minutes over Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Variability | Reduce the variability of travel time on specified routes by X percent during peak and off-peak periods by year Y. | Variance of travel time. Variance is the sum of the squared deviations from the mean. This can also be calculated as the standard deviation of travel time. Standard deviation is the square root of variance. |
| Travel Weather Management: Disseminating Information | Reduce time to alert travelers of travel weather impacts (using variable message signs, 511, road weather information systems, public information broadcasts, the agency's website, Web 2.0 technologies, etc.) by X (time period or percent) in Y years. | Time from beginning of weather event to posting of traveler information on (variable message signs, 511, Road Weather Information Systems, public information broadcasts etc.). |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Travel Weather Management: Disseminating Information | Reduce time to alert travelers of travel weather impacts (using variable message signs, 511, road weather information systems, public information broadcasts, the agency's website, Web 2.0 technologies, etc.) by X (time period or percent) in Y years. | Time from beginning of weather event to posting of traveler information on agency website. |
| Traveler Information: Information Dissemination | Increase the accuracy and completeness of traveler information posted (on variable message signs, websites, and/or web 2.0 technologies) by reducing the number of incomplete and inaccurate reports by X percent in Y years. | Number of complaints received from system users about inaccurate or missing information. |
| Work Zone Management: Traveler Information | Provide traveler information regarding work zones using variable message signs (VMS), 511, traveler information websites, and/or Web 2.0 technologies for at least X percent of work zones on major arterials, freeways, and transit routes over the next Y years. | Percent of work zones on major arterials, freeways, and transit routes for which traveler information is available via variable message signs (VMS), 511, traveler information websites, and/or Web 2.0 technologies. |

**ATMS06 – Traffic Information Dissemination**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Regional Traffic Management (ATMS07)

This service package provides for the sharing of traffic information and control among traffic management centers to support regional traffic management strategies. Regional traffic management strategies that are supported include inter-jurisdictional, real-time coordinated traffic signal control systems and coordination between freeway operations and traffic signal control within a corridor. This service package advances the ATMS03-Traffic Signal Control and ATMS04-Traffic Metering service packages by adding the communications links and integrated control strategies that enable integrated, interjurisdictional traffic management. 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 Traffic Signal Control and Traffic Metering service packages and adds hardware, software, and fixed-point to fixed-point communications capabilities to implement traffic management strategies that are coordinated between allied traffic management centers. Several levels of coordination are supported from sharing of information through sharing of control between traffic management centers.

Table 2.2.1-19: ATMS07 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| TMC Regional Traffic Management | Traffic Management |
| TMC Signal Control | Traffic Management |
| TMC Traffic Metering | Traffic Management |

Table 2.2.1-20: ATMS07 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight; | Enhance the integration and connectivity of the transportation system |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns; | Reduce environmental impacts |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.1-21: ATMS07 Associated Objectives and Performance Measures

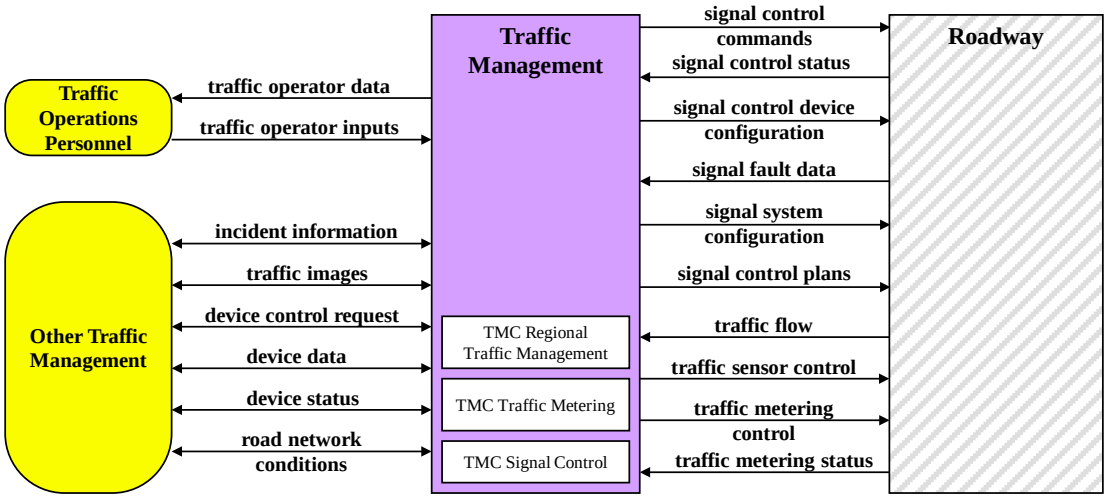
| Objective Category | Objective | Performance Measure |
|---|---|---|

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Arterial Management: Delay | Decrease the seconds of control delay per vehicles on arterial roads by X percent in Y years. (Control delay is defined as the portion of the total delay attributed to traffic signal operation for signalized intersections). | Control delay seconds per vehicle. |
| Arterial Management: Delay | Increase the miles of arterials in the region operating at level of service (LOS) Z by X percent in Y years. | Percent of arterial miles in region operating at LOS Z. |
| Integration: Connectivity | Reduce door-to-door trip time by X percent by year Y. | Average door-to-door trip time. |
| Special Event Management: Entry/Exit Travel Times | Reduce average time to clear event's exiting queue by X percent in Y years. | Average time to clear event's exiting queue by year per event. |
| Special Event Management: Entry/Exit Travel Times | Reduce average travel time into and out of the event by X percent in Y years. | Average travel time away from selected special events to a set of locations over a year. |
| Special Event Management: Entry/Exit Travel Times | Reduce average travel time into and out of the event by X percent in Y years. | Average travel time to selected special events from a set of locations in the area over a year. |
| Special Event Management: Entry/Exit Travel Times | Reduce buffer time index for travelers to multiple similar special events by X percent in Y years. | Buffer time index for travelers to multiple similar special events. |
| Special Event Management: Entry/Exit Travel Times | Reduce non-special event VMT in the event area during events by X percent in Y years. | Non-special event VMT in the event area during events over a year. |
| System Efficiency: Cost of Congestion | Reduce the annual monetary cost of congestion per capita for the next X years. | Cost (in dollars) of congestion or delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay per driver. |
| System Efficiency: Duration of Congestion | Reduce the daily hours of recurring congestion on major freeways from X to Y by year Z. | Hours per day at LOS F or V/C > 1.0 (or other threshold). |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Duration of Congestion | Reduce the number of hours per day that the top 20 most congested roadways experience recurring congestion by X percent by year Y. | Hours per day at LOS F or V/C > 1.0 (or other threshold). |
| System Efficiency: Energy Consumption | Reduce excess fuel consumed due to congestion by X percent by year Y. | Excess fuel consumed (total or per capita). |
| System Efficiency: Energy Consumption | Reduce total energy consumption per capita for transportation by X percent by year Y. | Total energy consumed per capita for transportation. |
| System Efficiency: Energy Consumption | Reduce total fuel consumption per capita for transportation by X percent by year Y. | Total fuel consumed per capita for transportation. |
| System Efficiency: Extent of Congestion | Maintain the rate of growth in facility miles experiencing recurring congestion as less than the population growth rate (or employment growth rate). | Percent of lane-miles (or rail) operating at LOS F or V/C > 1.0 |
| System Efficiency: Extent of Congestion | Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period by X percent by year Y. | Percent of lane-miles (or rail) operating at LOS F or V/C > 1.0 |
| System Efficiency: Extent of Congestion | Reduce the share of major intersections operating at LOS Z by X percent by year Y. | Percent of intersections operating at LOS F or V/C > 1.0 |
| System Efficiency: Intensity of Congestion (Travel Time Index) | Reduce the regional average travel time index by X percent per year. | Travel time index (the average travel time during the peak period, using congested speeds, divided by the off-peak period travel time, using posted or free-flow speeds). |
| System Efficiency: Travel Time | Annual rate of change in regional average commute travel time will not exceed regional rate of population growth through the year Y. | Average commute trip travel time (minutes). |
| System Efficiency: Travel Time | Improve average travel time during peak periods by X percent by year Y. | Average travel time during peak periods (minutes). |
| System Efficiency: Trip Connectivity | Reduce door-to-door trip time by X percent by year Y. | Average door-to-door trip time. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by all transient events such as traffic incidents, special events, and work zones. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by scheduled events, work zones, or system maintenance by x hours in y years. | Travel time delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by unscheduled disruptions to travel. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |

**ATMS07 – Regional Traffic Management**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Traffic Incident Management System (ATMS08)

This service package manages both unexpected incidents and planned events so that the impact to the transportation network and traveler safety is minimized. The service package includes incident detection capabilities through roadside surveillance devices (e.g. CCTV) and through regional coordination with other traffic management, maintenance and construction management and emergency management centers as well as rail operations and event promoters. Information from these diverse sources is collected and correlated by this service package to detect and verify incidents and implement an appropriate response. This service package supports traffic operations personnel in developing an appropriate response in coordination with emergency management, maintenance and construction management, and other incident response personnel to confirmed incidents. The response may include traffic control strategy modifications or resource coordination between center subsystems. Incident response also includes presentation of information to affected travelers using the Traffic Information Dissemination service package and dissemination of incident information to travelers through the Broadcast Traveler Information or Interactive Traveler Information service packages. The roadside equipment used to detect and verify incidents also allows the operator to monitor 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 allied response agencies and field service personnel.

Table 2.2.1-22: ATMS08 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Emergency Response Management | Emergency Management |
| Incident Command | Emergency Management |
| On-board EV Incident Management Communication | Emergency Vehicle |
| MCM Incident Management | Maintenance and Construction Management |
| Roadway Equipment Coordination | Roadway |
| Roadway Incident Detection | Roadway |
| TMC Incident Detection | Traffic Management |
| TMC Incident Dispatch Coordination/Communication | Traffic Management |

Table 2.2.1-23: ATMS08 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight; | Enhance the integration and connectivity of the transportation system |

| MetroFactor | Goal |
|---|---|
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |
| Increase the security of the transportation system for motorized and nonmotorized users; | Improve the security of the transportation system |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.1-24: ATMS08 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Arterial Management: Reliability | Reduce buffer index on arterials during peak and off-peak periods by X percent in Y years. | The buffer index (represents the extra time (buffer) travelers add to their average travel time when planning trips in order to arrive on-time 95 percent of the time). |
| Arterial Management: Reliability | Reduce delay associated with incidents on arterials by X percent by year Y. | Hours of delay associated with incidents. |
| Emergency/Incident Management: Customer Satisfaction | Increase customer satisfaction with the region's incident management by X percent over Y years. | Percentage of customers satisfied with region's incident management practices. |
| Emergency/Incident Management: Incident Duration | Reduce mean incident clearance time per incident by X percent over Y years. (Defined as the time between awareness of an incident and the time the last responder has left the scene.) | Mean incident clearance time per incident. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Emergency/Incident Management: Incident Duration | Reduce mean incident notification time (defined as the time between the first agency's awareness of an incident and the time to notify needed response agencies) by X percent over Y years (i.e., through "Motorist Assist" roving patrol programs, reduction of inaccurate verifications, etc.). | Average incident notification time of necessary response agencies. |
| Emergency/Incident Management: Incident Duration | Reduce mean roadway clearance time per incident by X percent over Y years. (Defined as the time between awareness of an incident and restoration of lanes to full operational status.) | Mean roadway clearance time per incident. |
| Emergency/Incident Management: Incident Duration | Reduce mean time for needed responders to arrive on-scene after notification by X percent over Y years. | Mean time for needed responders to arrive on-scene after notification. |
| Emergency/Incident Management: Incident Duration | Reduce mean time of incident duration (from awareness of incident to resumed traffic flow) on transit services and arterial and expressway facilities by X percent in Y years. | Mean time of incident duration. |
| Emergency/Incident Management: Inter-Agency Coordination | Increase percentage of incident management agencies in the region that (participate in a multi-modal information exchange network, use interoperable voice communications, participate in a regional coordinated incident response team, etc.) by X percent in Y years. | Number of agencies in the region with interoperable voice communications. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Emergency/Incident Management: Inter-Agency Coordination | Increase percentage of incident management agencies in the region that (participate in a multi-modal information exchange network, use interoperable voice communications, participate in a regional coordinated incident response team, etc.) by X percent in Y years. | Number of participating agencies in a regional coordinated incident response team. |
| Emergency/Incident Management: Inter-Agency Coordination | Increase percentage of incident management agencies in the region that (participate in a multi-modal information exchange network, use interoperable voice communications, participate in a regional coordinated incident response team, etc.) by X percent in Y years. | Percentage of incident management agencies in region participating in multi-modal information exchange network. |
| Emergency/Incident Management: Inter-Agency Coordination | Increase the number of corridors in the region covered by regional coordinated incident response teams by X percent in Y years. | Number of TIM corridors in the region covered by regional coordinated incident response teams. |
| Emergency/Incident Management: Person Hours of Delay | Reduce the person hours (or vehicle hours) of total delay associated with traffic incidents by X percent over Y years. | Person hours (or vehicle hours) of delay associated with traffic incidents. |
| Emergency/Incident Management: Training | By Y (year), X percent of staff in region with incident management responsibilities will have completed the National Incident Management System (NIMS) Training and at least X percent of transportation responders in the region are familiar with the incident command structure (ICS). | Percent of staff having completed NIMS training and percent of transportation responders familiar with ICS. |

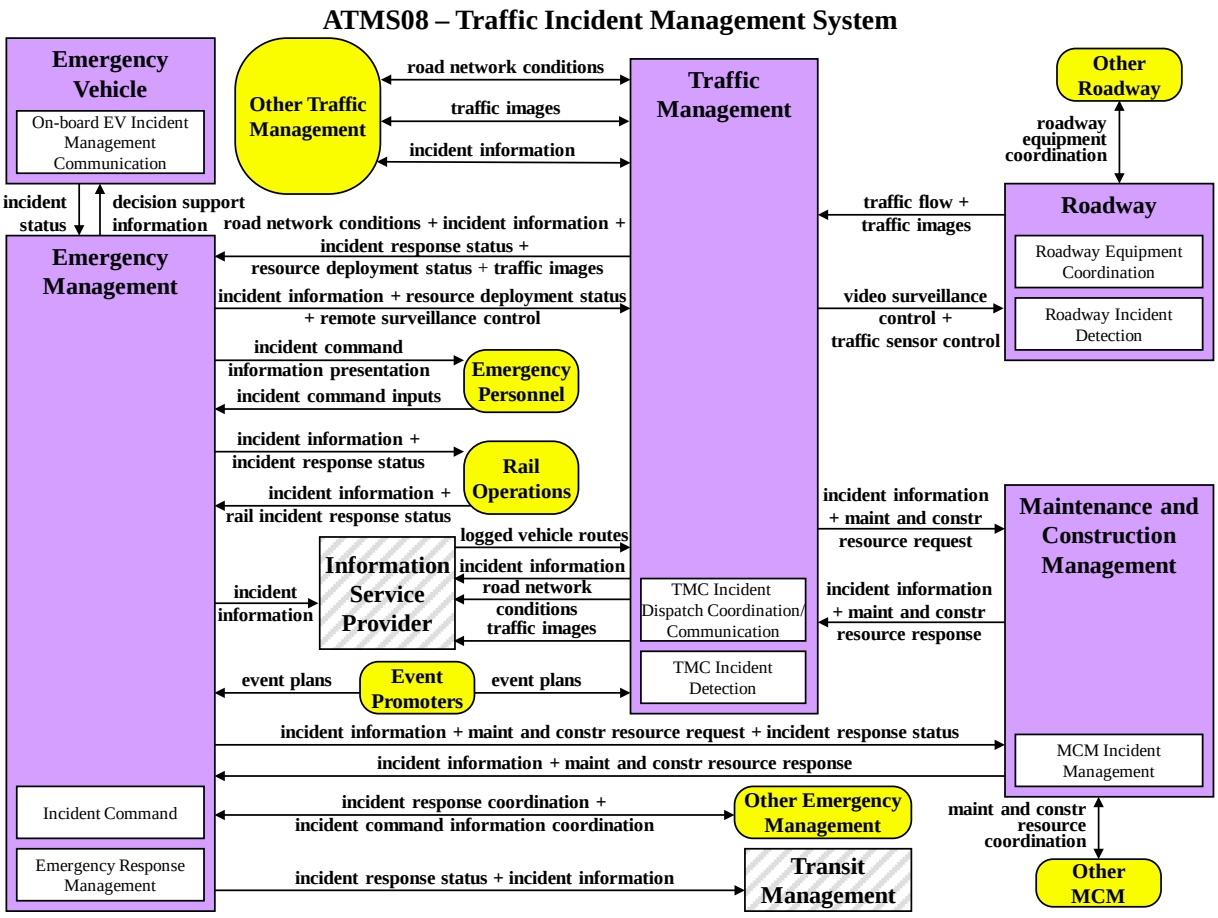
| Objective Category | Objective | Performance Measure |
|---|---|---|
| Emergency/Incident Management: Use of Technology | Increase number of ITS-related assets (e.g., roadside cameras, dynamic message signs, vehicle speed detectors) in use for incident and emergency detection by X in Y years. | Number of ITS-related assets in use for incident detection. |
| Emergency/Incident Management: Use of Technology | Increase number of regional road miles covered by ITS-related assets (e.g., roadside cameras, dynamic message signs, vehicle speed detectors) in use for incident detection by X percent in Y years. | Number of regional roadway miles covered by ITS-related assets in use for incident detection. |
| Freeway Management: Reliability | Reduce buffer index on the freeway system during peak and off-peak periods by X percent in Y years. | The buffer index (represents the extra time (buffer) travelers add to their average travel time when planning trips in order to arrive on-time 95 percent of the time). |
| Freeway Management: Reliability | Reduce delay associated with incidents on the freeway system by X percent by year Y. | Hours of delay associated with incidents. |
| Freight Management: Detours and Routing | Provide freight operators with traveler alerts and alternate routes in the case of incidents, special events, weather, construction, and severe congestion at choke points on X percent of freight-significant routes by year Y. | Percent of freight-significant routes where traveler alerts and alternate route information is provided in the case of incidents, special events, weather, construction, and severe congestion at choke points. |
| Freight Management: Travel Time Reliability | Reduce buffer index on regional freight routes during peak and off-peak periods by X percent in Y years. | Buffer Index on regional freight routes during peak and off-peak period. |
| Special Event Management: Entry/Exit Travel Times | Reduce average time to clear event's exiting queue by X percent in Y years. | Average time to clear event's exiting queue by year per event. |
| Special Event Management: Entry/Exit Travel Times | Reduce average travel time into and out of the event by X percent in Y years. | Average travel time away from selected special events to a set of locations over a year. |
| Special Event Management: Entry/Exit Travel Times | Reduce average travel time into and out of the event by X percent in Y years. | Average travel time to selected special events from a set of locations in the area over a year. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Special Event Management: Entry/Exit Travel Times | Reduce buffer time index for travelers to multiple similar special events by X percent in Y years. | Buffer time index for travelers to multiple similar special events. |
| Special Event Management: Entry/Exit Travel Times | Reduce non-special event VMT in the event area during events by X percent in Y years. | Non-special event VMT in the event area during events over a year. |
| Special Event Management: Multi-Agency Coordination and Training | Increase the number of agencies with special event management responsibilities that use interoperable communications by X percent in Y years. | Number of agencies special event management responsibilities using interoperable communications. |
| Special Event Management: Multi-Agency Coordination and Training | Increase the percentage of special event stakeholder agencies participating in a regional event management team to X percent by year Y. | Percent of stakeholder agencies participating agencies in a regional special event management team. |
| Special Event Management: Use of Technology | Implement special event traffic signal timing plans at X percent of major special events each year beginning in year Y. | Percent of major special events each year in which a special event traffic signal timing plan was implemented. |
| Special Event Management: Use of Technology | Increase the percent of major special events using ITS-related assets (e.g., roadside cameras, dynamic message signs, vehicle speed detectors) to detect and manage special event entry/exit bottlenecks and incidents by X percent in Y years. | Percent of special events using ITS-related assets to detect and manage incidents/bottlenecks at entry/exit routes of the events. |
| System Efficiency: Cost of Congestion | Reduce the annual monetary cost of congestion per capita for the next X years. | Cost (in dollars) of congestion or delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay per driver. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Travel Time | Annual rate of change in regional average commute travel time will not exceed regional rate of population growth through the year Y. | Average commute trip travel time (minutes). |
| System Efficiency: Travel Time | Improve average travel time during peak periods by X percent by year Y. | Average travel time during peak periods (minutes). |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by all transient events such as traffic incidents, special events, and work zones. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by scheduled events, work zones, or system maintenance by x hours in y years. | Travel time delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by unscheduled disruptions to travel. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Planning Time Index | Reduce the average planning time for (specific routes in region) by X minutes over the next Y years. | The planning time index represents the time that must be added to travel time at free-flow speeds or the posted speed limit to ensure on time arrivals for 95 percent of the trips. Planning time = 95th percentile travel time (minutes) – Travel time at free-flow speed or posted speed limit. Average planning time index or planning time can be computed using a weighted average over person miles traveled. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Planning Time Index | Reduce the average planning time index for (specific routes in region) by X (no units) over the next Y years. | The planning time index represents the time that must be added to travel time at free-flow speeds or the posted speed limit to ensure on time arrivals for 95 percent of the trips. Planning time = 95th percentile travel time (minutes) – Travel time at free-flow speed or posted speed limit. Average planning time index or planning time can be computed using a weighted average over person miles traveled. |
| System Reliability: Travel Time 90th/95th Percentile | Reduce the 90th (or 95th) percentile travel times for each route selected by X percent over Y years. | 95th or 90th percentile travel times for selected routes. |
| System Reliability: Travel Time 90th/95th Percentile | Reduce the average of the 90th (or 95th) percentile travel times for (a group of specific travel routes or trips in the region) by X minutes in Y years. | 95th or 90th percentile travel times for selected routes. |
| System Reliability: Travel Time Buffer Index | Decrease the average buffer index for (multiple routes or trips) by X percent over Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Travel Time Buffer Index | Decrease the buffer index for (specific travel routes) by X percent over the next Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Travel Time Buffer Index | Reduce the average buffer time needed to arrive on-time for 95 percent of trips on (specified routes) by X minutes over Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Variability | Reduce the variability of travel time on specified routes by X percent during peak and off-peak periods by year Y. | Variance of travel time. Variance is the sum of the squared deviations from the mean. This can also be calculated as the standard deviation of travel time. Standard deviation is the square root of variance. |
| Travel Weather Management: Clearance Time (Weather-Related Debris) | Reduce average time to complete clearing (interstates, freeways, expressways, all roads, main tracks, and main sidewalks) of weather-related debris after weather impact by X percent in Y years. | Average time to clear selected surface transportation facilities of weather-related debris after weather impact. |
| Travel Weather Management: Clearance Time (Weather-Related Debris) | Reduce average time to complete clearing (mode, hierarchy of facilities, or subarea of region) of weather-related debris after weather impact by X percent in Y years. | Average time to clear selected surface transportation facilities of weather-related debris after weather impact. |
| Work Zone Management: Travel Time Reliability | Reduce vehicle-hours of total delay in work zones caused by incidents (e.g., traffic crashes within or near the work zone). | Vehicle-hours of delay due to incidents related to work zones. |




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

**Transportation Decision Support and Demand Management (ATMS09)**
This service package recommends courses of action to traffic operations personnel based on an assessment of current and forecast road network performance. Recommendations may include predefined incident response plans and regional surface street and freeway control strategies that correct network imbalances. Where applicable, this service package also recommends transit, parking, and toll strategies to influence traveler route and mode choices to support travel demand management (TDM) programs and policies managing both traffic and the environment. TDM recommendations are coordinated with transit, parking, and toll administration centers to support regional implementation of TDM strategies. Incident response and congestion management recommendations are implemented by the local traffic management center and coordinated with other regional centers by other service packages (see ATMS07-Regional Traffic Management and ATMS08-Traffic Incident Management). All recommendations are based on historical evaluation, real-time assessment, and forecast of the roadway network performance based on predicted travel demand patterns. Traffic data is collected from sensors and surveillance equipment as well as other transportation management centers (see ATIS06-Transportation Operations Data Sharing). Forecasted traffic loads are derived from historical data and route plans supplied by the Information Service Provider Subsystem. This service package also collects air quality, parking availability, transit usage, and vehicle occupancy data to support TDM, where applicable.

Table 2.2.1-25: ATMS09 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| TMC Demand Management Coordination | Traffic Management |
| TMC Traffic Management Decision Support | Traffic Management |
| TMC Traffic Network Performance Evaluation | Traffic Management |
| Transit Center Multi-Modal Coordination | Transit Management |

Table 2.2.1-26: ATMS09 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns; | Reduce environmental impacts |

| MetroFactor | Goal |
|---|---|
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.1-27: ATMS09 Associated Objectives and Performance Measures

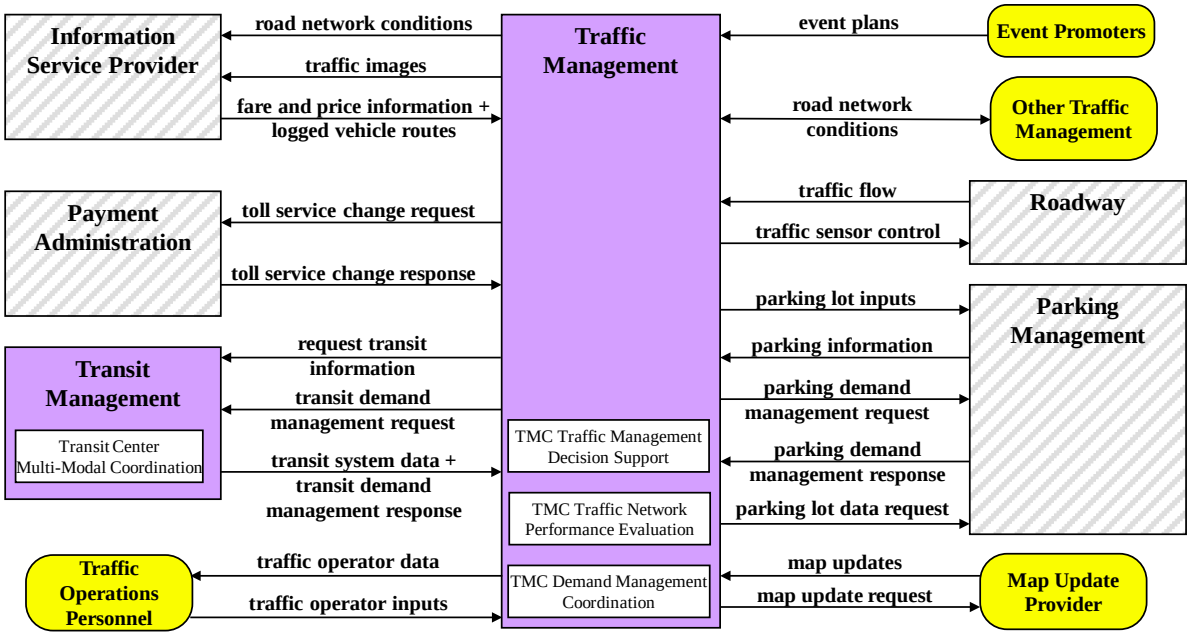
| Objective Category | Objective | Performance Measure |
|---|---|---|
| Special Event Management: Entry/Exit Travel Times | Reduce non-special event VMT in the event area during events by X percent in Y years. | Non-special event VMT in the event area during events over a year. |
| Special Event Management: Mode Shift from SOV | Decrease the percent of special event attendees traveling to the event in single-occupancy vehicles by X percent in Y years. | Percent of special event attendees using single-occupancy vehicles each year for selected events. |
| Special Event Management: Mode Shift from SOV | Increase the percent of special event attendees using park & ride lots by X percent in Y years. | Percent of special event attendees utilizing park & ride lots each year for selected events. |
| Special Event Management: Mode Shift from SOV | Increase the percent of special events with dedicated shuttle service by X percent in Y years. | Percent of special events with dedicated shuttle service for selected events during a 1-year period. |
| System Efficiency: Cost of Congestion | Reduce the annual monetary cost of congestion per capita for the next X years. | Cost (in dollars) of congestion or delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay per driver. |
| System Efficiency: Duration of Congestion | Reduce the daily hours of recurring congestion on major freeways from X to Y by year Z. | Hours per day at LOS F or V/C > 1.0 (or other threshold). |
| System Efficiency: Duration of Congestion | Reduce the number of hours per day that the top 20 most congested roadways experience recurring congestion by X percent by year Y. | Hours per day at LOS F or V/C > 1.0 (or other threshold). |
| System Efficiency: Energy Consumption | Reduce excess fuel consumed due to congestion by X percent by year Y. | Excess fuel consumed (total or per capita). |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Energy Consumption | Reduce total energy consumption per capita for transportation by X percent by year Y. | Total energy consumed per capita for transportation. |
| System Efficiency: Energy Consumption | Reduce total fuel consumption per capita for transportation by X percent by year Y. | Total fuel consumed per capita for transportation. |
| System Efficiency: Extent of Congestion | Maintain the rate of growth in facility miles experiencing recurring congestion as less than the population growth rate (or employment growth rate). | Percent of lane-miles (or rail) operating at LOS F or V/C > 1.0 |
| System Efficiency: Extent of Congestion | Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period by X percent by year Y. | Percent of lane-miles (or rail) operating at LOS F or V/C > 1.0 |
| System Efficiency: Extent of Congestion | Reduce the share of major intersections operating at LOS Z by X percent by year Y. | Percent of intersections operating at LOS F or V/C > 1.0 |
| System Efficiency: Intensity of Congestion (Travel Time Index) | Reduce the regional average travel time index by X percent per year. | Travel time index (the average travel time during the peak period, using congested speeds, divided by the off-peak period travel time, using posted or free-flow speeds). |
| System Efficiency: Travel Time | Annual rate of change in regional average commute travel time will not exceed regional rate of population growth through the year Y. | Average commute trip travel time (minutes). |
| System Efficiency: Travel Time | Improve average travel time during peak periods by X percent by year Y. | Average travel time during peak periods (minutes). |
| System Efficiency: Vehicle Miles Traveled | Reduce vehicle miles traveled per capita by X percent by year Y. | Average VMT per capita per day, per week, or per year. |
| System Options: Mode Share | Achieve X percent alternative (non-SOV) mode share in transit station communities (or other destinations) by year Y. | Percent of all trips made using alternative modes in transit station communities. |
| System Options: Mode Share | Increase active (bicycle/pedestrian) mode share by X percent by year Y. | Share of trips by each mode of travel. |
| System Options: Mode Share | Increase alternative (non-SOV) mode share for all trips by X percent within the next Y years. | Share of trips by each mode of travel. |
| System Options: Mode Share | Reduce per capita SOV commute trip rate by X percent in Y years. | SOV commute trips per capita. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Options: Mode Share | Reduce SOV vehicle trips by X percent through travel demand management strategies (e.g., employer or residential rideshare) by year Y. | Share of employees walking, biking, telecommuting, carpooling/vanpooling, riding transit, driving alone. |
| System Options: Transit Use | Increase average transit load factor by X percent by year Y. | Number of riders on various transit units per trip at peak travel times. |
| System Options: Transit Use | Increase passenger miles traveled per capita on transit by X percent by year Y. | Number of passenger miles traveled per capita. |
| System Options: Transit Use | Increase transit mode share by X percent by year Y during peak periods. | Percent of all peak-period trips made by transit. |
| System Options: Transit Use | Increase transit mode share by X percent by year Y. | Percent of all trips made by transit. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by all transient events such as traffic incidents, special events, and work zones. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by scheduled events, work zones, or system maintenance by x hours in y years. | Travel time delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by unscheduled disruptions to travel. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |
| Travel Demand Management: Auto Commuter Trip Reduction Programs | Reduce commuter vehicle miles traveled (VMT) per regional job by X percent in Y years. | Commuter VMT per regional employee. |
| Travel Demand Management: Parking Management | Biannually increase preferred parking spaces for carpool/vanpool participants within downtown, at special events, and among major employers by X percent within Y years. | Number of preferred parking spaces for carpool/vanpool participants. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Travel Demand Management: Parking Management | Implement parking pricing for X communities every Y years. | Number of communities with priced parking stalls. |
| Travel Demand Management: Parking Management | Implement shared parking for X communities every Y years. | Number of communities with shared parking. |
| Travel Demand Management: Parking Management | Increase park-and-ride lot capacity by X percent over Y years. | Capacity of park & ride lots. |
| Travel Demand Management: Parking Management | Increase the number of residents/commuters receiving information on parking pricing and availability within Y years. | Number of residents/commuters receiving information on parking pricing and availability. |

**ATMS09 – Transportation Decision Support and Demand Management**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Electronic Toll Collection (ATMS10)

This service package provides toll operators with the ability to collect tolls electronically and detect and process violations. The fees that are collected may be adjusted to implement demand management strategies. Field-Vehicle Communication between the roadway equipment and the vehicle is required as well as Fixed Point-Fixed Point interfaces between the toll collection equipment and transportation authorities and the financial infrastructure that supports fee collection. Toll violations are identified and electronically posted to vehicle owners. Standards, inter-agency coordination, and financial clearinghouse capabilities enable regional, and ultimately national interoperability for these services. Two other service packages, APTS04: Transit Fare Collection Management and ATMS16: Parking Facility Management also provide electronic payment services. These three service packages in combination provide an integrated electronic payment system for transportation services.

The vehicle equipment 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.

Table 2.2.1-28: ATMS10 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Fleet Administration | Fleet and Freight Management |
| Infrastructure Provided Trip Planning | Information Service Provider |
| ISP Traveler Data Collection | Information Service Provider |
| Toll Administration | Payment Administration |
| Toll Plaza Toll Collection | Roadway Payment |
| Vehicle Toll/Parking Interface | Vehicle |

Table 2.2.1-29: ATMS10 Associated Planning Factors and Goals

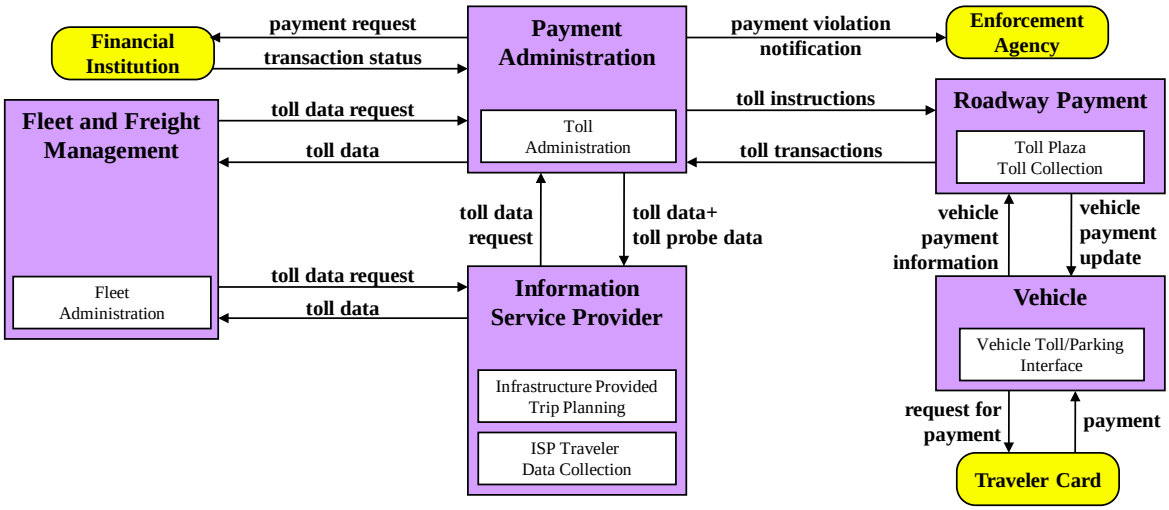
| MetroFactor | Goal |
|---|---|
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns; | Reduce environmental impacts |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.1-30: ATMS10 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Freeway Management: Pricing and Tolling | Increase the percentage of users carrying electronic toll collection (ETC) transponders by X percent by year Y. | Percentage of drivers with ETC transponders. |
| Freeway Management: Pricing and Tolling | Increase the share of freeways that are priced to X percent by year Y. | Lane miles that are priced. |
| Freeway Management: Pricing and Tolling | Increase the share of toll roadways and bridges that are using variable pricing (e.g., congestion pricing) to X percent by year Y. | Share of toll roads and bridges using variable pricing. |
| System Efficiency: Cost of Congestion | Reduce the annual monetary cost of congestion per capita for the next X years. | Cost (in dollars) of congestion or delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay per driver. |
| System Efficiency: Energy Consumption | Reduce excess fuel consumed due to congestion by X percent by year Y. | Excess fuel consumed (total or per capita). |
| System Efficiency: Energy Consumption | Reduce total energy consumption per capita for transportation by X percent by year Y. | Total energy consumed per capita for transportation. |
| System Efficiency: Energy Consumption | Reduce total fuel consumption per capita for transportation by X percent by year Y. | Total fuel consumed per capita for transportation. |
| System Efficiency: Intensity of Congestion (Travel Time Index) | Reduce the regional average travel time index by X percent per year. | Travel time index (the average travel time during the peak period, using congested speeds, divided by the off-peak period travel time, using posted or free-flow speeds). |
| System Efficiency: Travel Time | Annual rate of change in regional average commute travel time will not exceed regional rate of population growth through the year Y. | Average commute trip travel time (minutes). |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Travel Time | Improve average travel time during peak periods by X percent by year Y. | Average travel time during peak periods (minutes). |

**ATMS10 – Electronic Toll Collection**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Emissions Monitoring and Management (ATMS11)

This service 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 area wide air quality monitoring and point emissions monitoring are supported by this service package. For area wide monitoring, this service 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 service package collects data from on-board diagnostic systems and measures tail pipe emissions to identify vehicles that exceed emissions standards and/or clean vehicles that could be released from standard emissions tests, depending on policy and regulations. Summary emissions information or warnings can also be displayed to drivers. The gathered information can be used to implement environmentally sensitive TDM programs, policies, and regulations.

Table 2.2.1-31: ATMS11 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Emissions Data Management | Emissions Management |
| Roadway Emissions Monitoring | Roadway |
| Roadway Equipment Coordination | Roadway |
| Vehicle On-board Diagnostics System | Vehicle |

Table 2.2.1-32: ATMS11 Associated Planning Factors and Goals

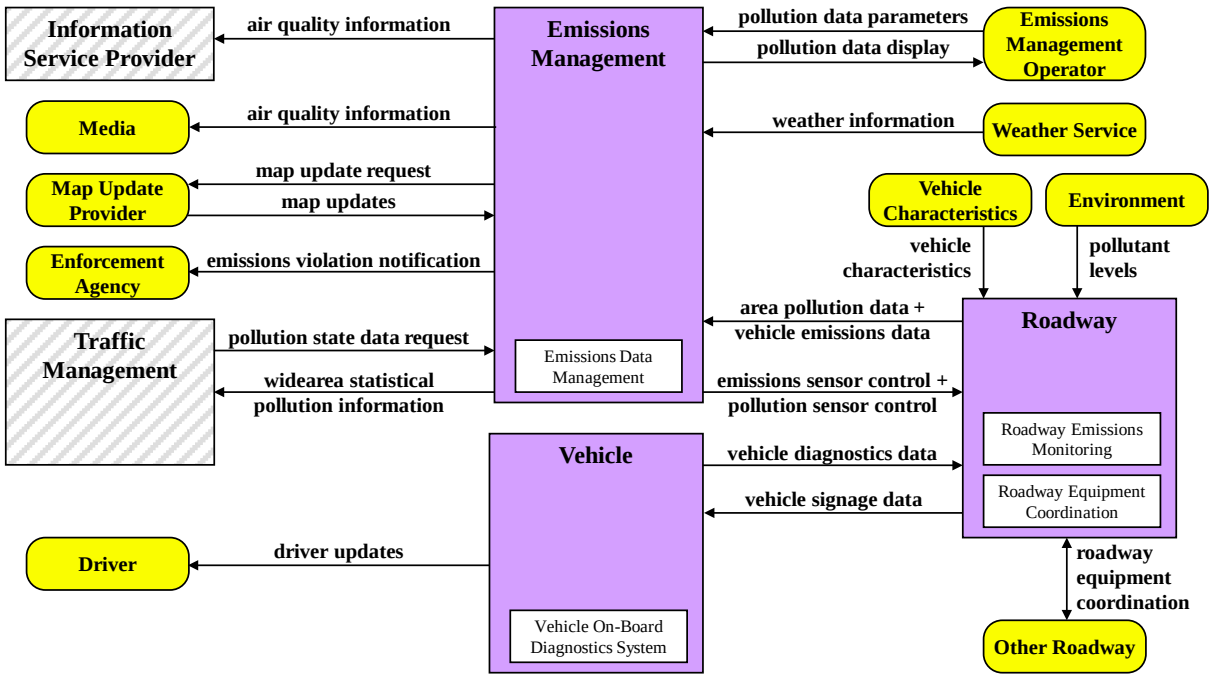
| MetroFactor | Goal |
|---|---|
| Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns; | Reduce environmental impacts |

Table 2.2.1-33: ATMS11 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Environment: Clean Air and Climate Change | Reduce carbon dioxide (CO2) emissions to X percent below year Y by year Z. | Carbon dioxide emissions - tons per day |
| Environment: Clean Air and Climate Change | Reduce emissions of coarse particulates (PM10) by X percent by year Y. | Course particular (PM10) levels - micrograms per cubic meter |
| Environment: Clean Air and Climate Change | Reduce emissions of coarse particulates (PM10) by X percent by year Y. | Course particulate (PM10) emissions - tons per day |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Environment: Clean Air and Climate Change | Reduce emissions of fine particulates (PM2.5) by X percent by year Y. | Fine particulate (PM2.5) emissions - tons per day |
| Environment: Clean Air and Climate Change | Reduce emissions of fine particulates (PM2.5) by X percent by year Y. | Fine particulate (PM2.5) levels - micrograms per cubic meter |

**ATMS11 – Emissions Monitoring and Management**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## Roadside Lighting System Control (ATMS12)

This service package includes systems that manage electrical lighting systems by monitoring operational conditions and using the lighting controls to vary the amount of light provided along the roadside. These systems allow a center to control lights based on traffic conditions, time-of-day, and the occurrence of incidents. Such systems can increase the safety of a roadway segment by increasing lighting and conserve energy at times when conditions warrant a reduction in the amount of lighting.

Table 2.2.1-34: ATMS12 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Roadside Lighting System Control | Roadway |
| TMC Lighting System Control | Traffic Management |

Table 2.2.1-35: ATMS12 Associated Planning Factors and Goals

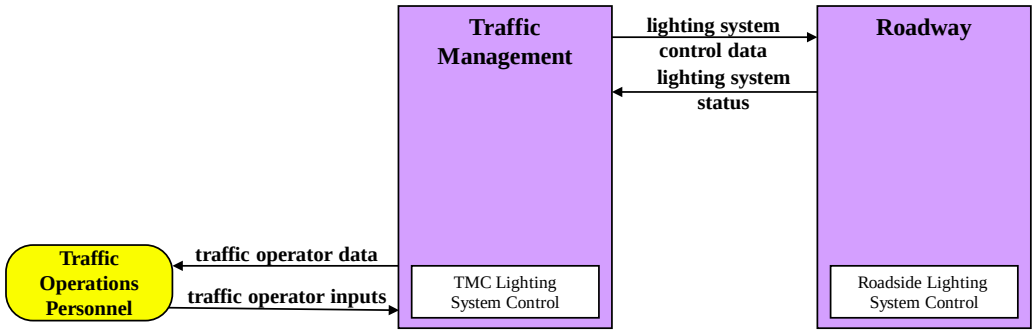
| MetroFactor | Goal |
|---|---|
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |
| Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns; | Reduce environmental impacts |

Table 2.2.1-36: ATMS12 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce crashes at intersections | Number of crashes and fatalities at signalized intersections |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes at intersections | Number of crashes and fatalities at unsignalized intersections |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes at intersections | Number of crashes and fatalities related to red-light running |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driver inattention and distraction |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driving while intoxicated |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to road weather conditions | Number of crashes and fatalities related to weather conditions |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to unexpected congestion | Number of crashes and fatalities related to unexpected congestion |
| Safety: Vehicle Crashes and Fatalities | Reduce lane departure crashes | Number of crashes and fatalities related to inappropriate lane departure, crossing or merging |
| Safety: Vehicle Crashes and Fatalities | Reduce secondary crashes | Number of secondary crashes |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes in the region by X percent by year Y. | Total crashes per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes involving bicyclists and pedestrians in the region by X percent by year Y. | Total crashes involving bicycles. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes involving bicyclists and pedestrians in the region by X percent by year Y. | Total crashes involving pedestrians. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total fatalities per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total severe injuries per X VMT. |
| Safety: Worker Safety | Enhance safety of workers | Number of crashes and fatalities in work zones |
| Safety: Worker Safety | Enhance safety of workers | Number of workers injured by vehicles in work zones |
| Safety: Worker Safety | Safeguard public safety personnel while they are at roadway incidents and emergencies | Number of public safety personnel struck by vehicle at incident/emergency site |
| Safety: Worker Safety | Safeguard public safety personnel while they are at roadway incidents and emergencies | Number of public safety vehicles struck at incident/emergency site |

**ATMS12 – Roadside Lighting System Control**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Standard Railroad Grade Crossing (ATMS13)

This service 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.

Table 2.2.1-37: ATMS13 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Standard Rail Crossing | Roadway |
| HRI Traffic Management | Traffic Management |

Table 2.2.1-38: ATMS13 Associated Planning Factors and Goals

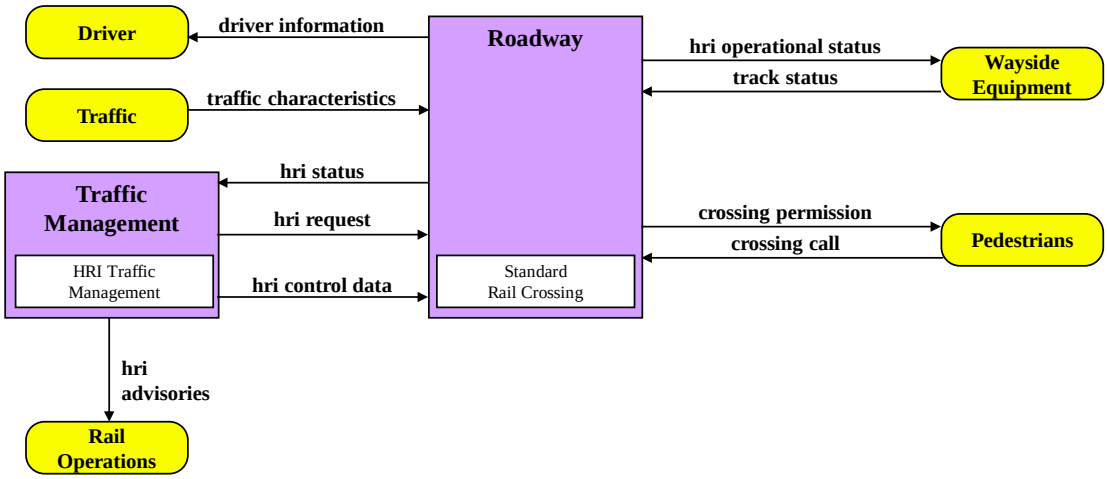
| MetroFactor | Goal |
|---|---|
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |

Table 2.2.1-39: ATMS13 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce crashes at railroad crossings | Number of crashes and fatalities at railroad crossings |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driver inattention and distraction |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driving while intoxicated |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes in the region by X percent by year Y. | Total crashes per X VMT. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes involving bicyclists and pedestrians in the region by X percent by year Y. | Total crashes involving bicycles. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes involving bicyclists and pedestrians in the region by X percent by year Y. | Total crashes involving pedestrians. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total fatalities per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total severe injuries per X VMT. |

**ATMS13 – Standard Railroad Grade Crossing**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Advanced Railroad Grade Crossing (ATMS14)

This service 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 service package includes all capabilities from the Standard Railroad Grade Crossing service package and augments these with additional safety features to mitigate the risks associated with higher rail speeds. The active warning systems supported by this service package include positive barrier systems that 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 service package, the wayside equipment provides additional information about the arriving train so that the train's direction of travel, estimated time of arrival, and 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 service package also includes additional detection capabilities that enable it to detect an entrapped or otherwise immobilized vehicle within the HRI and provide an immediate notification to highway and railroad officials.

Table 2.2.1-40: ATMS14 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Advanced Rail Crossing | Roadway |
| HRI Traffic Management | Traffic Management |

Table 2.2.1-41: ATMS14 Associated Planning Factors and Goals

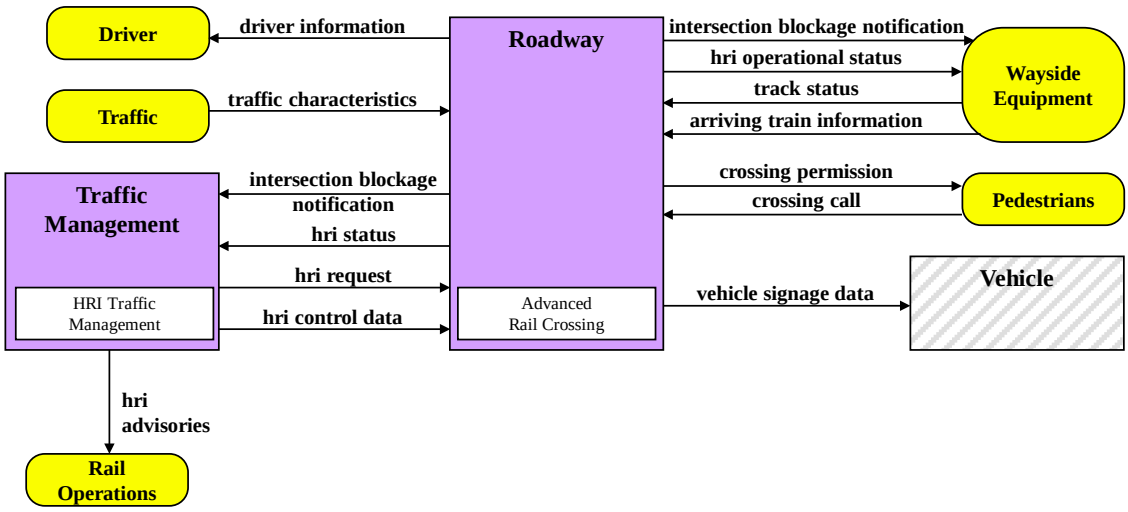
| MetroFactor | Goal |
|---|---|
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |

Table 2.2.1-42: ATMS14 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce crashes at railroad crossings | Number of crashes and fatalities at railroad crossings |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driver inattention and distraction |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driving while intoxicated |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes in the region by X percent by year Y. | Total crashes per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes involving bicyclists and pedestrians in the region by X percent by year Y. | Total crashes involving bicycles. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes involving bicyclists and pedestrians in the region by X percent by year Y. | Total crashes involving pedestrians. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total fatalities per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total severe injuries per X VMT. |

**ATMS14 – Advanced Railroad Grade Crossing**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Railroad Operations Coordination (ATMS15)

This service package provides an additional level of strategic coordination between freight rail operations and traffic management centers. Rail operations provides train schedules, maintenance schedules, and any other forecast events that will result in highway-rail intersection (HRI) closures. This information is used to develop forecast HRI closure times and durations that may be used in advanced traffic control strategies or to enhance the quality of traveler information.

Table 2.2.1-43: ATMS15 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Rail Operations Coordination | Traffic Management |

Table 2.2.1-44: ATMS15 Associated Planning Factors and Goals

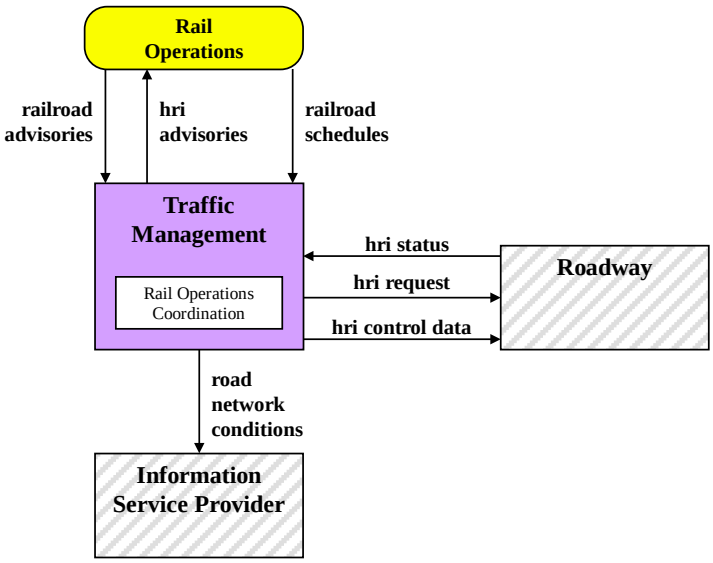
| MetroFactor | Goal |
|---|---|
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns; | Reduce environmental impacts |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.1-45: ATMS15 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Cost of Congestion | Reduce the annual monetary cost of congestion per capita for the next X years. | Cost (in dollars) of congestion or delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay per driver. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Duration of Congestion | Reduce the number of hours per day that the top 20 most congested roadways experience recurring congestion by X percent by year Y. | Hours per day at LOS F or V/C > 1.0 (or other threshold). |
| System Efficiency: Energy Consumption | Reduce excess fuel consumed due to congestion by X percent by year Y. | Excess fuel consumed (total or per capita). |
| System Efficiency: Energy Consumption | Reduce total energy consumption per capita for transportation by X percent by year Y. | Total energy consumed per capita for transportation. |
| System Efficiency: Energy Consumption | Reduce total fuel consumption per capita for transportation by X percent by year Y. | Total fuel consumed per capita for transportation. |
| System Efficiency: Extent of Congestion | Maintain the rate of growth in facility miles experiencing recurring congestion as less than the population growth rate (or employment growth rate). | Percent of lane-miles (or rail) operating at LOS F or V/C > 1.0 |
| System Efficiency: Extent of Congestion | Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period by X percent by year Y. | Percent of lane-miles (or rail) operating at LOS F or V/C > 1.0 |
| System Efficiency: Extent of Congestion | Reduce the share of major intersections operating at LOS Z by X percent by year Y. | Percent of intersections operating at LOS F or V/C > 1.0 |
| System Efficiency: Intensity of Congestion (Travel Time Index) | Reduce the regional average travel time index by X percent per year. | Travel time index (the average travel time during the peak period, using congested speeds, divided by the off-peak period travel time, using posted or free-flow speeds). |
| System Efficiency: Travel Time | Annual rate of change in regional average commute travel time will not exceed regional rate of population growth through the year Y. | Average commute trip travel time (minutes). |
| System Efficiency: Travel Time | Improve average travel time during peak periods by X percent by year Y. | Average travel time during peak periods (minutes). |

**ATMS15 – Railroad Operations Coordination**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Parking Facility Management (ATMS16)

This service package provides enhanced monitoring and management of parking facilities. It assists in the management of parking operations, coordinates with transportation authorities, and supports electronic collection of parking fees. This service package collects current parking status, shares this data with Information Service Providers and Traffic Management, and collects parking fees using the same in-vehicle equipment utilized for electronic toll collection or contact or proximity traveler cards used for electronic payment. Two other service packages, APTS04: Transit Fare Collection Management and ATMS10: Electronic Toll Collection also provide electronic payment services. These three service packages in combination provide an integrated electronic payment system for transportation services.

Table 2.2.1-46: ATMS16 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Parking Electronic Payment | Parking Management |
| Parking Management | Parking Management |
| Vehicle Toll/Parking Interface | Vehicle |

Table 2.2.1-47: ATMS16 Associated Planning Factors and Goals

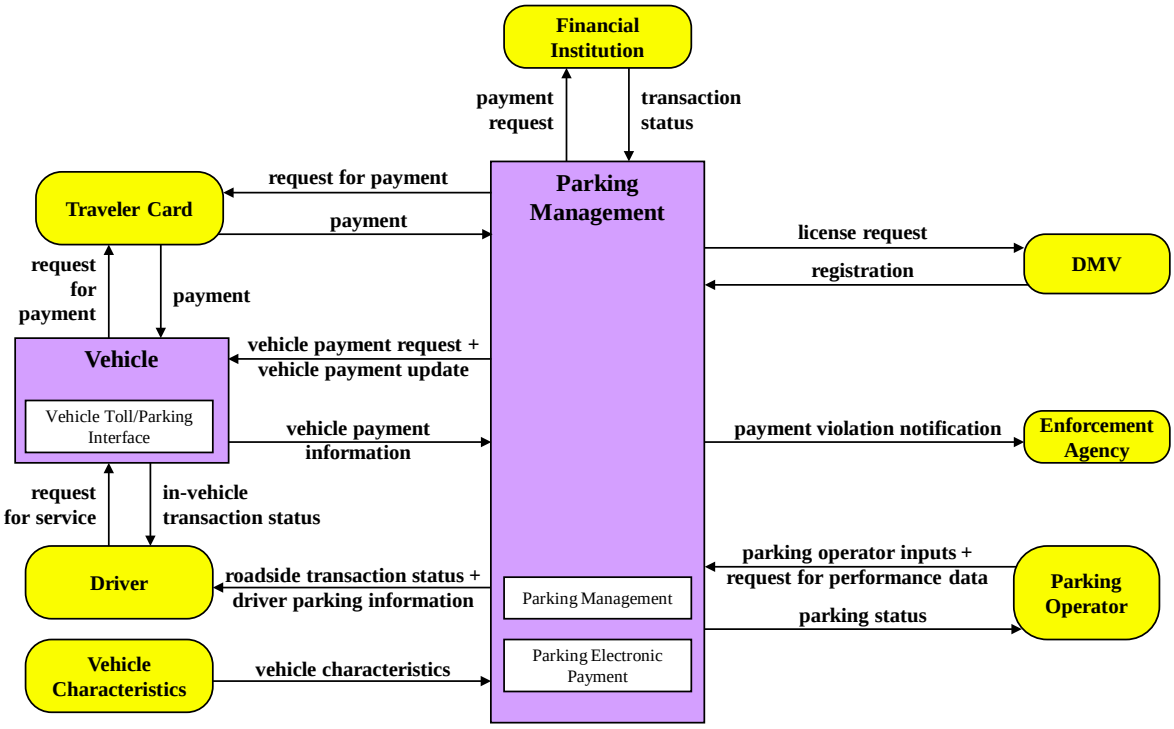
| MetroFactor | Goal |
|---|---|
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |

Table 2.2.1-48: ATMS16 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Special Event Management: Parking Management | Decrease the time spent clearing special event venue parking lots of vehicles by X percent in Y years following each event. | Percent decrease in time to clear parking lots. |
| Special Event Management: Parking Management | Enhance parking facility services and management | Number of parking facilities with advanced parking information to customers |
| Special Event Management: Parking Management | Enhance parking facility services and management | Number of parking facilities with automated occupancy counting and space management |
| Special Event Management: Parking Management | Enhance parking facility services and management | Number of parking facilities with coordinated availability information |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Special Event Management: Parking Management | Enhance parking facility services and management | Number of parking facilities with coordinated electronic payment systems |
| Special Event Management: Parking Management | Enhance parking facility services and management | Number of parking facilities with electronic fee collection |
| Special Event Management: Parking Management | Enhance parking facility services and management | Number parking facilities with electronic fee collection |
| Special Event Management: Parking Management | Increase the number of special events that use shared parking facilities (e.g., parking lots of nearby businesses or organizations) by X percent in Y years. | Number of special events that use shared parking facilities. |
| Special Event Management: Parking Management | Increase the use of flexible pricing mechanisms near special event locations on X percent of parking spaces in Y years. | Percent of parking spaces near special event locations that use flexible pricing mechanisms. |
| Transit Operations and Management: Park-and-Ride Support | Increase the number of automobile and bicycle spaces by X percent within Y years for lots currently experiencing X percent utilization. | Number of auto/bicycle spaces at the park-and-ride lots |
| Transit Operations and Management: Park-and-Ride Support | Increase traveler awareness of park-and-ride lots by X percent within Y years. | Number of users aware of park-and-ride lots in their region. |

**ATMS16 – Parking Facility Management**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## Regional Parking Management (ATMS17)

This service package supports communication and coordination between equipped parking facilities and also supports regional coordination between parking facilities and traffic and transit management systems. This service package also shares information with transit management systems and information service providers to support multimodal travel planning, including parking reservation capabilities. Information including current parking availability, system status, and operating strategies are shared to enable local parking facility management that supports regional transportation strategies.

Table 2.2.1-49: ATMS17 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Parking Coordination | Parking Management |

Table 2.2.1-50: ATMS17 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |

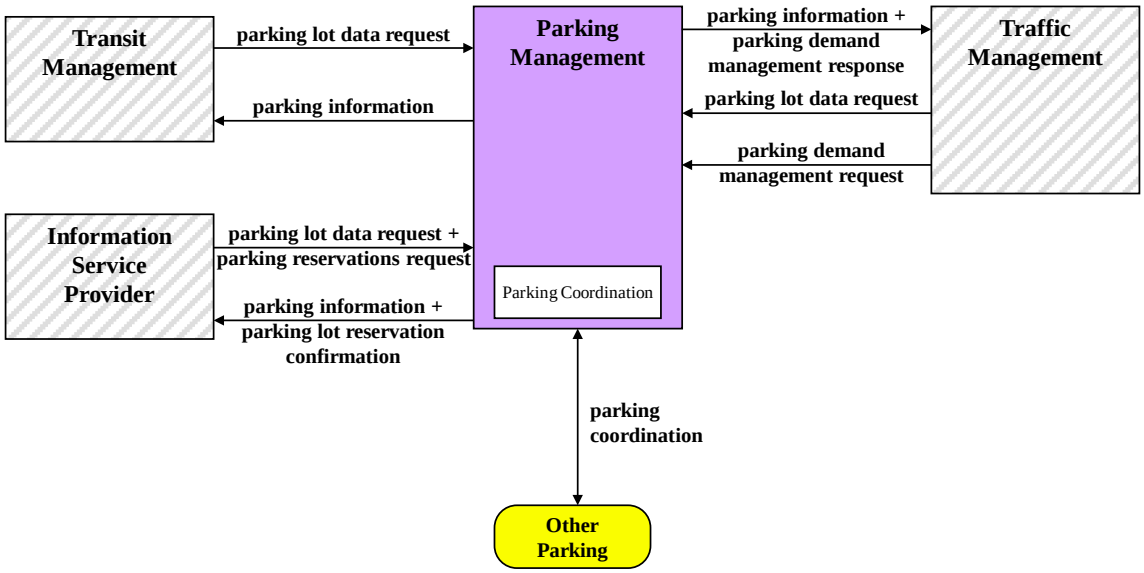
Table 2.2.1-51: ATMS17 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Special Event Management: Entry/Exit Travel Times | Reduce average time to clear event's exiting queue by X percent in Y years. | Average time to clear event's exiting queue by year per event. |
| Special Event Management: Entry/Exit Travel Times | Reduce average travel time into and out of the event by X percent in Y years. | Average travel time away from selected special events to a set of locations over a year. |
| Special Event Management: Entry/Exit Travel Times | Reduce average travel time into and out of the event by X percent in Y years. | Average travel time to selected special events from a set of locations in the area over a year. |
| Special Event Management: Entry/Exit Travel Times | Reduce buffer time index for travelers to multiple similar special events by X percent in Y years. | Buffer time index for travelers to multiple similar special events. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Special Event Management: Mode Shift from SOV | Increase the percent of special event attendees using park & ride lots by X percent in Y years. | Percent of special event attendees utilizing park & ride lots each year for selected events. |
| Special Event Management: Mode Shift from SOV | Increase the percent of special events with dedicated shuttle service by X percent in Y years. | Percent of special events with dedicated shuttle service for selected events during a 1-year period. |
| Special Event Management: Parking Management | Decrease the time spent clearing special event venue parking lots of vehicles by X percent in Y years following each event. | Percent decrease in time to clear parking lots. |
| Special Event Management: Parking Management | Enhance parking facility services and management | Number of parking facilities with advanced parking information to customers |
| Special Event Management: Parking Management | Enhance parking facility services and management | Number of parking facilities with automated occupancy counting and space management |
| Special Event Management: Parking Management | Enhance parking facility services and management | Number of parking facilities with coordinated availability information |
| Special Event Management: Parking Management | Enhance parking facility services and management | Number of parking facilities with coordinated electronic payment systems |
| Special Event Management: Parking Management | Enhance parking facility services and management | Number of parking facilities with electronic fee collection |
| Special Event Management: Parking Management | Enhance parking facility services and management | Number parking facilities with electronic fee collection |
| Special Event Management: Parking Management | Increase on-street parking restrictions on X percent of widely used routes during special events in Y years. | Percent of routes widely used during planned special events with on-street parking restrictions. |
| Special Event Management: Parking Management | Increase the number of special events that use shared parking facilities (e.g., parking lots of nearby businesses or organizations) by X percent in Y years. | Number of special events that use shared parking facilities. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Special Event Management: Parking Management | Increase the use of flexible pricing mechanisms near special event locations on X percent of parking spaces in Y years. | Percent of parking spaces near special event locations that use flexible pricing mechanisms. |
| System Efficiency: Travel Time | Annual rate of change in regional average commute travel time will not exceed regional rate of population growth through the year Y. | Average commute trip travel time (minutes). |
| System Efficiency: Travel Time | Improve average travel time during peak periods by X percent by year Y. | Average travel time during peak periods (minutes). |
| Travel Demand Management: Parking Management | Biannually increase preferred parking spaces for carpool/vanpool participants within downtown, at special events, and among major employers by X percent within Y years. | Number of preferred parking spaces for carpool/vanpool participants. |
| Travel Demand Management: Parking Management | Implement parking pricing for X communities every Y years. | Number of communities with priced parking stalls. |
| Travel Demand Management: Parking Management | Implement shared parking for X communities every Y years. | Number of communities with shared parking. |
| Travel Demand Management: Parking Management | Increase park-and-ride lot capacity by X percent over Y years. | Capacity of park & ride lots. |
| Travel Demand Management: Parking Management | Increase the number of residents/commuters receiving information on parking pricing and availability within Y years. | Number of residents/commuters receiving information on parking pricing and availability. |
| Travel Demand Management: Parking Management | Install parking meters along X corridors by year Y in the urban core/transit supportive areas. | Number of corridors in urban core/transit supportive areas with parking meters. |

**ATMS17 – Regional Parking Management**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Reversible Lane Management (ATMS18)

This service package provides for the management of reversible lane facilities. In addition to standard surveillance capabilities, this service 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 service package also includes the equipment used to electronically reconfigure intersections and manage right-of-way to address dynamic demand changes and special events.

Table 2.2.1-52: ATMS18 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Roadway Equipment Coordination | Roadway |
| Roadway Reversible Lanes | Roadway |
| TMC Reversible Lane Management | Traffic Management |

Table 2.2.1-53: ATMS18 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns; | Reduce environmental impacts |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

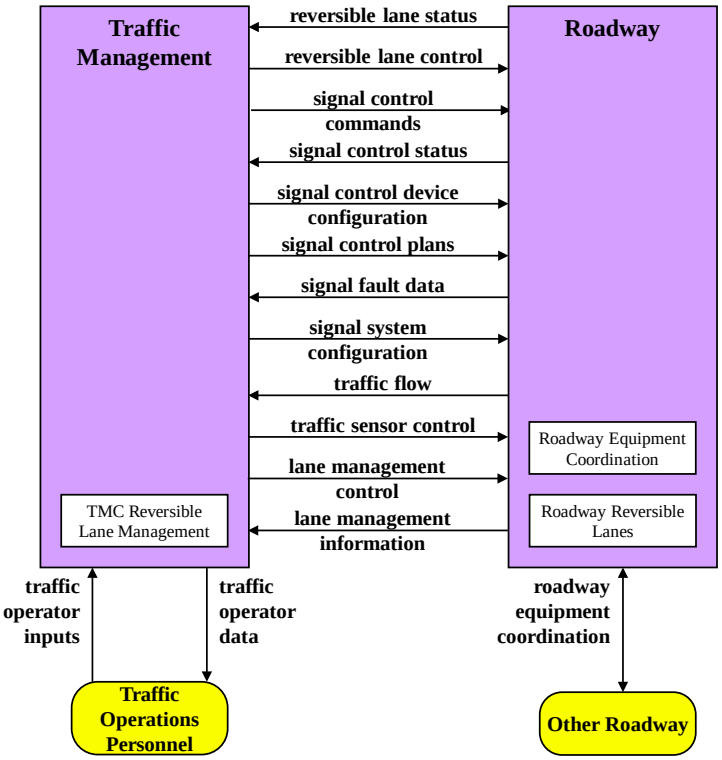
Table 2.2.1-54: ATMS18 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Freeway Management: Efficiency | Reduce the number of person hours (or vehicle hours) of delay experienced by travelers on the freeway system. | Hours of delay (vehicle-hours or person-hours). |
| Freeway Management: Efficiency | Reduce the number of person hours (or vehicle hours) of delay experienced by travelers on the freeway system. | Hours of delay per capita or driver. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Freeway Management: Efficiency | Reduce the share of freeway miles at Level of Service (LOS) X by Y by year Z. | Miles at LOS X or V/C > 1.0 (or other threshold). |
| Special Event Management: Entry/Exit Travel Times | Reduce average time to clear event's exiting queue by X percent in Y years. | Average time to clear event's exiting queue by year per event. |
| Special Event Management: Entry/Exit Travel Times | Reduce average travel time into and out of the event by X percent in Y years. | Average travel time away from selected special events to a set of locations over a year. |
| Special Event Management: Entry/Exit Travel Times | Reduce average travel time into and out of the event by X percent in Y years. | Average travel time to selected special events from a set of locations in the area over a year. |
| Special Event Management: Entry/Exit Travel Times | Reduce buffer time index for travelers to multiple similar special events by X percent in Y years. | Buffer time index for travelers to multiple similar special events. |
| System Efficiency: Cost of Congestion | Reduce the annual monetary cost of congestion per capita for the next X years. | Cost (in dollars) of congestion or delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay per driver. |
| System Efficiency: Duration of Congestion | Reduce the daily hours of recurring congestion on major freeways from X to Y by year Z. | Hours per day at LOS F or V/C > 1.0 (or other threshold). |
| System Efficiency: Duration of Congestion | Reduce the number of hours per day that the top 20 most congested roadways experience recurring congestion by X percent by year Y. | Hours per day at LOS F or V/C > 1.0 (or other threshold). |
| System Efficiency: Energy Consumption | Reduce excess fuel consumed due to congestion by X percent by year Y. | Excess fuel consumed (total or per capita). |
| System Efficiency: Energy Consumption | Reduce total energy consumption per capita for transportation by X percent by year Y. | Total energy consumed per capita for transportation. |
| System Efficiency: Energy Consumption | Reduce total fuel consumption per capita for transportation by X percent by year Y. | Total fuel consumed per capita for transportation. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Extent of Congestion | Maintain the rate of growth in facility miles experiencing recurring congestion as less than the population growth rate (or employment growth rate). | Percent of lane-miles (or rail) operating at LOS F or V/C > 1.0 |
| System Efficiency: Extent of Congestion | Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period by X percent by year Y. | Percent of lane-miles (or rail) operating at LOS F or V/C > 1.0 |
| System Efficiency: Extent of Congestion | Reduce the share of major intersections operating at LOS Z by X percent by year Y. | Percent of intersections operating at LOS F or V/C > 1.0 |
| System Efficiency: Intensity of Congestion (Travel Time Index) | Reduce the regional average travel time index by X percent per year. | Travel time index (the average travel time during the peak period, using congested speeds, divided by the off-peak period travel time, using posted or free-flow speeds). |
| System Efficiency: Travel Time | Annual rate of change in regional average commute travel time will not exceed regional rate of population growth through the year Y. | Average commute trip travel time (minutes). |
| System Efficiency: Travel Time | Improve average travel time during peak periods by X percent by year Y. | Average travel time during peak periods (minutes). |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by all transient events such as traffic incidents, special events, and work zones. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by scheduled events, work zones, or system maintenance by x hours in y years. | Travel time delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by unscheduled disruptions to travel. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |

**ATMS18 – Reversible Lane Management**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Speed Warning and Enforcement (ATMS19)

This service package monitors vehicle speeds and supports warning drivers when their speed is excessive. Also the service includes notifications to an enforcement agency to enforce the speed limit of the roadway. Speed monitoring can be made via spot speed or average speed measurements. Roadside equipment can display the speed of passing vehicles and/or suggest a safe driving speed. Environmental conditions and vehicle characteristics may be monitored and factored into the safe speed advisories that are provided to the motorist. For example, warnings can be generated recognizing the limitations of a given vehicle for the geometry of the roadway such as rollover risk for tall vehicles.

This service focuses on monitoring of vehicle speeds and enforcement of the speed limit while the variable speed limits service (covered in ATMS22-Variable Speed Limits service package) focuses on varying the posted speed limits to create more uniform speeds along a roadway, to promote safer driving during adverse conditions (such as fog) and/or to reduce air pollution.

Table 2.2.1-55: ATMS19 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| MCM Speed Monitoring and Warning | Maintenance and Construction Management |
| Roadway Equipment Coordination | Roadway |
| Roadway Speed Monitoring and Warning | Roadway |
| TMC Speed Monitoring and Warning | Traffic Management |

Table 2.2.1-56: ATMS19 Associated Planning Factors and Goals

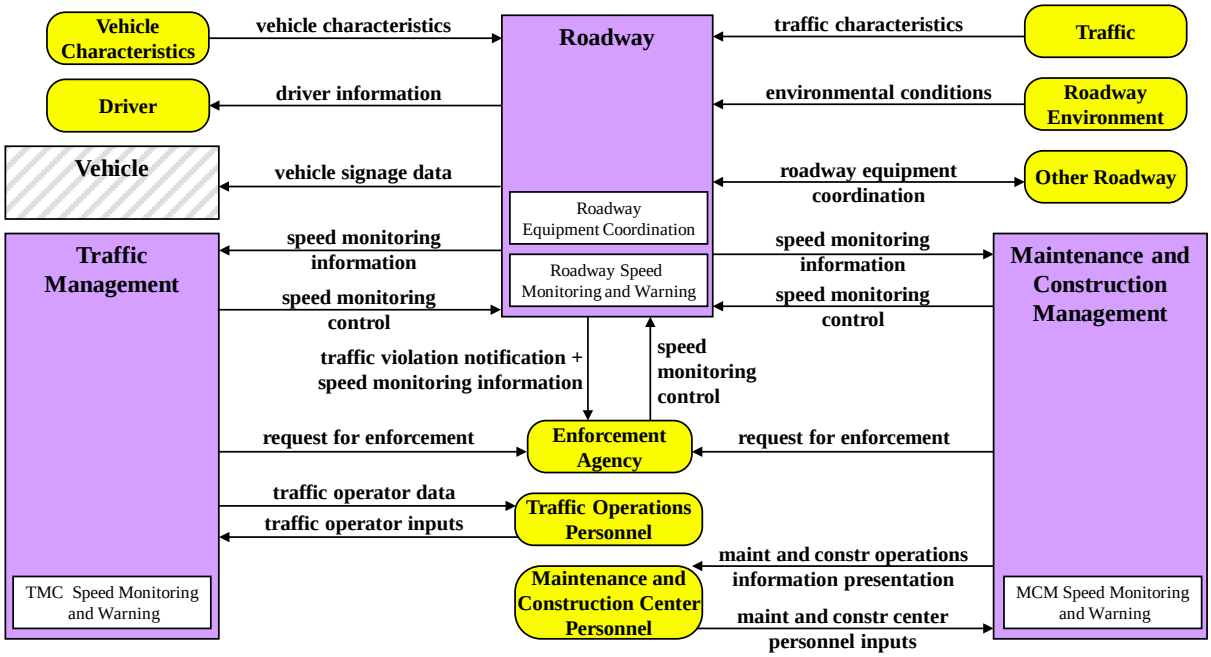
| MetroFactor | Goal |
|---|---|
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |

Table 2.2.1-57: ATMS19 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driver inattention and distraction |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driving while intoxicated |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to unexpected congestion | Number of crashes and fatalities related to unexpected congestion |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce speed differential | Number of crashes and fatalities related to excessive speeding |
| Safety: Vehicle Crashes and Fatalities | Reduce speed differential | Number of speed violations |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes in the region by X percent by year Y. | Total crashes per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes involving bicyclists and pedestrians in the region by X percent by year Y. | Total crashes involving bicycles. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes involving bicyclists and pedestrians in the region by X percent by year Y. | Total crashes involving pedestrians. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total fatalities per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total severe injuries per X VMT. |

**ATMS19 – Speed Warning and Enforcement**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## Drawbridge Management (ATMS20)

This service package supports systems that manage drawbridges at rivers and canals and other multimodal crossings (other than railroad grade crossings which are specifically covered by other service packages). The equipment managed by this service package includes control devices (e.g., gates, warning lights, dynamic message signs) at the drawbridge as well as the information systems that are used to keep travelers apprised of current and forecasted drawbridge status.

Table 2.2.1-58: ATMS20 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Multimodal Crossing Control | Roadway |
| TMC Multimodal Crossing Management | Traffic Management |

Table 2.2.1-59: ATMS20 Associated Planning Factors and Goals

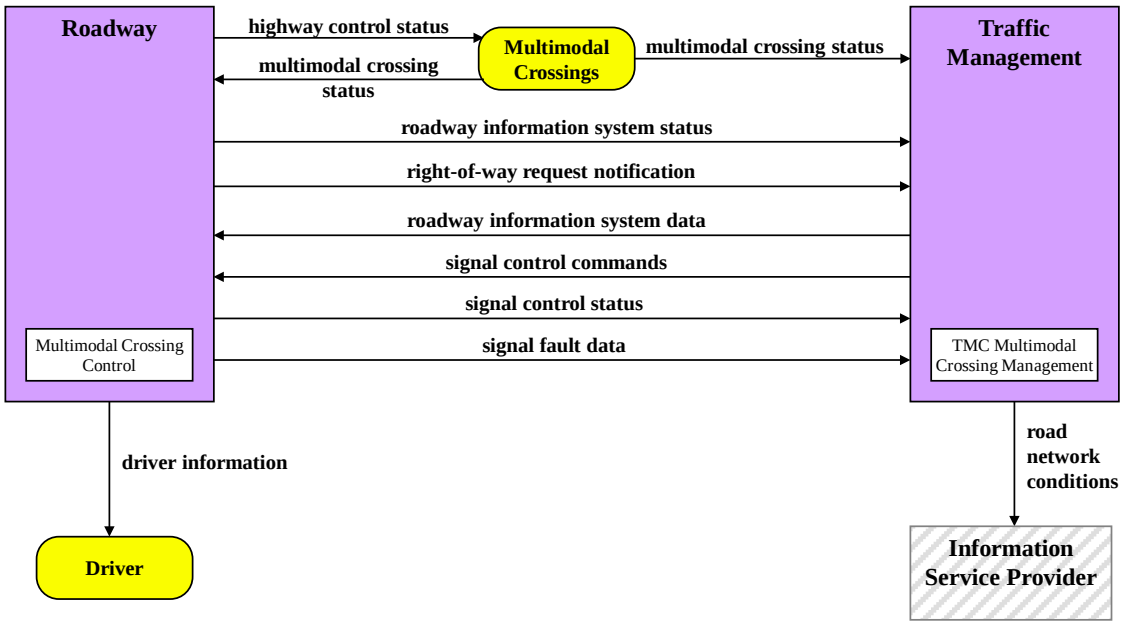
| MetroFactor | Goal |
|---|---|
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns; | Reduce environmental impacts |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.1-60: ATMS20 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Cost of Congestion | Reduce the annual monetary cost of congestion per capita for the next X years. | Cost (in dollars) of congestion or delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay per driver. |
| System Efficiency: Energy Consumption | Reduce excess fuel consumed due to congestion by X percent by year Y. | Excess fuel consumed (total or per capita). |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Energy Consumption | Reduce total energy consumption per capita for transportation by X percent by year Y. | Total energy consumed per capita for transportation. |
| System Efficiency: Energy Consumption | Reduce total fuel consumption per capita for transportation by X percent by year Y. | Total fuel consumed per capita for transportation. |
| System Efficiency: Intensity of Congestion (Travel Time Index) | Reduce the regional average travel time index by X percent per year. | Travel time index (the average travel time during the peak period, using congested speeds, divided by the off-peak period travel time, using posted or free-flow speeds). |
| System Efficiency: Travel Time | Annual rate of change in regional average commute travel time will not exceed regional rate of population growth through the year Y. | Average commute trip travel time (minutes). |
| System Efficiency: Travel Time | Improve average travel time during peak periods by X percent by year Y. | Average travel time during peak periods (minutes). |

**ATMS20 – Drawbridge Management**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Roadway Closure Management (ATMS21)

This service package closes roadways to vehicular traffic when driving conditions are unsafe, maintenance must be performed, and other scenarios where access to the roadway must be prohibited. The service package includes automatic or remotely controlled gates or barriers that control access to roadway segments including ramps and traffic lanes. Remote control systems allow the gates to be controlled from a central location or from a vehicle at the gate/barrier location, improving system efficiency and reducing personnel exposure to unsafe conditions during severe weather and other situations where roads must be closed. Surveillance systems allow operating personnel to visually verify the safe activation of the closure system and driver information systems (e.g., DMS) provide closure information to motorists in the vicinity of the closure. The equipment managed by this service package includes the control and monitoring systems, the field devices (e.g., gates, warning lights, DMS, CCTV cameras) at the closure location(s), and the information systems that notify other systems of a closure. This service package covers general road closure applications; specific closure systems that are used at railroad grade crossings, drawbridges, reversible lanes, etc. are covered by other ATMS service packages.

Table 2.2.1-61: ATMS21 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Emergency Response Management | Emergency Management |
| On-Board EV Barrier System Control | Emergency Vehicle |
| MCM Work Zone Management | Maintenance and Construction Management |
| MCV Barrier System Control | Maintenance and Construction Vehicle |
| Field Barrier System Control | Roadway |
| Roadway Basic Surveillance | Roadway |
| Roadway Equipment Coordination | Roadway |
| Roadway Traffic Information Dissemination | Roadway |
| Roadway Work Zone Traffic Control | Roadway |
| Barrier System Management | Traffic Management |
| Collect Traffic Surveillance | Traffic Management |
| TMC Traffic Information Dissemination | Traffic Management |

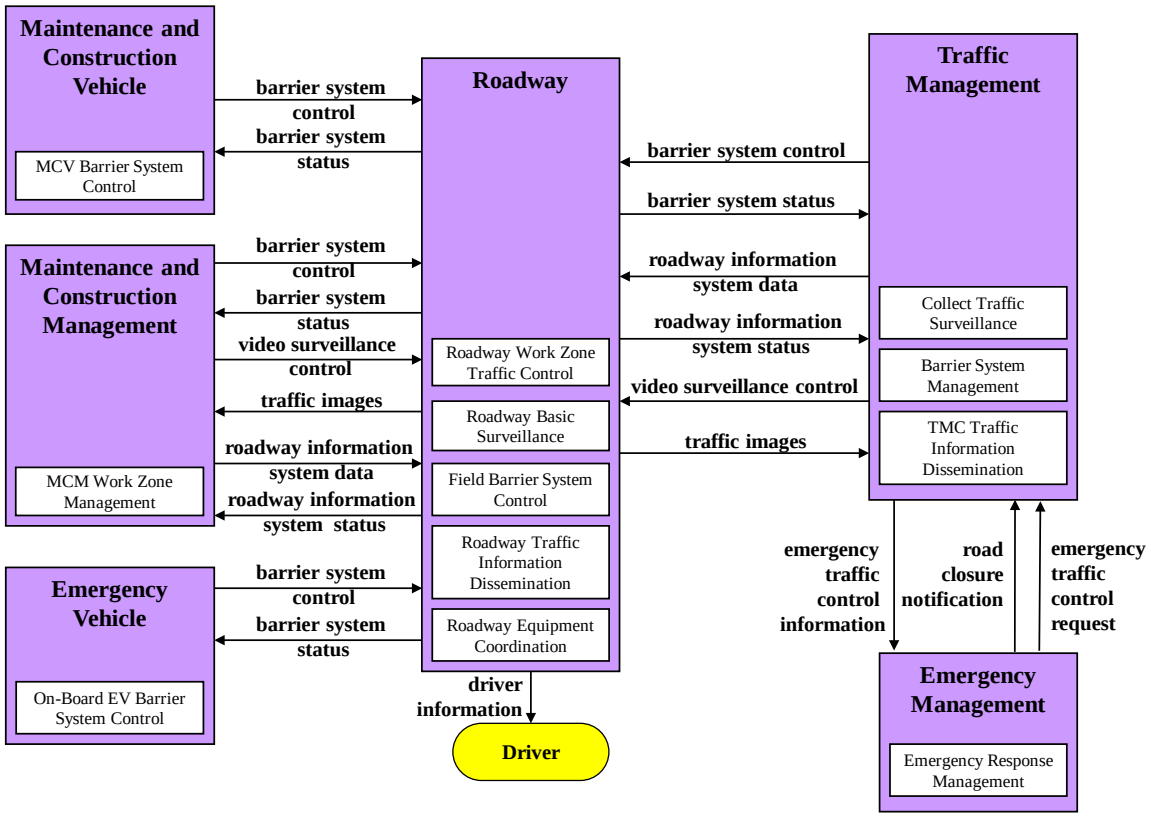
Table 2.2.1-62: ATMS21 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |

Table 2.2.1-63: ATMS21 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Travel Weather Management: Detours for Impacted Roadways | Increase by X percent of significant travel routes covered by weather-related diversion plans by year Y. | Percent of significant travel routes covered by weather-related diversion plans. |

**ATMS21 – Roadway Closure Management**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Variable Speed Limits (ATMS22)

This service package sets variable speed limits along a roadway to create more uniform speeds, to promote safer driving during adverse conditions (such as fog), and/or to reduce air pollution. Also known as speed harmonization, this service monitors traffic and environmental conditions along the roadway. Based on the measured data, the system calculates and sets suitable speed limits, usually by lane. Equipment over and along the roadway displays the speed limits and additional information such as basic safety rules and current traffic information. The system can be centrally monitored and controlled by a traffic management center or it can be autonomous.

This service establishes variable speed limits and communicates the speed limits to drivers. Speed warnings and enforcement of speeds limits, including variable speed limits, is covered in the ATMS19-Automated Speed Warning and Enforcement service package.

Variable speed limits are an Active Traffic Management (ATM) strategy and are typically used in conjunction with other ATM strategies (such as ATMS23-Dynamic Lane Management and Shoulder Use and ATMS24-Dynamic Roadway Warning).

Table 2.2.1-64: ATMS22 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Roadway Basic Surveillance | Roadway |
| Roadway Equipment Coordination | Roadway |
| Roadway Traffic Information Dissemination | Roadway |
| Roadway Variable Speed Limits | Roadway |
| Collect Traffic Surveillance | Traffic Management |
| TMC Traffic Information Dissemination | Traffic Management |
| TMC Variable Speed Limits | Traffic Management |
| Traffic Equipment Maintenance | Traffic Management |

Table 2.2.1-65: ATMS22 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.1-66: ATMS22 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Freeway Management: Efficiency | Reduce the number of person hours (or vehicle hours) of delay experienced by travelers on the freeway system. | Hours of delay (vehicle-hours or person-hours). |
| Freeway Management: Efficiency | Reduce the number of person hours (or vehicle hours) of delay experienced by travelers on the freeway system. | Hours of delay per capita or driver. |
| Freeway Management: Efficiency | Reduce the share of freeway miles at Level of Service (LOS) X by Y by year Z. | Miles at LOS X or V/C > 1.0 (or other threshold). |
| Freeway Management: Reliability | Reduce buffer index on the freeway system during peak and off-peak periods by X percent in Y years. | The buffer index (represents the extra time (buffer) travelers add to their average travel time when planning trips in order to arrive on-time 95 percent of the time). |
| Freeway Management: Reliability | Reduce delay associated with incidents on the freeway system by X percent by year Y. | Hours of delay associated with incidents. |
| Freight Management: Travel Time Reliability | Reduce buffer index on regional freight routes during peak and off-peak periods by X percent in Y years. | Buffer Index on regional freight routes during peak and off-peak period. |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to road weather conditions | Number of crashes and fatalities related to weather conditions |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to unexpected congestion | Number of crashes and fatalities related to unexpected congestion |
| Safety: Vehicle Crashes and Fatalities | Reduce lane departure crashes | Number of crashes and fatalities related to inappropriate lane departure, crossing or merging |
| Safety: Vehicle Crashes and Fatalities | Reduce secondary crashes | Number of secondary crashes |
| Safety: Vehicle Crashes and Fatalities | Reduce speed differential | Number of crashes and fatalities related to excessive speeding |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce speed differential | Number of speed violations |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes in the region by X percent by year Y. | Total crashes per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total fatalities per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total severe injuries per X VMT. |
| Special Event Management: Entry/Exit Travel Times | Reduce average time to clear event's exiting queue by X percent in Y years. | Average time to clear event's exiting queue by year per event. |
| Special Event Management: Entry/Exit Travel Times | Reduce average travel time into and out of the event by X percent in Y years. | Average travel time away from selected special events to a set of locations over a year. |
| Special Event Management: Entry/Exit Travel Times | Reduce average travel time into and out of the event by X percent in Y years. | Average travel time to selected special events from a set of locations in the area over a year. |
| Special Event Management: Entry/Exit Travel Times | Reduce buffer time index for travelers to multiple similar special events by X percent in Y years. | Buffer time index for travelers to multiple similar special events. |
| Special Event Management: Entry/Exit Travel Times | Reduce non-special event VMT in the event area during events by X percent in Y years. | Non-special event VMT in the event area during events over a year. |
| System Efficiency: Cost of Congestion | Reduce the annual monetary cost of congestion per capita for the next X years. | Cost (in dollars) of congestion or delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay (person-hours). |

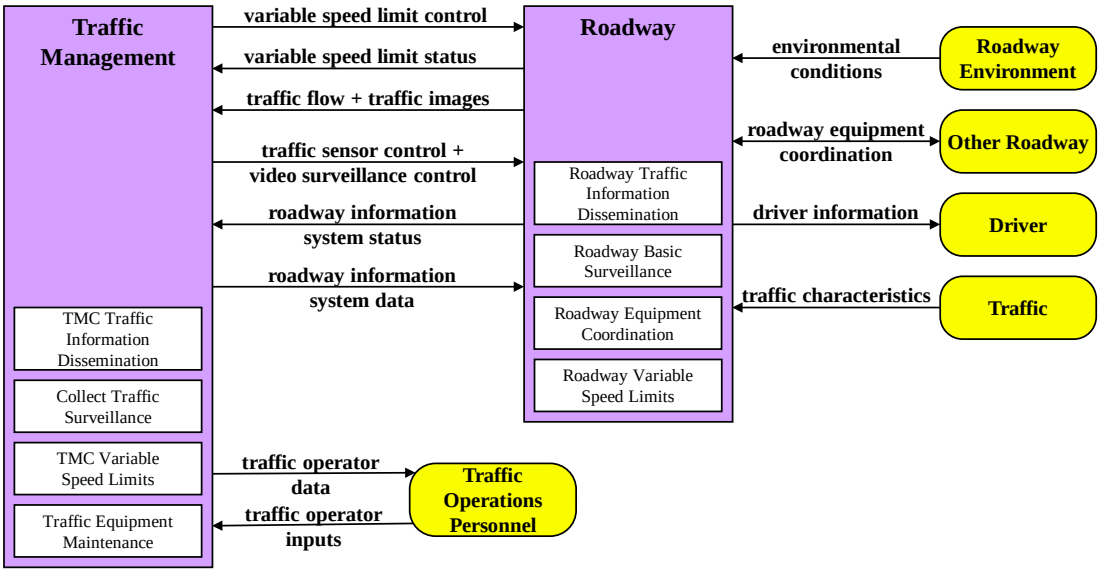
| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay per driver. |
| System Efficiency: Duration of Congestion | Reduce the daily hours of recurring congestion on major freeways from X to Y by year Z. | Hours per day at LOS F or V/C > 1.0 (or other threshold). |
| System Efficiency: Duration of Congestion | Reduce the number of hours per day that the top 20 most congested roadways experience recurring congestion by X percent by year Y. | Hours per day at LOS F or V/C > 1.0 (or other threshold). |
| System Efficiency: Extent of Congestion | Maintain the rate of growth in facility miles experiencing recurring congestion as less than the population growth rate (or employment growth rate). | Percent of lane-miles (or rail) operating at LOS F or V/C > 1.0 |
| System Efficiency: Extent of Congestion | Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period by X percent by year Y. | Percent of lane-miles (or rail) operating at LOS F or V/C > 1.0 |
| System Efficiency: Extent of Congestion | Reduce the share of major intersections operating at LOS Z by X percent by year Y. | Percent of intersections operating at LOS F or V/C > 1.0 |
| System Efficiency: Intensity of Congestion (Travel Time Index) | Reduce the regional average travel time index by X percent per year. | Travel time index (the average travel time during the peak period, using congested speeds, divided by the off-peak period travel time, using posted or free-flow speeds). |
| System Efficiency: Travel Time | Annual rate of change in regional average commute travel time will not exceed regional rate of population growth through the year Y. | Average commute trip travel time (minutes). |
| System Efficiency: Travel Time | Improve average travel time during peak periods by X percent by year Y. | Average travel time during peak periods (minutes). |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by all transient events such as traffic incidents, special events, and work zones. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by scheduled events, work zones, or system maintenance by x hours in y years. | Travel time delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by unscheduled disruptions to travel. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Planning Time Index | Reduce the average planning time for (specific routes in region) by X minutes over the next Y years. | The planning time index represents the time that must be added to travel time at free-flow speeds or the posted speed limit to ensure on time arrivals for 95 percent of the trips. Planning time = 95th percentile travel time (minutes) – Travel time at free-flow speed or posted speed limit. Average planning time index or planning time can be computed using a weighted average over person miles traveled. |
| System Reliability: Planning Time Index | Reduce the average planning time index for (specific routes in region) by X (no units) over the next Y years. | The planning time index represents the time that must be added to travel time at free-flow speeds or the posted speed limit to ensure on time arrivals for 95 percent of the trips. Planning time = 95th percentile travel time (minutes) – Travel time at free-flow speed or posted speed limit. Average planning time index or planning time can be computed using a weighted average over person miles traveled. |
| System Reliability: Travel Time 90th/95th Percentile | Reduce the 90th (or 95th) percentile travel times for each route selected by X percent over Y years. | 95th or 90th percentile travel times for selected routes. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Travel Time 90th/95th Percentile | Reduce the average of the 90th (or 95th) percentile travel times for (a group of specific travel routes or trips in the region) by X minutes in Y years. | 95th or 90th percentile travel times for selected routes. |
| System Reliability: Travel Time Buffer Index | Decrease the average buffer index for (multiple routes or trips) by X percent over Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Travel Time Buffer Index | Decrease the buffer index for (specific travel routes) by X percent over the next Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Travel Time Buffer Index | Reduce the average buffer time needed to arrive on-time for 95 percent of trips on (specified routes) by X minutes over Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Variability | Reduce the variability of travel time on specified routes by X percent during peak and off-peak periods by year Y. | Variance of travel time. Variance is the sum of the squared deviations from the mean. This can also be calculated as the standard deviation of travel time. Standard deviation is the square root of variance. |

**ATMS22 – Variable Speed Limits**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

**Dynamic Lane Management and Shoulder Use (ATMS23)**
This service package provides for active management of travel lanes along a roadway. The package includes the field equipment, physical overhead lane signs and associated control electronics that are used to manage and control specific lanes and/or the shoulders. This equipment can be used to change the lane configuration on the roadway according to traffic demand and lane destination along a typical roadway section or on approach to or access from a border crossing, multimodal crossing or intermodal freight depot. This package can be used to allow temporary or interim use of shoulders as travel lanes. The equipment can be used to electronically reconfigure intersections and interchanges and manage right-of-way dynamically including merges. Also, lanes can be designated for use by special vehicles only, such as buses, high occupancy vehicles (HOVs), vehicles attending a special event, etc. Prohibitions or restrictions of types of vehicles from using particular lanes can be implemented.

The lane management system can be centrally monitored and controlled by a traffic management center or it can be autonomous. This service also can include automated enforcement equipment that notifies the enforcement agency of violators of the lane controls.

Dynamic lane management and shoulder use is an Active Traffic Management (ATM) strategy and is typically used in conjunction with other ATM strategies (such as ATMS22-Variable Speed Limits and ATMS24-Dynamic Roadway Warning).

Table 2.2.1-67: ATMS23 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Roadway Basic Surveillance | Roadway |
| Roadway Dynamic Lane Management and Shoulder Use | Roadway |
| Roadway Equipment Coordination | Roadway |
| Collect Traffic Surveillance | Traffic Management |
| TMC Dynamic Lane Management and Shoulder Use | Traffic Management |
| Traffic Equipment Maintenance | Traffic Management |
| Vehicle Traffic Probe Support | Vehicle |

Table 2.2.1-68: ATMS23 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.1-69: ATMS23 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Freeway Management: Efficiency | Reduce the number of person hours (or vehicle hours) of delay experienced by travelers on the freeway system. | Hours of delay (vehicle-hours or person-hours). |
| Freeway Management: Efficiency | Reduce the number of person hours (or vehicle hours) of delay experienced by travelers on the freeway system. | Hours of delay per capita or driver. |
| Freeway Management: Efficiency | Reduce the share of freeway miles at Level of Service (LOS) X by Y by year Z. | Miles at LOS X or V/C > 1.0 (or other threshold). |
| Freeway Management: Managed Lanes | Ensure that all managed lanes (e.g., HOV lanes, HOT lanes) carry a throughput of at least Y persons per hour. | Passenger volumes in managed lanes. |
| Freeway Management: Managed Lanes | Ensure that all managed lanes (e.g., HOV lanes, HOT lanes) operate at no less than 50 mph during their hours of operation. | Average speeds in managed lanes. |
| Freeway Management: Managed Lanes | Ensure that all managed lanes (e.g., HOV lanes, HOT lanes) operate with a volume of at least X vehicles per hour. | Vehicle volumes in managed lanes. |
| Freeway Management: Managed Lanes | Increase the miles of managed lanes in the region from X to Y by year Z. | Miles of managed lanes. |
| Freeway Management: Managed Lanes | Provide options for reliable travel times for certain types of travel (e.g., transit, carpools, trucks, etc.) on at least X percent of the freeway network by year Y. | Share of freeway network with managed lanes (by class of traveler). |
| Freeway Management: Reliability | Reduce buffer index on the freeway system during peak and off-peak periods by X percent in Y years. | The buffer index (represents the extra time (buffer) travelers add to their average travel time when planning trips in order to arrive on-time 95 percent of the time). |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Freeway Management: Reliability | Reduce delay associated with incidents on the freeway system by X percent by year Y. | Hours of delay associated with incidents. |
| Freight Management: Intermodal Facilities | Reduce the average duration of delays per month at intermodal facilities by X percent in Y years. | Average duration of delays per month at intermodal facilities. |
| Freight Management: Intermodal Facilities | Reduce the frequency of delays per month at intermodal facilities by X percent in Y years. | Frequency of delays per month at intermodal facilities where a delay is defined as an addition of Z minutes to free flow conditions. |
| Freight Management: Travel Time Reliability | Reduce buffer index on regional freight routes during peak and off-peak periods by X percent in Y years. | Buffer Index on regional freight routes during peak and off-peak period. |
| Special Event Management: Entry/Exit Travel Times | Reduce average time to clear event's exiting queue by X percent in Y years. | Average time to clear event's exiting queue by year per event. |
| Special Event Management: Entry/Exit Travel Times | Reduce average travel time into and out of the event by X percent in Y years. | Average travel time away from selected special events to a set of locations over a year. |
| Special Event Management: Entry/Exit Travel Times | Reduce average travel time into and out of the event by X percent in Y years. | Average travel time to selected special events from a set of locations in the area over a year. |
| Special Event Management: Entry/Exit Travel Times | Reduce buffer time index for travelers to multiple similar special events by X percent in Y years. | Buffer time index for travelers to multiple similar special events. |
| Special Event Management: Entry/Exit Travel Times | Reduce non-special event VMT in the event area during events by X percent in Y years. | Non-special event VMT in the event area during events over a year. |
| System Efficiency: Cost of Congestion | Reduce the annual monetary cost of congestion per capita for the next X years. | Cost (in dollars) of congestion or delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay (person-hours). |

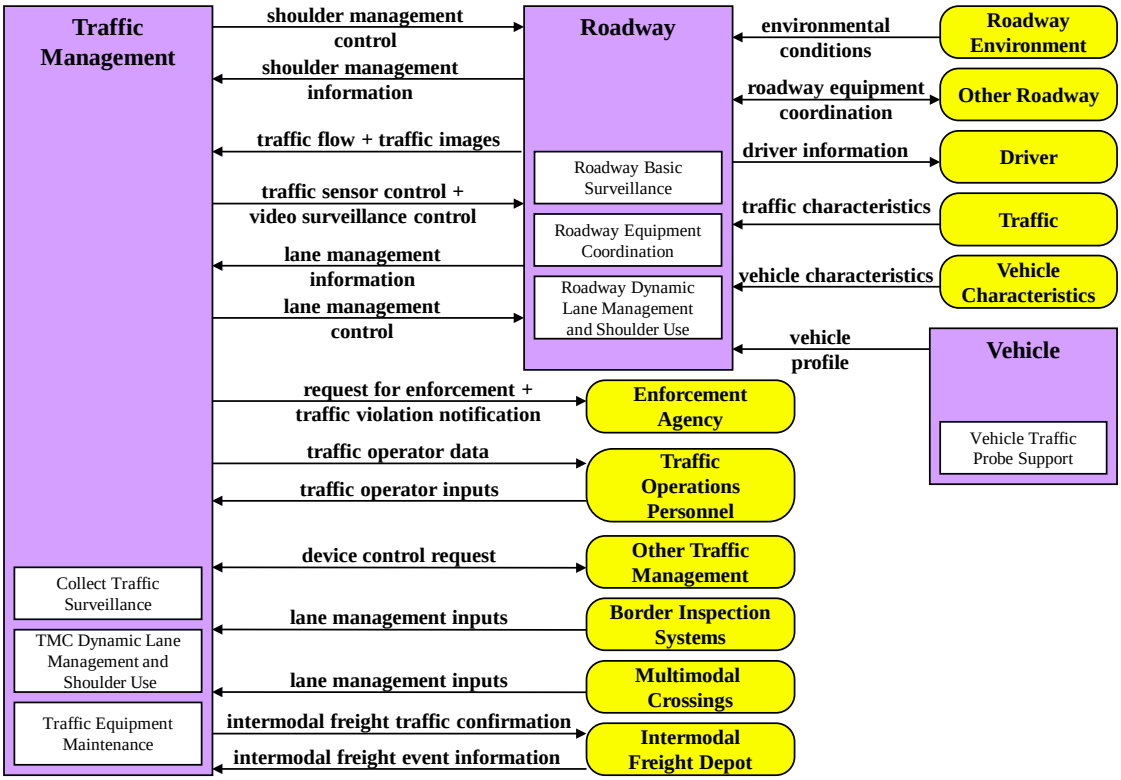
| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay per driver. |
| System Efficiency: Duration of Congestion | Reduce the daily hours of recurring congestion on major freeways from X to Y by year Z. | Hours per day at LOS F or V/C > 1.0 (or other threshold). |
| System Efficiency: Duration of Congestion | Reduce the number of hours per day that the top 20 most congested roadways experience recurring congestion by X percent by year Y. | Hours per day at LOS F or V/C > 1.0 (or other threshold). |
| System Efficiency: Extent of Congestion | Maintain the rate of growth in facility miles experiencing recurring congestion as less than the population growth rate (or employment growth rate). | Percent of lane-miles (or rail) operating at LOS F or V/C > 1.0 |
| System Efficiency: Extent of Congestion | Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period by X percent by year Y. | Percent of lane-miles (or rail) operating at LOS F or V/C > 1.0 |
| System Efficiency: Extent of Congestion | Reduce the share of major intersections operating at LOS Z by X percent by year Y. | Percent of intersections operating at LOS F or V/C > 1.0 |
| System Efficiency: Intensity of Congestion (Travel Time Index) | Reduce the regional average travel time index by X percent per year. | Travel time index (the average travel time during the peak period, using congested speeds, divided by the off-peak period travel time, using posted or free-flow speeds). |
| System Efficiency: Travel Time | Annual rate of change in regional average commute travel time will not exceed regional rate of population growth through the year Y. | Average commute trip travel time (minutes). |
| System Efficiency: Travel Time | Improve average travel time during peak periods by X percent by year Y. | Average travel time during peak periods (minutes). |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by all transient events such as traffic incidents, special events, and work zones. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by scheduled events, work zones, or system maintenance by x hours in y years. | Travel time delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by unscheduled disruptions to travel. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Planning Time Index | Reduce the average planning time for (specific routes in region) by X minutes over the next Y years. | The planning time index represents the time that must be added to travel time at free-flow speeds or the posted speed limit to ensure on time arrivals for 95 percent of the trips. Planning time = 95th percentile travel time (minutes) – Travel time at free-flow speed or posted speed limit. Average planning time index or planning time can be computed using a weighted average over person miles traveled. |
| System Reliability: Planning Time Index | Reduce the average planning time index for (specific routes in region) by X (no units) over the next Y years. | The planning time index represents the time that must be added to travel time at free-flow speeds or the posted speed limit to ensure on time arrivals for 95 percent of the trips. Planning time = 95th percentile travel time (minutes) – Travel time at free-flow speed or posted speed limit. Average planning time index or planning time can be computed using a weighted average over person miles traveled. |
| System Reliability: Travel Time 90th/95th Percentile | Reduce the 90th (or 95th) percentile travel times for each route selected by X percent over Y years. | 95th or 90th percentile travel times for selected routes. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Travel Time 90th/95th Percentile | Reduce the average of the 90th (or 95th) percentile travel times for (a group of specific travel routes or trips in the region) by X minutes in Y years. | 95th or 90th percentile travel times for selected routes. |
| System Reliability: Travel Time Buffer Index | Decrease the average buffer index for (multiple routes or trips) by X percent over Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Travel Time Buffer Index | Decrease the buffer index for (specific travel routes) by X percent over the next Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Travel Time Buffer Index | Reduce the average buffer time needed to arrive on-time for 95 percent of trips on (specified routes) by X minutes over Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Variability | Reduce the variability of travel time on specified routes by X percent during peak and off-peak periods by year Y. | Variance of travel time. Variance is the sum of the squared deviations from the mean. This can also be calculated as the standard deviation of travel time. Standard deviation is the square root of variance. |

**ATMS23 – Dynamic Lane Management and Shoulder Use**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Dynamic Roadway Warning (ATMS24)

This service package includes systems that dynamically warn drivers approaching hazards on a roadway. Such hazards include roadway weather conditions, road surface conditions, traffic conditions including queues, obstacles or animals in the roadway and any other transient event that can be sensed. These dynamic roadway warning systems can alert approaching drivers via warning signs, flashing lights, in-vehicle messages, etc. Such systems can increase the safety of a roadway by reducing the occurrence of incidents. The system can be centrally monitored and controlled by a traffic management center or it can be autonomous.

Speed warnings that consider the limitations of a given vehicle for the geometry of the roadway (e.g., rollover risk for tall vehicles) are not included in this service package but are covered by the ATMS19 – Speed Warning and Enforcement service package.

Roadway warning systems, especially queue warning systems are an Active Traffic Management (ATM) strategy and are typically used in conjunction with other ATM strategies (such as ATMS22-Variable Speed Limits and ATMS23-Dynamic Lane Management and Shoulder Use).

Table 2.2.1-70: ATMS24 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Roadway Basic Surveillance | Roadway |
| Roadway Equipment Coordination | Roadway |
| Roadway Warning | Roadway |
| Collect Traffic Surveillance | Traffic Management |
| TMC Roadway Warning | Traffic Management |
| Traffic Equipment Maintenance | Traffic Management |

Table 2.2.1-71: ATMS24 Associated Planning Factors and Goals

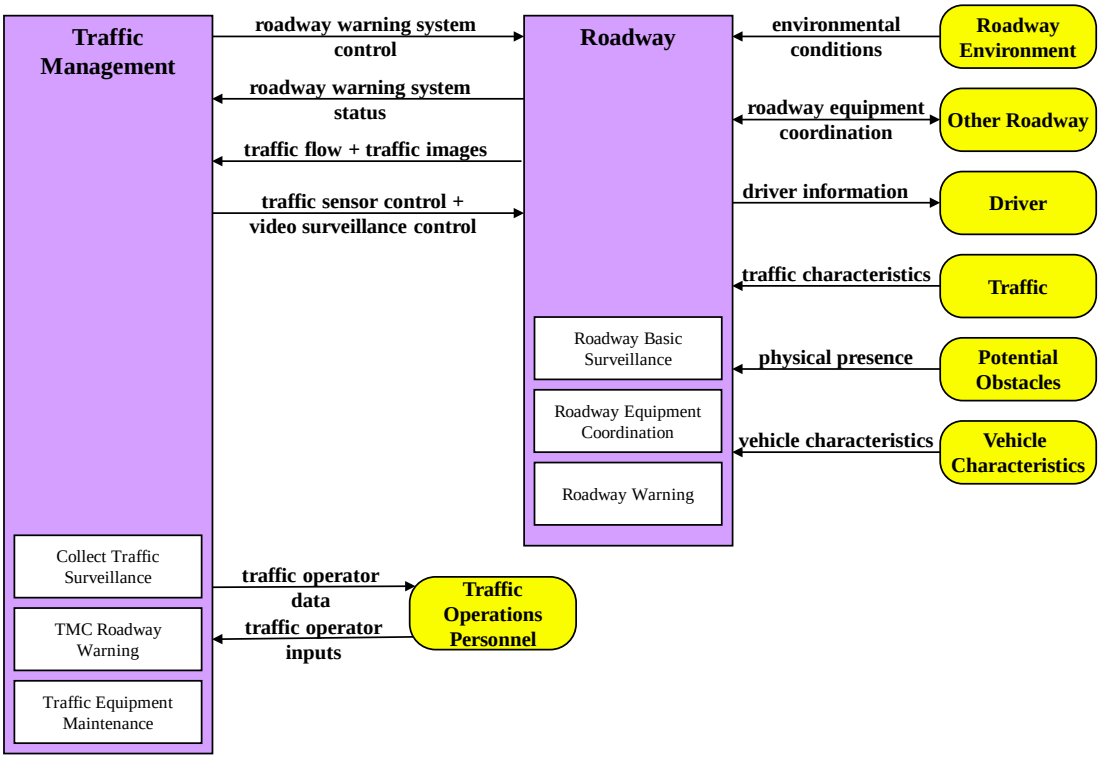
| MetroFactor | Goal |
|---|---|
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |

Table 2.2.1-72: ATMS24 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driver inattention and distraction |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driving while intoxicated |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to road weather conditions | Number of crashes and fatalities related to weather conditions |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to unexpected congestion | Number of crashes and fatalities related to unexpected congestion |
| Safety: Vehicle Crashes and Fatalities | Reduce secondary crashes | Number of secondary crashes |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes in the region by X percent by year Y. | Total crashes per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total fatalities per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total severe injuries per X VMT. |
| System Efficiency: Travel Time | Annual rate of change in regional average commute travel time will not exceed regional rate of population growth through the year Y. | Average commute trip travel time (minutes). |
| System Efficiency: Travel Time | Improve average travel time during peak periods by X percent by year Y. | Average travel time during peak periods (minutes). |

**ATMS24 – Dynamic Roadway Warning**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

**VMT Road User Payment (ATMS25)**
This service package facilitates charging fees to roadway vehicle owners for using specific roadways with potentially differential payment rates based on time-of-day, which specific roadway is used, and class of vehicle (a local policy decision by each roadway owner). Vehicle owners need only register with a single payment entity of their choice (a participating state, municipal, or regional DOT, an authority, or a private entity), and payments are reconciled by the entity receiving payment (and travel history) with all roadway owners that participate in the VMT payment scheme, which may also include the Federal government. Vehicle owners would pay nothing for distances traveled where there are no payments required (e.g. in jurisdictions that have not implemented a distance based payment or for roadway operators that collect payment using traditional tolls), although a Federal payment rate might cover some or all roadway operations (a Federal policy decision). Basic operation depends on the vehicle tracking its own location, and periodically reporting its travel history to the registered entity receiving payment using C-V communications. Roadway VMT Payment can duplicate the functions of current toll road payment schemes based on F-V communications, parking payment functions, as well as augment and/or replace federal and state gasoline taxes (which are otherwise ineffective for vehicles that don't use gasoline).

The payments per distance traveled can be structured to provide some amount of demand management by motivating vehicle owner travel choices to minimize payments. The use of this service package for demand management is a local policy decision by each roadway owner.

Alternatively, for vehicle owners that prefer a strictly odometer ("high privacy") based payment approach (that does not need to record and report specific locations and times of travel), then the payment amount may assume a payment rate corresponding to the most expensive roads at the most expensive times. Specific payment rates for this option are a local policy decision.

Odometer readings (from vehicle registration and periodic safety inspection events stored at the state DOT where the vehicle is registered) can be used as a back-office audit to detect gross vehicle equipment failures and fraud (e.g. disabling or dismounting vehicle equipment). In addition, vehicle equipment can be read by fixed or mobile roadside equipment using F-V communications for a more immediate audit of in-vehicle equipment and enforcement (for vehicle owners that have not chosen the odometer-only method of payment).

Payment can be made periodically through a normal bill/payment cycle that is part of the registration process a vehicle owner chooses, or using a vehicle mounted or entered payment instrument/information with vehicle operator or owner initiated payment points. This facilitates payment by vehicle operators (instead of owners) for various commercial operations such as rental vehicles, taxi operators.

Table 2.2.1-73: ATMS25 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| ISP Traveler Data Collection | Information Service Provider |
| Center VMT Payment Administration | Payment Administration |
| Personal Interactive Information Reception | Personal Information Access |
| Remote Interactive Information Reception | Remote Traveler Support |
| Roadway VMT Payment | Roadway Payment |
| Vehicle VMT Payment Collection | Vehicle |

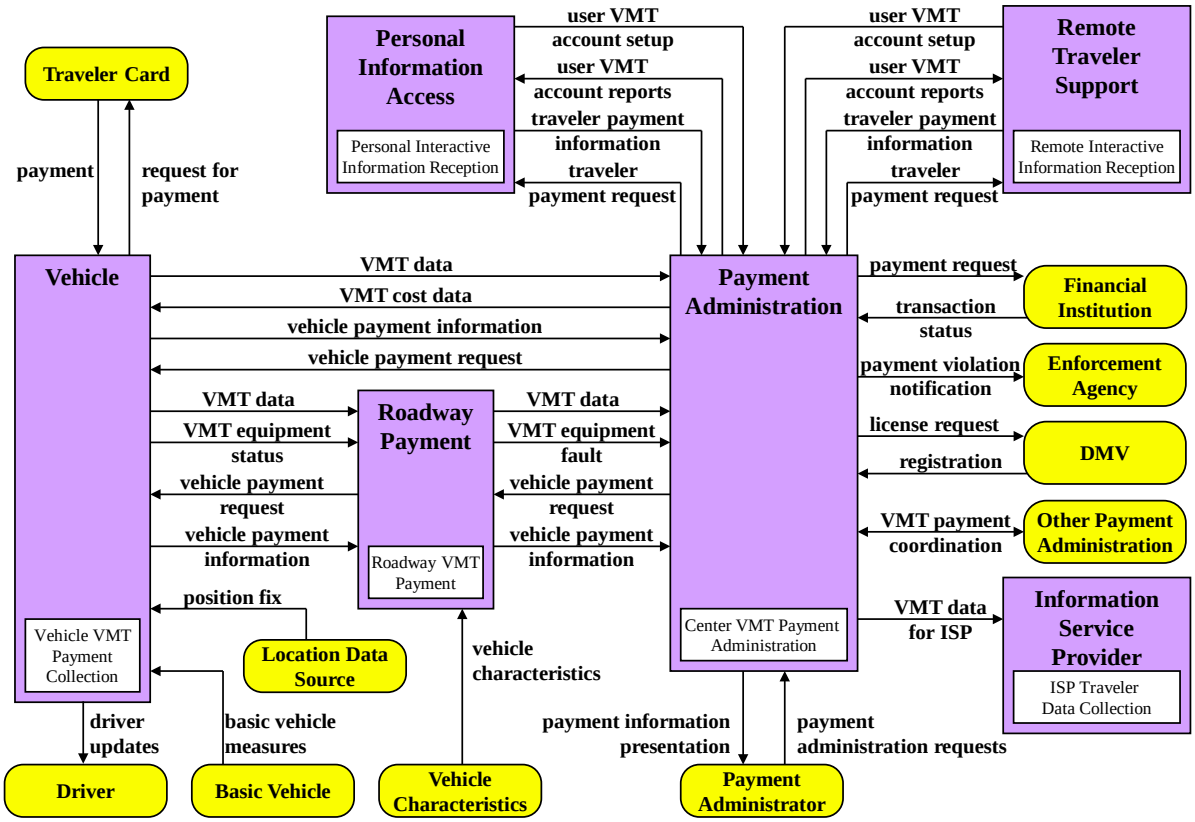
Table 2.2.1-74: ATMS25 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |

Table 2.2.1-75: ATMS25 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Freeway Management: Pricing and Tolling | Increase the share of freeways that are priced to X percent by year Y. | Lane miles that are priced. |
| Freeway Management: Pricing and Tolling | Increase the share of toll roadways and bridges that are using variable pricing (e.g., congestion pricing) to X percent by year Y. | Share of toll roads and bridges using variable pricing. |

**ATMS25 – VMT Road User Payment**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## Mixed Use Warning Systems (ATMS26)

This service package supports the sensing and warning systems used to interact with pedestrians, bicyclists, and other vehicles that operate on the main vehicle roadways, or on pathways which intersect the main vehicle roadways. These systems could allow automated warning or active protection for this class of users.

Table 2.2.1-76: ATMS26 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Roadway Mixed Use Sensing | Roadway |
| Roadway Warning | Roadway |
| TMC Roadway Warning | Traffic Management |
| TMC Signal Control | Traffic Management |

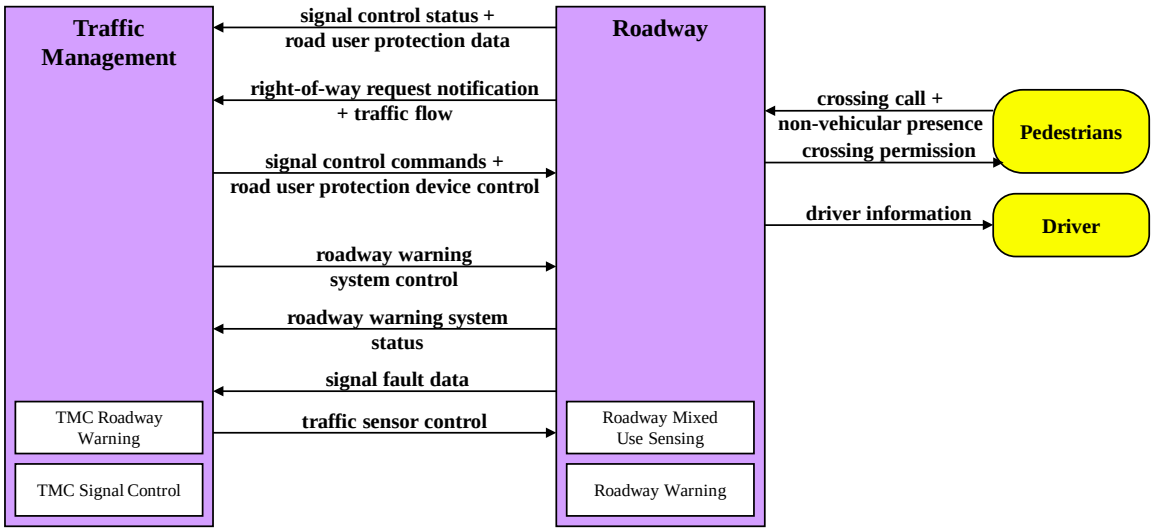
Table 2.2.1-77: ATMS26 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |

Table 2.2.1-78: ATMS26 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes in the region by X percent by year Y. | Total crashes per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes involving bicyclists and pedestrians in the region by X percent by year Y. | Total crashes involving bicycles. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes involving bicyclists and pedestrians in the region by X percent by year Y. | Total crashes involving pedestrians. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total fatalities per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total severe injuries per X VMT. |

**ATMS26 – Mixed Use Warning Systems**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## 2.2.2 Maintenance and Construction Operations Service Packages

### Maintenance and Construction Vehicle and Equipment Tracking (MC01)

This service 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.

Table 2.2.2-1: MC01 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| MCM Vehicle Tracking | Maintenance and Construction Management |
| MCV Vehicle Location Tracking | Maintenance and Construction Vehicle |

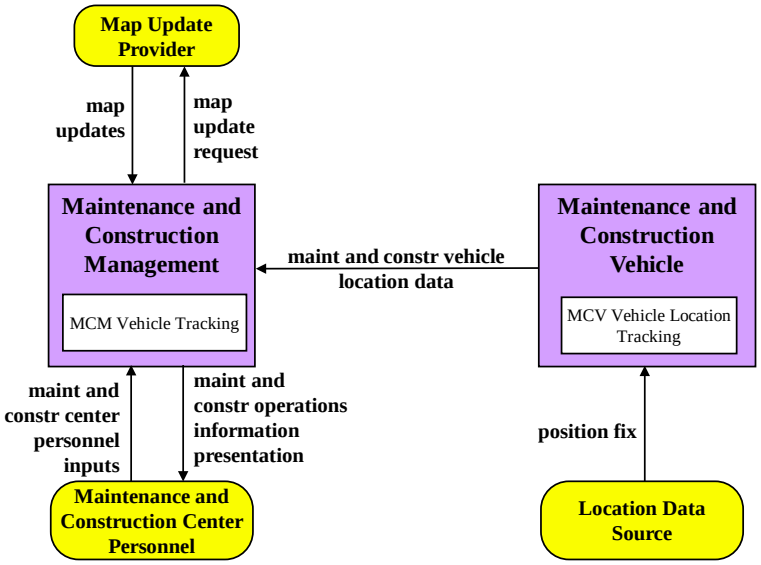
Table 2.2.2-2: MC01 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Emphasize the preservation of the existing transportation system. | Preserve the transportation system |

Table 2.2.2-3: MC01 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Preservation: Preserve Existing Infrastructure | Enhance asset and resource management | Extended pavement life due to truck weight enforcement |
| Preservation: Preserve Existing Infrastructure | Enhance asset and resource management | Number of assets tracked in real-time |
| Preservation: Preserve Existing Infrastructure | Enhance asset and resource management | Percentage of fleet/equipment within lifecycle |
| Preservation: Preserve Existing Infrastructure | Enhance asset and resource management | Percentage of geographic jurisdiction covered by agency electronic communications |
| Preservation: Preserve Existing Infrastructure | Enhance asset and resource management | Percentage of maintenance activities completed in required time-frame |
| Preservation: Preserve Existing Infrastructure | Enhance asset and resource management | Rate at which equipment is utilized |
| Preservation: Preserve Existing Infrastructure | Enhance asset and resource management | Vehicle operating costs |

**MC01 - Maintenance and Construction Vehicle and Equipment Tracking**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Maintenance and Construction Vehicle Maintenance (MC02)

This service package performs vehicle maintenance scheduling and manages 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, and the systems that collect this diagnostic information and use it to schedule and manage vehicle maintenance.

Table 2.2.2-4: MC02 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| MCM Vehicle and Equipment Maintenance Management | Maintenance and Construction Management |
| MCV Vehicle System Monitoring and Diagnostics | Maintenance and Construction Vehicle |
| Vehicle Safety Monitoring System | Vehicle |

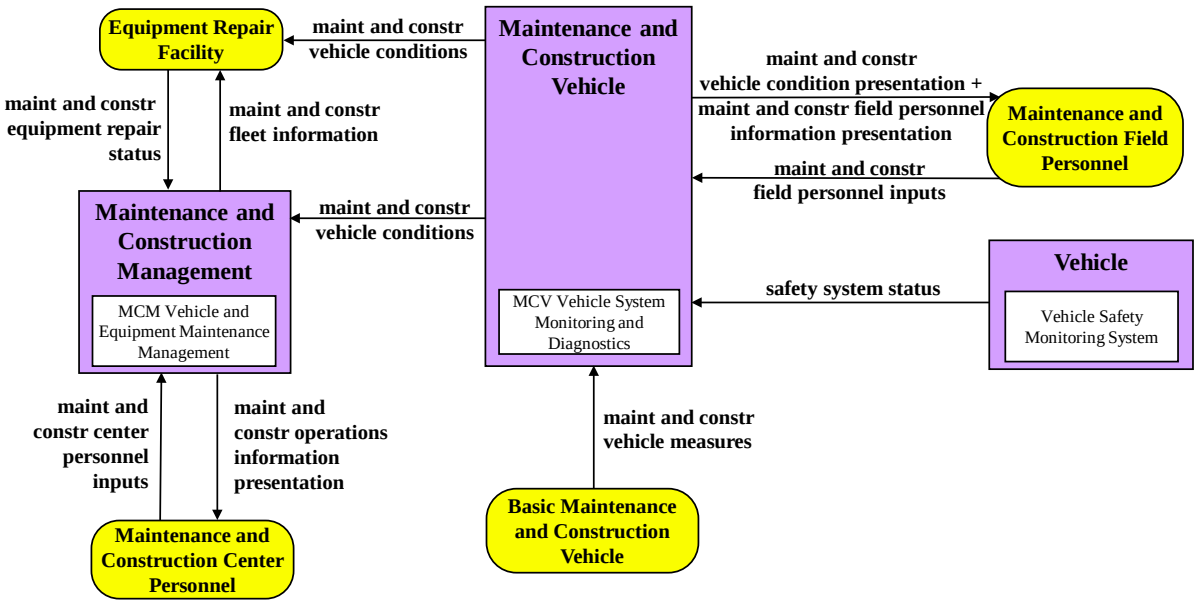
Table 2.2.2-5: MC02 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Emphasize the preservation of the existing transportation system. | Preserve the transportation system |

Table 2.2.2-6: MC02 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Preservation: Preserve Existing Infrastructure | Enhance asset and resource management | Extended pavement life due to truck weight enforcement |
| Preservation: Preserve Existing Infrastructure | Enhance asset and resource management | Number of assets tracked in real-time |
| Preservation: Preserve Existing Infrastructure | Enhance asset and resource management | Percentage of fleet/equipment within lifecycle |
| Preservation: Preserve Existing Infrastructure | Enhance asset and resource management | Percentage of geographic jurisdiction covered by agency electronic communications |
| Preservation: Preserve Existing Infrastructure | Enhance asset and resource management | Percentage of maintenance activities completed in required time-frame |
| Preservation: Preserve Existing Infrastructure | Enhance asset and resource management | Rate at which equipment is utilized |
| Preservation: Preserve Existing Infrastructure | Enhance asset and resource management | Vehicle operating costs |

**MC02 - Maintenance and Construction Vehicle Maintenance**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Road Weather Data Collection (MC03)

This service 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. The collected environmental data is used by the Weather Information Processing and Distribution service package to process the information and make decisions on operations. The collected environmental data may be aggregated, combined with data attributes and sent to meteorological systems for data qualification and further data consolidation. The service package may also request and receive qualified data sets from meteorological systems.

Table 2.2.2-7: MC03 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| MCM Environmental Information Collection | Maintenance and Construction Management |
| MCV Environmental Monitoring | Maintenance and Construction Vehicle |
| Roadway Environmental Monitoring | Roadway |
| TMC Environmental Monitoring | Traffic Management |

Table 2.2.2-8: MC03 Associated Planning Factors and Goals

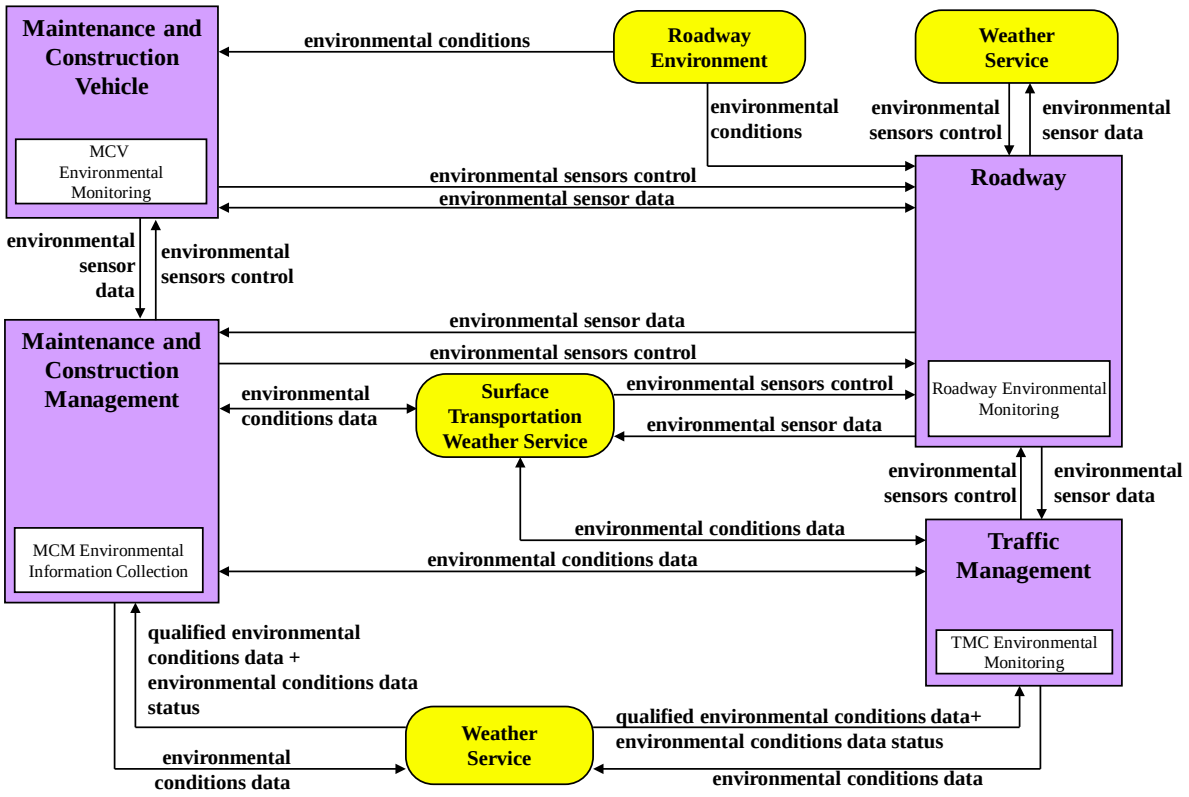
| MetroFactor | Goal |
|---|---|
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |

Table 2.2.2-9: MC03 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Travel Weather Management: Disseminating Information | Reduce time to alert travelers of travel weather impacts (using variable message signs, 511, road weather information systems, public information broadcasts, the agency's website, Web 2.0 technologies, etc.) by X (time period or percent) in Y years. | Time from beginning of weather event to posting of traveler information on (variable message signs, 511, Road Weather Information Systems, public information broadcasts etc.). |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Travel Weather Management: Disseminating Information | Reduce time to alert travelers of travel weather impacts (using variable message signs, 511, road weather information systems, public information broadcasts, the agency's website, Web 2.0 technologies, etc.) by X (time period or percent) in Y years. | Time from beginning of weather event to posting of traveler information on agency website. |
| Travel Weather Management: Road Weather Information System Coverage | Increase the percent of major road network (or transit network or regional bicycle network) covered by weather sensors or a road weather information system (RWIS) by X percent in Y years as defined by an RWIS station within Z miles. | Percent of major road (transit or bicycle) network within Z miles of an RWIS station. |

**MC03 – Road Weather Data Collection**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Weather Information Processing and Distribution (MC04)

This service package processes and distributes the environmental information collected from the Road Weather Data Collection service package. This service 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, issue location specific warnings to drivers using the Traffic Information Dissemination service package, and aid operators in scheduling work activity.

Table 2.2.2-10: MC04 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Emergency Environmental Monitoring | Emergency Management |
| ISP Traveler Data Collection | Information Service Provider |
| MCM Environmental Information Processing | Maintenance and Construction Management |
| TMC Environmental Monitoring | Traffic Management |
| Transit Environmental Monitoring | Transit Management |

Table 2.2.2-11: MC04 Associated Planning Factors and Goals

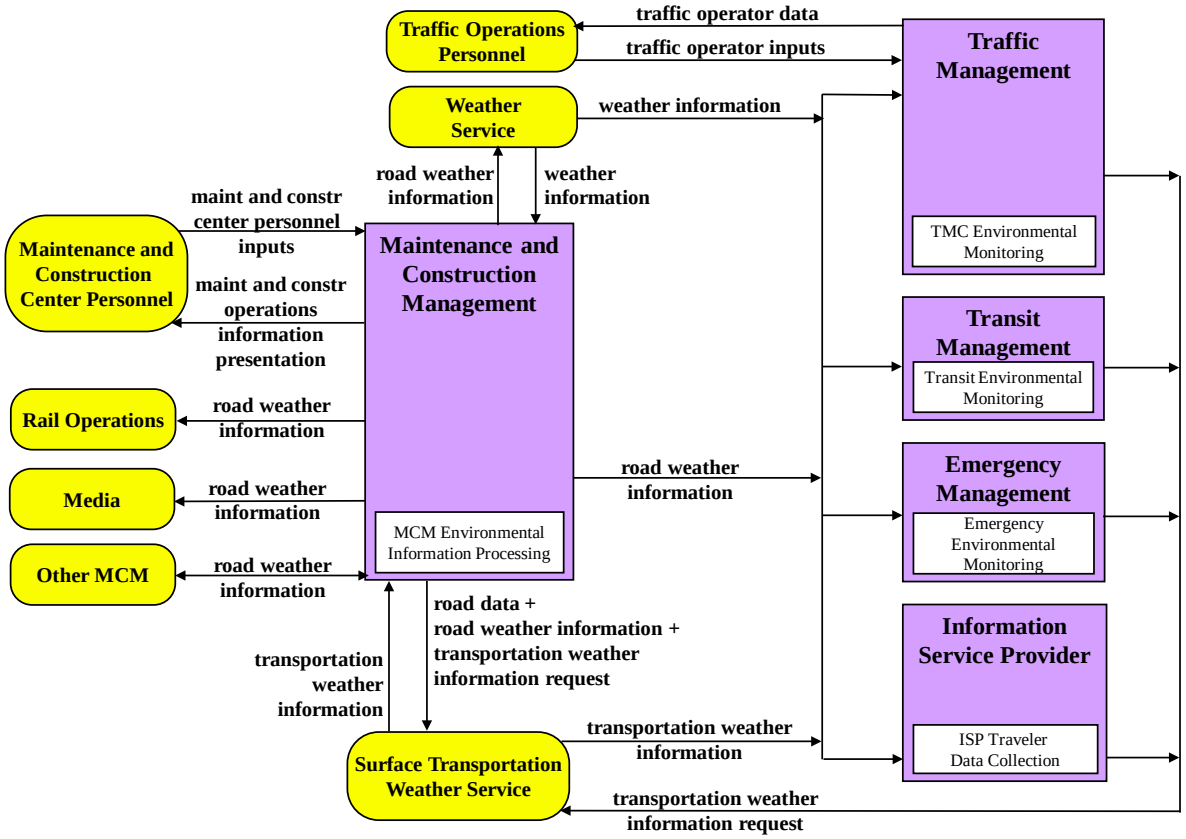
| MetroFactor | Goal |
|---|---|
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.2-12: MC04 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Freight Management: Detours and Routing | Provide freight operators with traveler alerts and alternate routes in the case of incidents, special events, weather, construction, and severe congestion at choke points on X percent of freight-significant routes by year Y. | Percent of freight-significant routes where traveler alerts and alternate route information is provided in the case of incidents, special events, weather, construction, and severe congestion at choke points. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Travel Weather Management: Detours for Impacted Roadways | Increase by X percent of significant travel routes covered by weather-related diversion plans by year Y. | Percent of significant travel routes covered by weather-related diversion plans. |
| Travel Weather Management: Detours for Impacted Roadways | Increase the percent of agencies that have adopted multi-agency weather-related transportation operations plans and that are involved in transportation operations during weather events to X percent by year Y. | Percent of agencies involved in transportation operations during weather events that have adopted multi-agency, weather-related transportation operations plans. |
| Travel Weather Management: Disseminating Information | Reduce time to alert travelers of travel weather impacts (using variable message signs, 511, road weather information systems, public information broadcasts, the agency's website, Web 2.0 technologies, etc.) by X (time period or percent) in Y years. | Time from beginning of weather event to posting of traveler information on (variable message signs, 511, Road Weather Information Systems, public information broadcasts etc.). |
| Travel Weather Management: Disseminating Information | Reduce time to alert travelers of travel weather impacts (using variable message signs, 511, road weather information systems, public information broadcasts, the agency's website, Web 2.0 technologies, etc.) by X (time period or percent) in Y years. | Time from beginning of weather event to posting of traveler information on agency website. |
| Travel Weather Management: Road Weather Information System Coverage | Increase the percent of major road network (or transit network or regional bicycle network) covered by weather sensors or a road weather information system (RWIS) by X percent in Y years as defined by an RWIS station within Z miles. | Percent of major road (transit or bicycle) network within Z miles of an RWIS station. |

**MC04 - Weather Information Processing and Distribution**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## Roadway Automated Treatment (MC05)

This service package automatically treats a roadway section based on environmental or atmospheric conditions. Treatments include fog dispersion, anti-icing chemicals, etc. The service 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.

Table 2.2.2-13: MC05 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| MCM Automated Treatment System Control | Maintenance and Construction Management |
| Roadway Automated Treatment | Roadway |
| Roadway Equipment Coordination | Roadway |
| Roadway Traffic Information Dissemination | Roadway |

Table 2.2.2-14: MC05 Associated Planning Factors and Goals

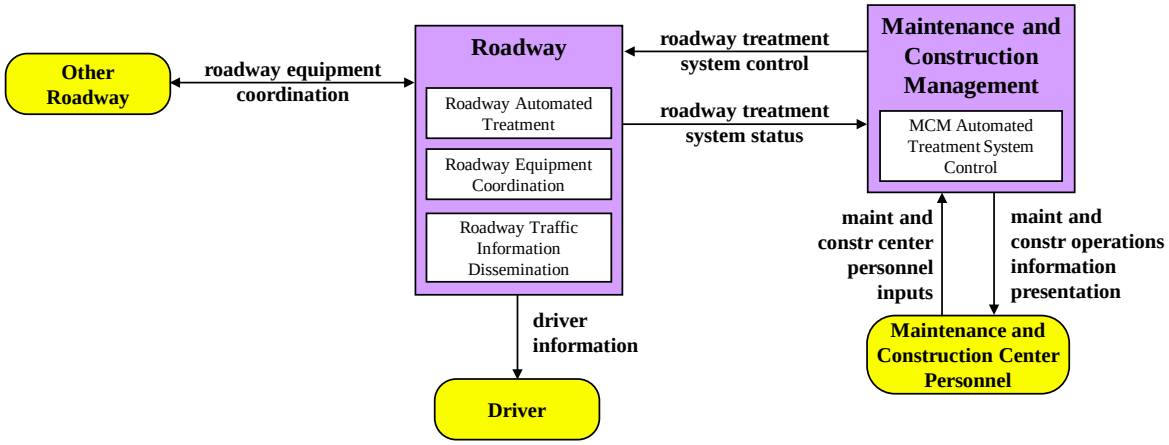
| MetroFactor | Goal |
|---|---|
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.2-15: MC05 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driver inattention and distraction |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driving while intoxicated |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to road weather conditions | Number of crashes and fatalities related to weather conditions |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to unsafe drivers, vehicles and cargo on the transportation system | Number of crashes and fatalities due to commercial vehicle safety violations |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce lane departure crashes | Number of crashes and fatalities related to inappropriate lane departure, crossing or merging |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes in the region by X percent by year Y. | Total crashes per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total fatalities per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total severe injuries per X VMT. |
| Travel Weather Management: Clearance Time (Weather-Related Debris) | Reduce average time to complete clearing (interstates, freeways, expressways, all roads, main tracks, and main sidewalks) of weather-related debris after weather impact by X percent in Y years. | Average time to clear selected surface transportation facilities of weather-related debris after weather impact. |
| Travel Weather Management: Clearance Time (Weather-Related Debris) | Reduce average time to complete clearing (mode, hierarchy of facilities, or subarea of region) of weather-related debris after weather impact by X percent in Y years. | Average time to clear selected surface transportation facilities of weather-related debris after weather impact. |

**MC05 - Roadway Automated Treatment**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Winter Maintenance (MC06)

This service package supports winter road maintenance including snow plow operations, roadway treatments (e.g., salt spraying and other anti-icing material applications), and other snow and ice control activities. This package monitors environmental conditions and weather forecasts and uses the information to schedule winter maintenance activities, determine the appropriate snow and ice control response, and track and manage response operations.

Table 2.2.2-16: MC06 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| MCM Maintenance Decision Support | Maintenance and Construction Management |
| MCM Winter Maintenance Management | Maintenance and Construction Management |
| MCV Winter Maintenance | Maintenance and Construction Vehicle |
| TMC Incident Dispatch Coordination/Communication | Traffic Management |

Table 2.2.2-17: MC06 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

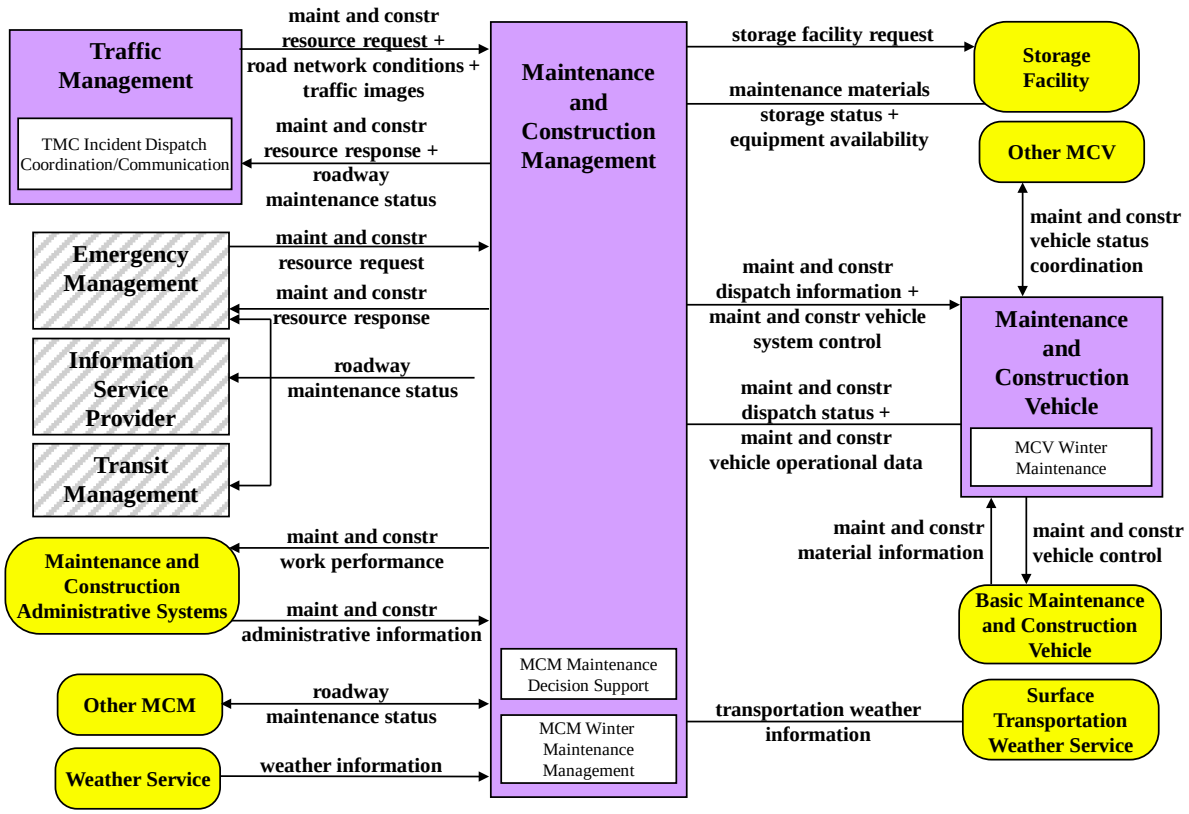
Table 2.2.2-18: MC06 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Freight Management: Travel Time Reliability | Reduce buffer index on regional freight routes during peak and off-peak periods by X percent in Y years. | Buffer Index on regional freight routes during peak and off-peak period. |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay (person-hours). |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay per driver. |
| System Reliability: Planning Time Index | Reduce the average planning time for (specific routes in region) by X minutes over the next Y years. | The planning time index represents the time that must be added to travel time at free-flow speeds or the posted speed limit to ensure on time arrivals for 95 percent of the trips. Planning time = 95th percentile travel time (minutes) – Travel time at free-flow speed or posted speed limit. Average planning time index or planning time can be computed using a weighted average over person miles traveled. |
| System Reliability: Planning Time Index | Reduce the average planning time index for (specific routes in region) by X (no units) over the next Y years. | The planning time index represents the time that must be added to travel time at free-flow speeds or the posted speed limit to ensure on time arrivals for 95 percent of the trips. Planning time = 95th percentile travel time (minutes) – Travel time at free-flow speed or posted speed limit. Average planning time index or planning time can be computed using a weighted average over person miles traveled. |
| System Reliability: Travel Time 90th/95th Percentile | Reduce the 90th (or 95th) percentile travel times for each route selected by X percent over Y years. | 95th or 90th percentile travel times for selected routes. |
| System Reliability: Travel Time 90th/95th Percentile | Reduce the average of the 90th (or 95th) percentile travel times for (a group of specific travel routes or trips in the region) by X minutes in Y years. | 95th or 90th percentile travel times for selected routes. |
| System Reliability: Travel Time Buffer Index | Decrease the average buffer index for (multiple routes or trips) by X percent over Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Travel Time Buffer Index | Decrease the buffer index for (specific travel routes) by X percent over the next Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Travel Time Buffer Index | Reduce the average buffer time needed to arrive on-time for 95 percent of trips on (specified routes) by X minutes over Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Variability | Reduce the variability of travel time on specified routes by X percent during peak and off-peak periods by year Y. | Variance of travel time. Variance is the sum of the squared deviations from the mean. This can also be calculated as the standard deviation of travel time. Standard deviation is the square root of variance. |
| Travel Weather Management: Clearance Time (Weather-Related Debris) | Reduce average time to complete clearing (interstates, freeways, expressways, all roads, main tracks, and main sidewalks) of weather-related debris after weather impact by X percent in Y years. | Average time to clear selected surface transportation facilities of weather-related debris after weather impact. |
| Travel Weather Management: Clearance Time (Weather-Related Debris) | Reduce average time to complete clearing (mode, hierarchy of facilities, or subarea of region) of weather-related debris after weather impact by X percent in Y years. | Average time to clear selected surface transportation facilities of weather-related debris after weather impact. |

**MC06 - Winter Maintenance**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Roadway Maintenance and Construction (MC07)

This service 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.

Table 2.2.2-19: MC07 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| MCM Maintenance Decision Support | Maintenance and Construction Management |
| MCM Roadway Maintenance and Construction | Maintenance and Construction Management |
| MCV Roadway Maintenance and Construction | Maintenance and Construction Vehicle |
| Roadway Field Device Monitoring | Roadway |
| Traffic Equipment Maintenance | Traffic Management |

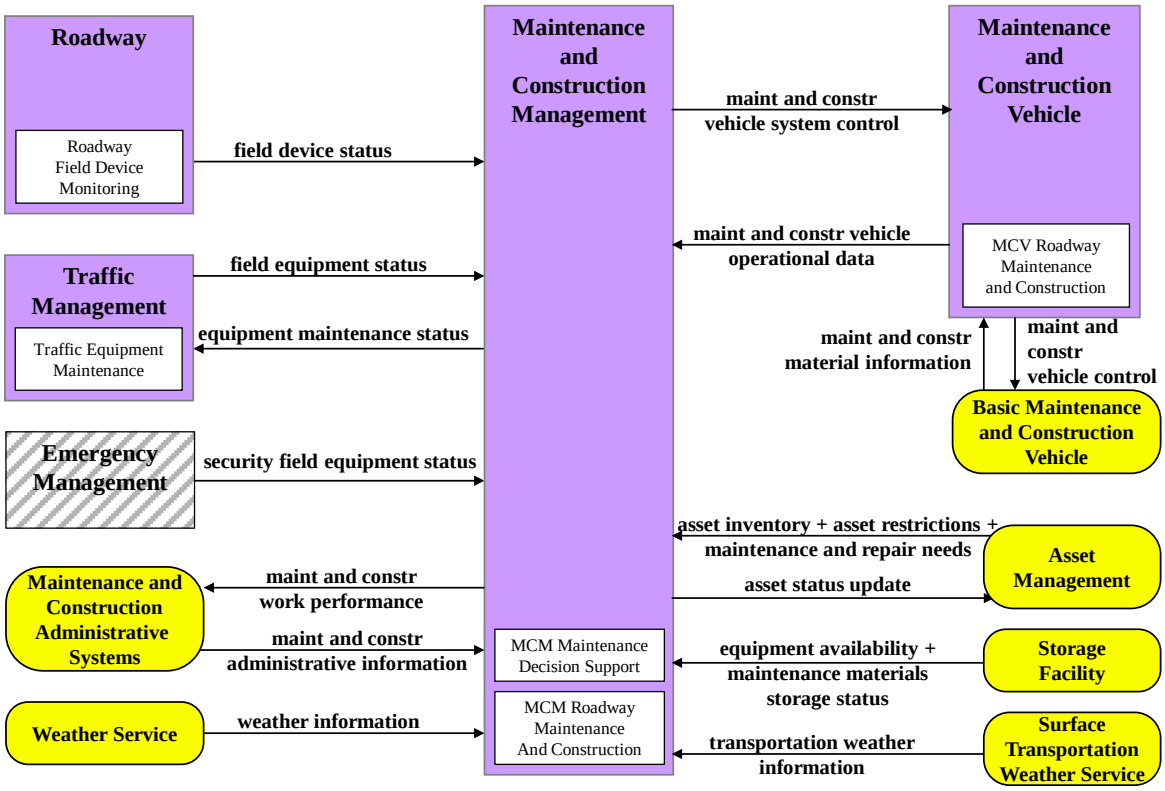
Table 2.2.2-20: MC07 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |

Table 2.2.2-21: MC07 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Work Zone Management: Travel Time Delay | Increase the percentage of construction projects that employ night/ off-peak work zones by X percent in Y years. | Percent of construction project employing night /off-peak work zones. |
| Work Zone Management: Travel Time Delay | Increase the rate of on-time completion of construction projects to X percent within Y years. | Percent of construction projects completed on-time according to established schedule. |
| Work Zone Management: Travel Time Delay | Reduce the person hours (or vehicle hours) of total delay associated with work zones by X percent over Y years. | Person hours (or vehicle hours) of delay associated with work zones. |

**MC07 – Roadway Maintenance and Construction**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Work Zone Management (MC08)

This service package manages work zones, controlling traffic in areas of the roadway where maintenance, construction, and utility work activities are underway. Traffic conditions are monitored using CCTV cameras and controlled using dynamic message signs (DMS), Highway Advisory Radio (HAR), gates and barriers. Work zone information is coordinated with other groups (e.g., ISP, traffic management, other maintenance and construction centers). Work zone speeds and delays are provided to the motorist prior to the work zones. This service package provides control of field equipment in all maintenance and construction areas, including fixed, portable, and truck-mounted devices supporting both stationary and mobile work zones.

Table 2.2.2-22: MC08 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| MCM Work Zone Management | Maintenance and Construction Management |
| MCV Barrier System Control | Maintenance and Construction Vehicle |
| MCV Work Zone Support | Maintenance and Construction Vehicle |
| Roadway Work Zone Traffic Control | Roadway |
| TMC Work Zone Traffic Management | Traffic Management |

Table 2.2.2-23: MC08 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns; | Reduce environmental impacts |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.2-24: MC08 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Arterial Management: Reliability | Reduce buffer index on arterials during peak and off-peak periods by X percent in Y years. | The buffer index (represents the extra time (buffer) travelers add to their average travel time when planning trips in order to arrive on-time 95 percent of the time). |
| Freeway Management: Reliability | Reduce buffer index on the freeway system during peak and off-peak periods by X percent in Y years. | The buffer index (represents the extra time (buffer) travelers add to their average travel time when planning trips in order to arrive on-time 95 percent of the time). |
| Freight Management: Travel Time Reliability | Reduce buffer index on regional freight routes during peak and off-peak periods by X percent in Y years. | Buffer Index on regional freight routes during peak and off-peak period. |
| System Efficiency: Cost of Congestion | Reduce the annual monetary cost of congestion per capita for the next X years. | Cost (in dollars) of congestion or delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay per driver. |
| System Efficiency: Duration of Congestion | Reduce the daily hours of recurring congestion on major freeways from X to Y by year Z. | Hours per day at LOS F or V/C > 1.0 (or other threshold). |
| System Efficiency: Duration of Congestion | Reduce the number of hours per day that the top 20 most congested roadways experience recurring congestion by X percent by year Y. | Hours per day at LOS F or V/C > 1.0 (or other threshold). |
| System Efficiency: Energy Consumption | Reduce excess fuel consumed due to congestion by X percent by year Y. | Excess fuel consumed (total or per capita). |
| System Efficiency: Energy Consumption | Reduce total energy consumption per capita for transportation by X percent by year Y. | Total energy consumed per capita for transportation. |
| System Efficiency: Energy Consumption | Reduce total fuel consumption per capita for transportation by X percent by year Y. | Total fuel consumed per capita for transportation. |

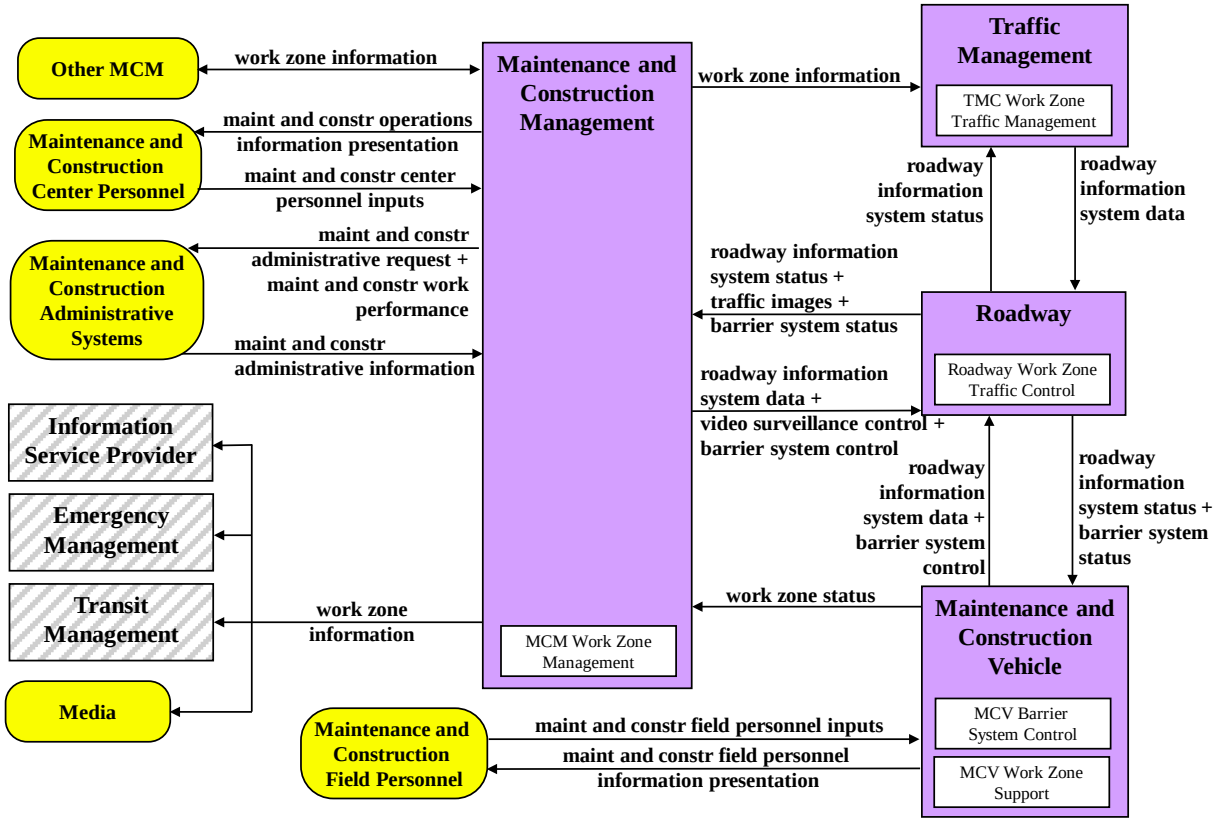
| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Extent of Congestion | Maintain the rate of growth in facility miles experiencing recurring congestion as less than the population growth rate (or employment growth rate). | Percent of lane-miles (or rail) operating at LOS F or V/C > 1.0 |
| System Efficiency: Extent of Congestion | Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period by X percent by year Y. | Percent of lane-miles (or rail) operating at LOS F or V/C > 1.0 |
| System Efficiency: Extent of Congestion | Reduce the share of major intersections operating at LOS Z by X percent by year Y. | Percent of intersections operating at LOS F or V/C > 1.0 |
| System Efficiency: Intensity of Congestion (Travel Time Index) | Reduce the regional average travel time index by X percent per year. | Travel time index (the average travel time during the peak period, using congested speeds, divided by the off-peak period travel time, using posted or free-flow speeds). |
| System Efficiency: Travel Time | Annual rate of change in regional average commute travel time will not exceed regional rate of population growth through the year Y. | Average commute trip travel time (minutes). |
| System Efficiency: Travel Time | Improve average travel time during peak periods by X percent by year Y. | Average travel time during peak periods (minutes). |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by all transient events such as traffic incidents, special events, and work zones. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by scheduled events, work zones, or system maintenance by x hours in y years. | Travel time delay during scheduled and/or unscheduled disruptions to travel. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by unscheduled disruptions to travel. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Planning Time Index | Reduce the average planning time for (specific routes in region) by X minutes over the next Y years. | The planning time index represents the time that must be added to travel time at free-flow speeds or the posted speed limit to ensure on time arrivals for 95 percent of the trips. Planning time = 95th percentile travel time (minutes) – Travel time at free-flow speed or posted speed limit. Average planning time index or planning time can be computed using a weighted average over person miles traveled. |
| System Reliability: Planning Time Index | Reduce the average planning time index for (specific routes in region) by X (no units) over the next Y years. | The planning time index represents the time that must be added to travel time at free-flow speeds or the posted speed limit to ensure on time arrivals for 95 percent of the trips. Planning time = 95th percentile travel time (minutes) – Travel time at free-flow speed or posted speed limit. Average planning time index or planning time can be computed using a weighted average over person miles traveled. |
| System Reliability: Travel Time 90th/95th Percentile | Reduce the 90th (or 95th) percentile travel times for each route selected by X percent over Y years. | 95th or 90th percentile travel times for selected routes. |
| System Reliability: Travel Time 90th/95th Percentile | Reduce the average of the 90th (or 95th) percentile travel times for (a group of specific travel routes or trips in the region) by X minutes in Y years. | 95th or 90th percentile travel times for selected routes. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Travel Time Buffer Index | Decrease the average buffer index for (multiple routes or trips) by X percent over Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Travel Time Buffer Index | Decrease the buffer index for (specific travel routes) by X percent over the next Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Travel Time Buffer Index | Reduce the average buffer time needed to arrive on-time for 95 percent of trips on (specified routes) by X minutes over Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Variability | Reduce the variability of travel time on specified routes by X percent during peak and off-peak periods by year Y. | Variance of travel time. Variance is the sum of the squared deviations from the mean. This can also be calculated as the standard deviation of travel time. Standard deviation is the square root of variance. |
| Work Zone Management: Customer Satisfaction | Increase customer satisfaction with region's work zone management by X percent over Y years. | Percentage of customers satisfied with region's work zone management practices. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Work Zone Management: Extent of Congestion | Reduce the average and maximum length of queues, when present, by X percent over Y years. | Length of average and maximum queues in work zones. |
| Work Zone Management: Extent of Congestion | Reduce the average time duration (in minutes) of queue length greater than some threshold (e.g., 0.5 mile) by X percent in Y years. | Average duration in minutes of queue length greater than X miles. |
| Work Zone Management: Extent of Congestion | Reduce the percentage of vehicles traveling through work zones that are queued by X percent in Y years. | Percentage of vehicles experiencing queuing in work zones. |
| Work Zone Management: Travel Time Delay | Increase the percentage of construction projects that employ night/ off-peak work zones by X percent in Y years. | Percent of construction project employing night /off-peak work zones. |
| Work Zone Management: Travel Time Delay | Increase the rate of on-time completion of construction projects to X percent within Y years. | Percent of construction projects completed on-time according to established schedule. |
| Work Zone Management: Travel Time Delay | Reduce the person hours (or vehicle hours) of total delay associated with work zones by X percent over Y years. | Person hours (or vehicle hours) of delay associated with work zones. |
| Work Zone Management: Travel Time Reliability | Reduce vehicle-hours of total delay in work zones caused by incidents (e.g., traffic crashes within or near the work zone). | Vehicle-hours of delay due to incidents related to work zones. |

**MC08 - Work Zone Management**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Work Zone Safety Monitoring (MC09)

This service package includes systems that improve work crew safety and reduce collisions between the motoring public and maintenance and construction vehicles. This service 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 service package supports both stationary and mobile work zones. The intrusion detection and alarm systems may be collocated or distributed, allowing systems that detect safety issues far upstream from a work zone (e.g., detection of over dimension vehicles before they enter the work zone).

Table 2.2.2-25: MC09 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| MCM Work Zone Safety Management | Maintenance and Construction Management |
| MCV Vehicle Safety Monitoring | Maintenance and Construction Vehicle |
| Roadway Equipment Coordination | Roadway |
| Roadway Work Zone Safety | Roadway |

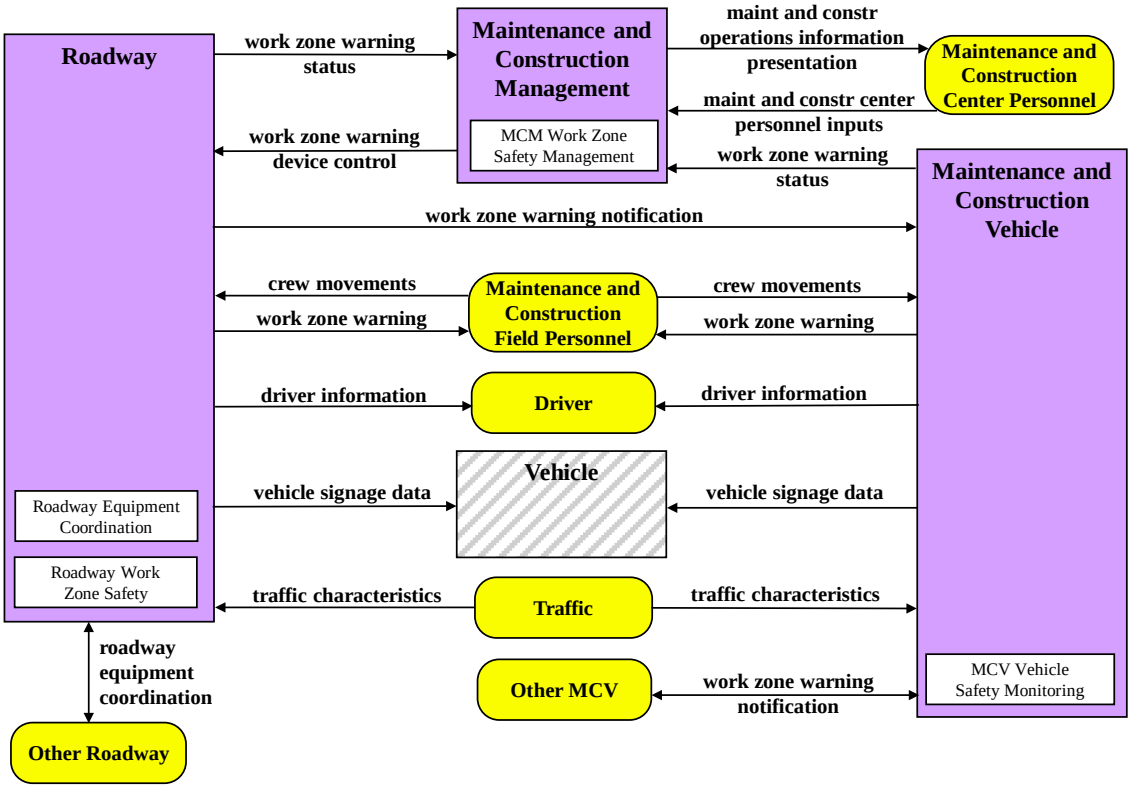
Table 2.2.2-26: MC09 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |

Table 2.2.2-27: MC09 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Worker Safety | Enhance safety of workers | Number of crashes and fatalities in work zones |
| Safety: Worker Safety | Enhance safety of workers | Number of workers injured by vehicles in work zones |
| Safety: Worker Safety | Safeguard public safety personnel while they are at roadway incidents and emergencies | Number of public safety personnel struck by vehicle at incident/emergency site |
| Safety: Worker Safety | Safeguard public safety personnel while they are at roadway incidents and emergencies | Number of public safety vehicles struck at incident/emergency site |
| Work Zone Management: Travel Time Reliability | Reduce vehicle-hours of total delay in work zones caused by incidents (e.g., traffic crashes within or near the work zone). | Vehicle-hours of delay due to incidents related to work zones. |

**MC09 - Work Zone Safety Monitoring**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## Maintenance and Construction Activity Coordination (MC10)

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

Table 2.2.2-28: MC10 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Emergency Response Management | Emergency Management |
| MCM Work Activity Coordination | Maintenance and Construction Management |
| TMC Work Zone Traffic Management | Traffic Management |
| Transit Center Multi-Modal Coordination | Transit Management |

Table 2.2.2-29: MC10 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns; | Reduce environmental impacts |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.2-30: MC10 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Arterial Management: Reliability | Reduce buffer index on arterials during peak and off-peak periods by X percent in Y years. | The buffer index (represents the extra time (buffer) travelers add to their average travel time when planning trips in order to arrive on-time 95 percent of the time). |
| Freeway Management: Reliability | Reduce buffer index on the freeway system during peak and off-peak periods by X percent in Y years. | The buffer index (represents the extra time (buffer) travelers add to their average travel time when planning trips in order to arrive on-time 95 percent of the time). |
| Freight Management: Travel Time Reliability | Reduce buffer index on regional freight routes during peak and off-peak periods by X percent in Y years. | Buffer Index on regional freight routes during peak and off-peak period. |

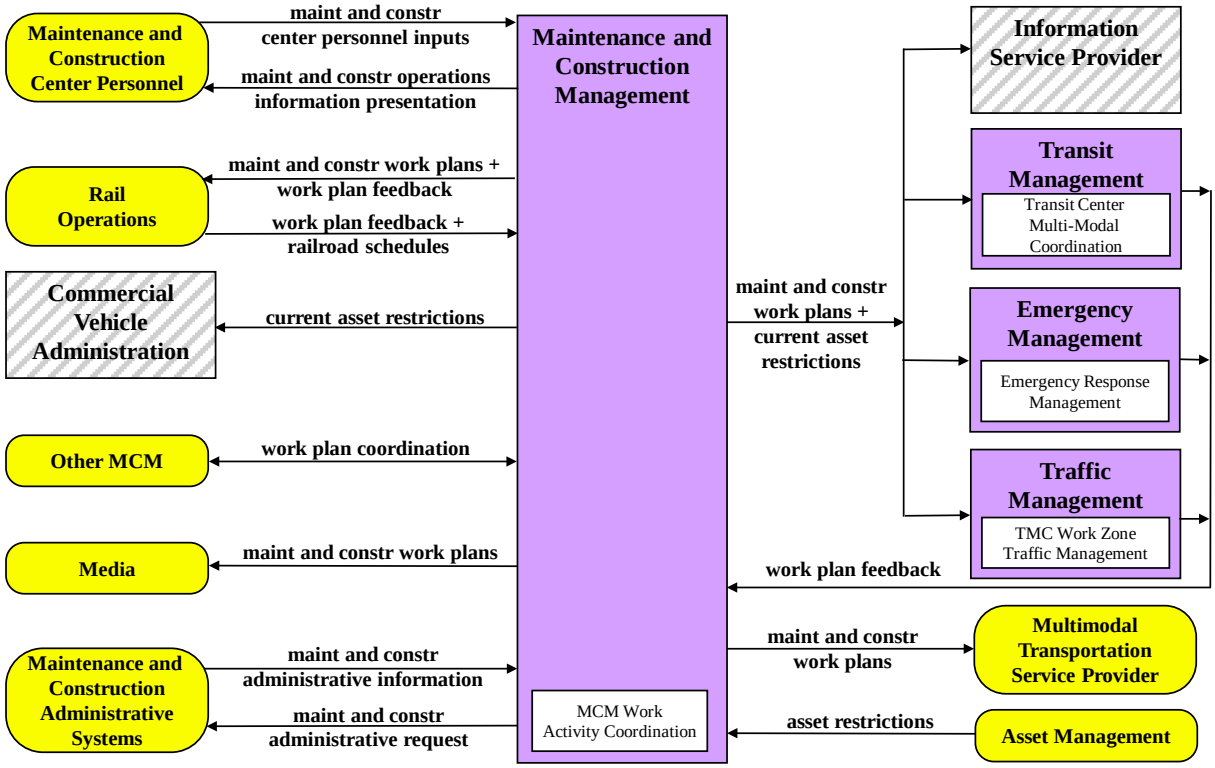
| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Cost of Congestion | Reduce the annual monetary cost of congestion per capita for the next X years. | Cost (in dollars) of congestion or delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay per driver. |
| System Efficiency: Energy Consumption | Reduce excess fuel consumed due to congestion by X percent by year Y. | Excess fuel consumed (total or per capita). |
| System Efficiency: Energy Consumption | Reduce total energy consumption per capita for transportation by X percent by year Y. | Total energy consumed per capita for transportation. |
| System Efficiency: Energy Consumption | Reduce total fuel consumption per capita for transportation by X percent by year Y. | Total fuel consumed per capita for transportation. |
| System Efficiency: Intensity of Congestion (Travel Time Index) | Reduce the regional average travel time index by X percent per year. | Travel time index (the average travel time during the peak period, using congested speeds, divided by the off-peak period travel time, using posted or free-flow speeds). |
| System Efficiency: Travel Time | Annual rate of change in regional average commute travel time will not exceed regional rate of population growth through the year Y. | Average commute trip travel time (minutes). |
| System Efficiency: Travel Time | Improve average travel time during peak periods by X percent by year Y. | Average travel time during peak periods (minutes). |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by all transient events such as traffic incidents, special events, and work zones. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by scheduled events, work zones, or system maintenance by x hours in y years. | Travel time delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Planning Time Index | Reduce the average planning time for (specific routes in region) by X minutes over the next Y years. | The planning time index represents the time that must be added to travel time at free-flow speeds or the posted speed limit to ensure on time arrivals for 95 percent of the trips. Planning time = 95th percentile travel time (minutes) – Travel time at free-flow speed or posted speed limit. Average planning time index or planning time can be computed using a weighted average over person miles traveled. |
| System Reliability: Planning Time Index | Reduce the average planning time index for (specific routes in region) by X (no units) over the next Y years. | The planning time index represents the time that must be added to travel time at free-flow speeds or the posted speed limit to ensure on time arrivals for 95 percent of the trips. Planning time = 95th percentile travel time (minutes) – Travel time at free-flow speed or posted speed limit. Average planning time index or planning time can be computed using a weighted average over person miles traveled. |
| System Reliability: Travel Time 90th/95th Percentile | Reduce the 90th (or 95th) percentile travel times for each route selected by X percent over Y years. | 95th or 90th percentile travel times for selected routes. |
| System Reliability: Travel Time 90th/95th Percentile | Reduce the average of the 90th (or 95th) percentile travel times for (a group of specific travel routes or trips in the region) by X minutes in Y years. | 95th or 90th percentile travel times for selected routes. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Travel Time Buffer Index | Decrease the average buffer index for (multiple routes or trips) by X percent over Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Travel Time Buffer Index | Decrease the buffer index for (specific travel routes) by X percent over the next Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Travel Time Buffer Index | Reduce the average buffer time needed to arrive on-time for 95 percent of trips on (specified routes) by X minutes over Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Variability | Reduce the variability of travel time on specified routes by X percent during peak and off-peak periods by year Y. | Variance of travel time. Variance is the sum of the squared deviations from the mean. This can also be calculated as the standard deviation of travel time. Standard deviation is the square root of variance. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Work Zone Management: Construction Coordination | Decrease the number of work zones on parallel routes/along the same corridor by X percent in Y years. | Percent of work zones on parallel routes/along the same corridor. |
| Work Zone Management: Construction Coordination | Establish a work zone management system within X years to facilitate coordination of work zones in the region. | Presence of an established work zone management system. |
| Work Zone Management: Construction Coordination | Increase the number of capital projects reviewed for regional construction coordination by X percent in Y years. | Percent of capital projects whose project schedules have been reviewed. |
| Work Zone Management: Extent of Congestion | Reduce the average and maximum length of queues, when present, by X percent over Y years. | Length of average and maximum queues in work zones. |
| Work Zone Management: Extent of Congestion | Reduce the average time duration (in minutes) of queue length greater than some threshold (e.g., 0.5 mile) by X percent in Y years. | Average duration in minutes of queue length greater than X miles. |
| Work Zone Management: Extent of Congestion | Reduce the percentage of vehicles traveling through work zones that are queued by X percent in Y years. | Percentage of vehicles experiencing queuing in work zones. |
| Work Zone Management: Travel Time Delay | Increase the percentage of construction projects that employ night/ off-peak work zones by X percent in Y years. | Percent of construction project employing night /off-peak work zones. |
| Work Zone Management: Travel Time Delay | Increase the rate of on-time completion of construction projects to X percent within Y years. | Percent of construction projects completed on-time according to established schedule. |
| Work Zone Management: Travel Time Delay | Reduce the person hours (or vehicle hours) of total delay associated with work zones by X percent over Y years. | Person hours (or vehicle hours) of delay associated with work zones. |

**MC10 - Maintenance and Construction Activity Coordination**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Environmental Probe Surveillance (MC11)

This service package collects data from vehicles in the road network that can be used to directly measure or infer current environmental conditions. It leverages vehicle on-board systems that measure temperature, sense current weather conditions (rain and sun sensors) and also can monitor aspects of the vehicle operational status (e.g., use of headlights, wipers, and traction control system) to gather information about local environmental conditions. It includes the on-board vehicle systems that collect and report environmental probe data, the infrastructure equipment that collects the probe data and the centers that aggregate and share the collected probe data.

Table 2.2.2-31: MC11 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| ISP Probe Information Collection | Information Service Provider |
| MCM Environmental Information Collection | Maintenance and Construction Management |
| Roadway Probe Data Communications | Roadway |
| Vehicle Environmental Probe Support | Vehicle |

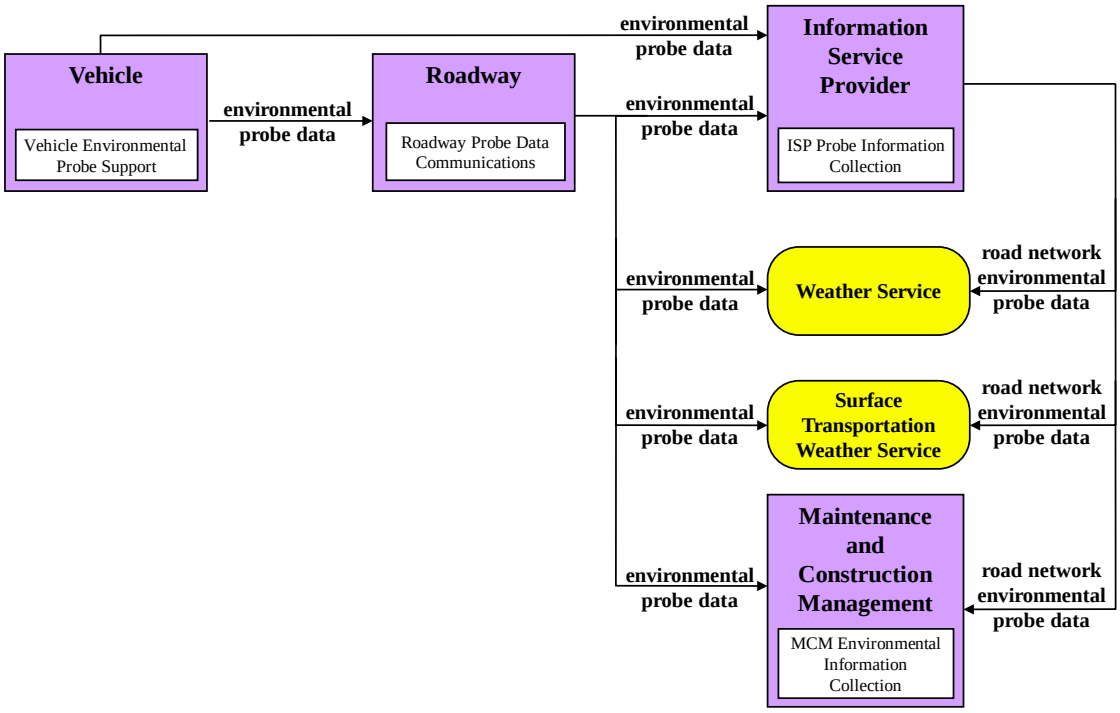
Table 2.2.2-32: MC11 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |

Table 2.2.2-33: MC11 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Travel Weather Management: Road Weather Information System Coverage | Increase the percent of major road network (or transit network or regional bicycle network) covered by weather sensors or a road weather information system (RWIS) by X percent in Y years as defined by an RWIS station within Z miles. | Percent of major road (transit or bicycle) network within Z miles of an RWIS station. |

**MC11 – Environmental Probe Surveillance**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Infrastructure Monitoring (MC12)

This service package monitors the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts) using both fixed and vehicle-based infrastructure monitoring sensors. Fixed sensors monitor vibration, stress, temperature, continuity, and other parameters and mobile sensors and data logging devices collect information on current infrastructure condition. This service package also monitors vehicle probes for vertical acceleration data and other probe data that may be used to determine current pavement condition.

Table 2.2.2-34: MC12 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| MCM Infrastructure Monitoring | Maintenance and Construction Management |
| MCV Infrastructure Monitoring | Maintenance and Construction Vehicle |
| Roadway Infrastructure Monitoring | Roadway |
| Roadway Probe Data Communications | Roadway |
| Vehicle Environmental Probe Support | Vehicle |

Table 2.2.2-35: MC12 Associated Planning Factors and Goals

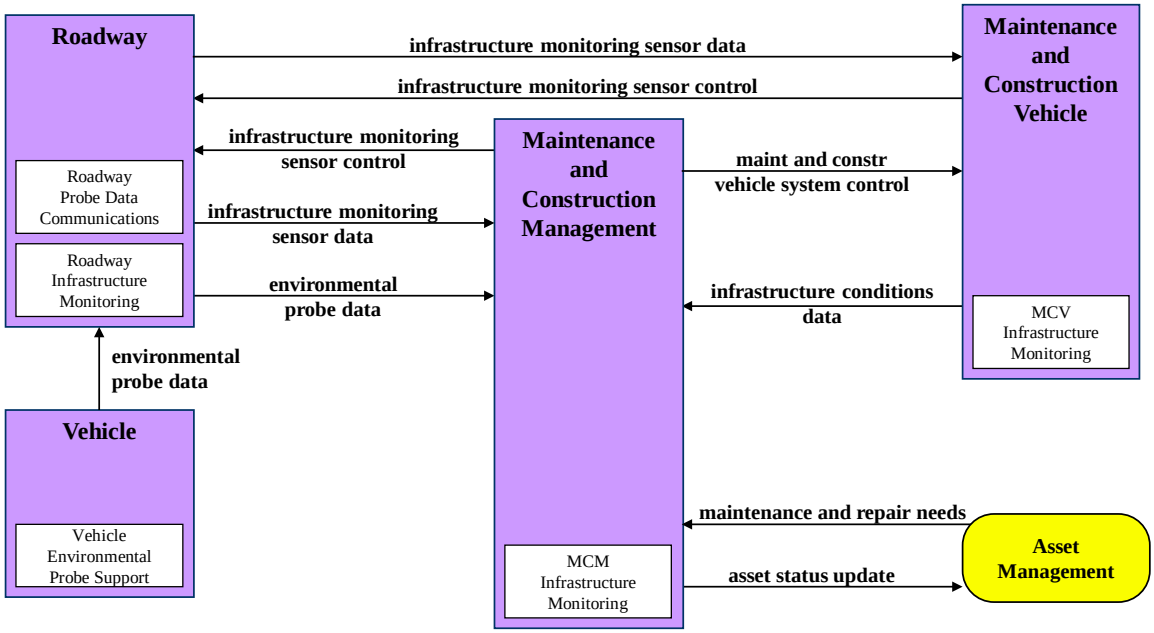
| MetroFactor | Goal |
|---|---|
| Emphasize the preservation of the existing transportation system. | Preserve the transportation system |

Table 2.2.2-36: MC12 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Preservation: Preserve Existing Infrastructure | Distressed pavement condition lane-miles not to exceed X percent of total state highway system | Distressed pavement condition lane miles |
| Preservation: Preserve Existing Infrastructure | Enhance asset and resource management | Extended pavement life due to truck weight enforcement |
| Preservation: Preserve Existing Infrastructure | Enhance asset and resource management | Number of assets tracked in real-time |
| Preservation: Preserve Existing Infrastructure | Enhance asset and resource management | Percentage of fleet/equipment within lifecycle |
| Preservation: Preserve Existing Infrastructure | Enhance asset and resource management | Percentage of geographic jurisdiction covered by agency electronic communications |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Preservation: Preserve Existing Infrastructure | Enhance asset and resource management | Percentage of maintenance activities completed in required time-frame |
| Preservation: Preserve Existing Infrastructure | Enhance asset and resource management | Rate at which equipment is utilized |
| Preservation: Preserve Existing Infrastructure | Enhance asset and resource management | Vehicle operating costs |
| Preservation: Preserve Existing Infrastructure | Maintain pavement condition index (PCI) of X or greater for local streets and roads | Pavement condition index |

**MC12 –Infrastructure Monitoring**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## 2.2.3 Transit Management Service Packages

### Transit Vehicle Tracking (APTS01)

This service package monitors current transit vehicle location using an Automated Vehicle Location System. The location data may be used to determine real time schedule adherence and update 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.

Table 2.2.3-1: APTS01 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Transit Center Vehicle Tracking | Transit Management |
| On-board Transit Trip Monitoring | Transit Vehicle |

Table 2.2.3-2: APTS01 Associated Planning Factors and Goals

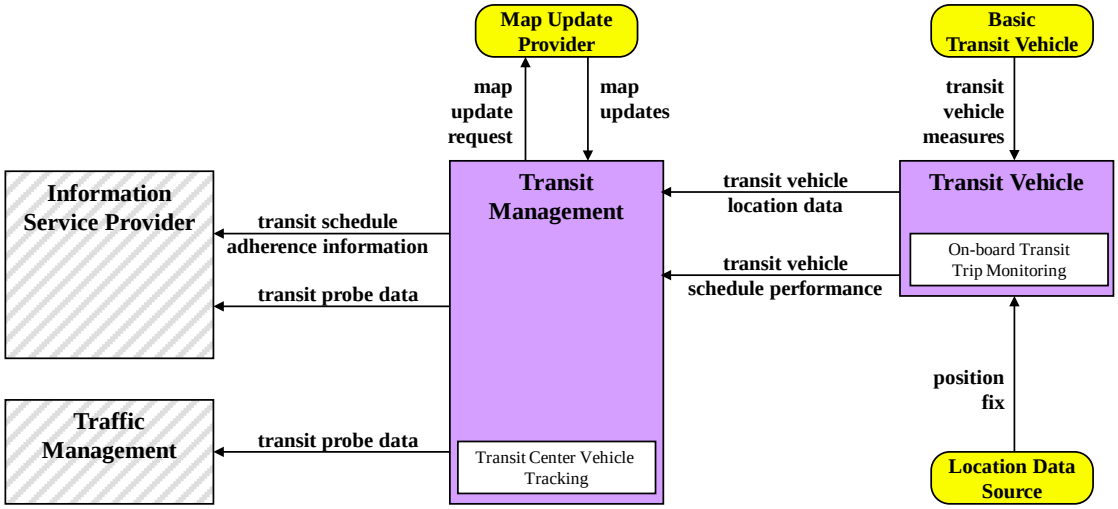
| MetroFactor | Goal |
|---|---|
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |

Table 2.2.3-3: APTS01 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Transit Operations and Management: Transit Signal Priority | Decrease delay by X percent per year by increasing the use of queue jumping and automated vehicle location. | Travel time delay on routes with queue jumping and automated vehicle location in use. |
| Traveler Information: Data Collection and Sharing on Travel Conditions | Increase the percent of modes in the region that share their traveler information with other modes in the region to 100 percent by Y year. | Percent of modes in the region that share their traveler information with other modes. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Traveler Information: Data Collection and Sharing on Travel Conditions | Increase the percent of the transportation system in which travel conditions can be detected remotely via CCTV, speed detectors, etc. to X percent by Y year. | Percent of the transportation system in which travel conditions can be detected remotely via CCTV, speed detectors, etc. |
| Traveler Information: Data Collection and Sharing on Travel Conditions | Increase the percent of transportation facilities whose owners share their traveler information with other agencies in the region to X percent by Y year. | Percent of transportation facilities whose owners share their traveler information with other agencies in the region. |

**APTS01 – Transit Vehicle Tracking**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Transit Fixed-Route Operations (APTS02)

This service package performs automated dispatch and system monitoring for fixed-route and flexible-route transit services. This service performs scheduling activities including the creation of schedules, blocks and runs, as well as operator assignment. This service determines the transit vehicle trip performance against the schedule using AVL data and provides information displays at the Transit Management Subsystem. Static and real time transit data is exchanged with Information Service Providers 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.

Table 2.2.3-4: APTS02 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Transit Center Fixed-Route Operations | Transit Management |
| Transit Vehicle Operator Assignment | Transit Management |
| On-board Schedule Management | Transit Vehicle |

Table 2.2.3-5: APTS02 Associated Planning Factors and Goals

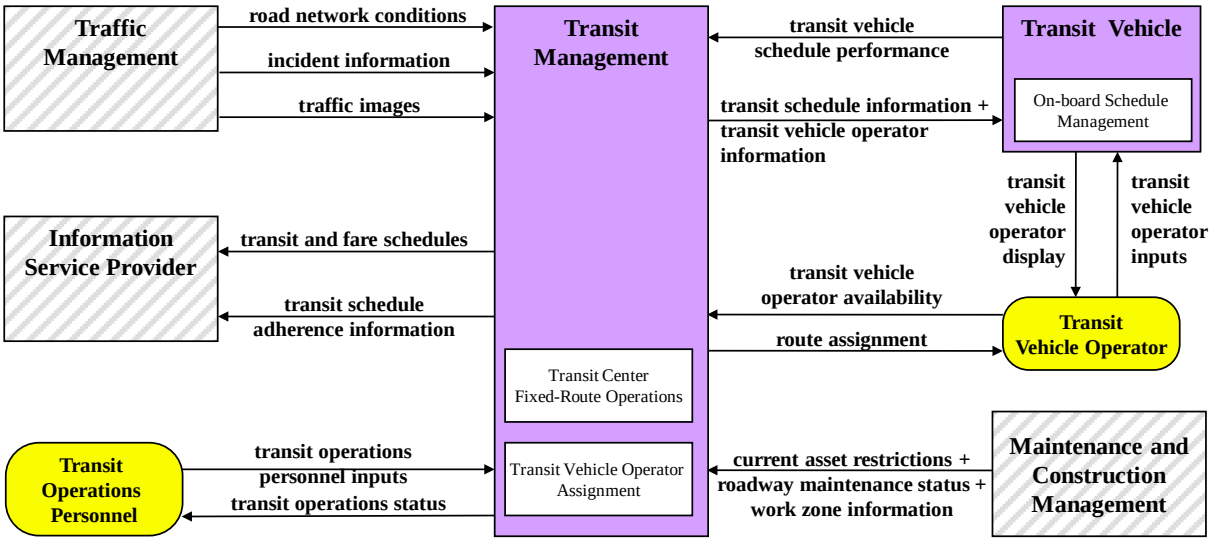
| MetroFactor | Goal |
|---|---|
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |

Table 2.2.3-6: APTS02 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Travel Time | Annual rate of change in regional average commute travel time will not exceed regional rate of population growth through the year Y. | Average commute trip travel time (minutes). |
| System Efficiency: Travel Time | Improve average travel time during peak periods by X percent by year Y. | Average travel time during peak periods (minutes). |
| System Efficiency: Trip Connectivity | Reduce cost of transfer fees paid by X percent by year Y. | Average cost of transfers. |
| System Efficiency: Trip Connectivity | Reduce door-to-door trip time by X percent by year Y. | Average door-to-door trip time. |
| System Reliability: Transit On-Time Performance | Improve average on-time performance for specified transit routes/facilities by X percent within Y years. | On-time performance of transit. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Transit Operations and Management: Line-Haul Transit | Improve average on-time performance for specified line-haul transit routes by X percent annually. | Average line-haul transit on-time performance for specified line-haul transit routes. |
| Transit Operations and Management: Line-Haul Transit | Improve average travel speeds by X percent for specified line-haul transit routes every Y years. | Average line-haul transit travel speeds for specified line-haul transit routes. |
| Transit Operations and Management: Line-Haul Transit | Provide line-haul transit travel times equal to or less than average auto travel times on same corridors/parallel corridors for X number of routes over Y years. | Number of line-haul transit routes operating with travel times equal to or less than average auto travel times on same corridors/parallel corridors. |
| Transit Operations and Management: Loading Standards | Load factors for (route type) routes at each route's busiest point should not exceed X on any vehicle (or on the average vehicle) during peak/off-peak periods. | Load factor. |
| Transit Operations and Management: Loading Standards | No more than X standees should be present at each route's busiest point on any vehicle (or on the average vehicle) during peak/off-peak periods. | Maximum standees. |
| Transit Operations and Management: Loading Standards | No passenger will have to stand for more than X minutes during their journey. | Duration of standee time. |
| Transit Operations and Management: Loading Standards | Passenger loads on (route type) routes at each route's busiest point should not exceed X passengers on any vehicle (or on average) during the hour during peak/off-peak periods | Maximum passenger loads. |
| Transit Operations and Management: Service Directness | At least X percent of trips can be made with no more than Y transfers. | Percent of trips with no more than Y transfers. |
| Transit Operations and Management: Service Directness | Scheduled transfer times between routes should be no longer than X minutes. | Scheduled transfer times between routes. |

**APTS02 – Transit Fixed-Route Operations**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Demand Response Transit Operations (APTS03)

This service package performs automated dispatch and system monitoring for demand responsive transit services. This service performs scheduling activities as well as operator assignment. In addition, this service package performs similar functions to support dynamic features of flexible-route transit services. This package monitors the 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. This service includes the capability for a traveler request for personalized transit services to be made through the Information Service Provider (ISP) Subsystem. The ISP may either be operated by a 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 that the paratransit service is a viable means of satisfying a traveler request and makes a reservation for the traveler.

Table 2.2.3-7: APTS03 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Transit Center Paratransit Operations | Transit Management |
| Transit Vehicle Operator Assignment | Transit Management |
| On-board Paratransit Operations | Transit Vehicle |

Table 2.2.3-8: APTS03 Associated Planning Factors and Goals

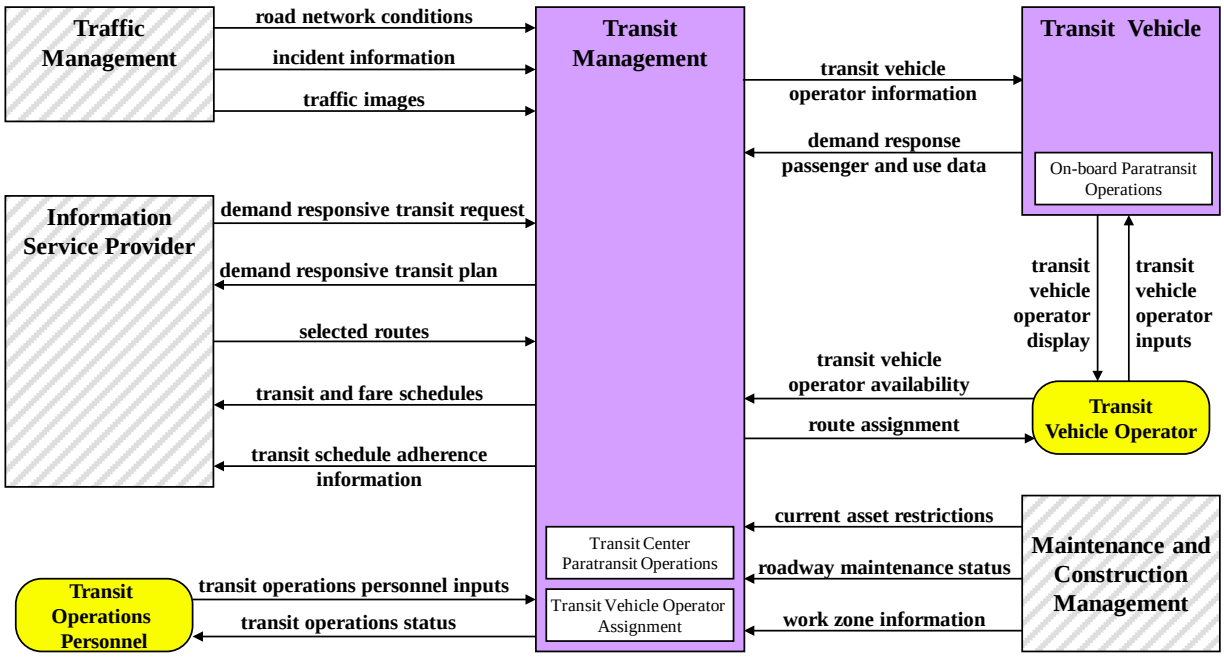
| MetroFactor | Goal |
|---|---|
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |

Table 2.2.3-9: APTS03 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Options: Modal Options for Individuals with Disabilities | Increase the availability of transit to individuals with disabilities by X percent by year Y. | The percent of individuals with disabilities that can access transit. |
| Transit Operations and Management: Demand Responsive Transit | Improve on-time pick-up of demand response transit passengers. | Demand response passenger pick-up on-time performance |
| Transit Operations and Management: Demand Responsive Transit | Improve the operational efficiency of the demand response transit service in the region. | Operating expense per passenger mile |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Transit Operations and Management: Demand Responsive Transit | Improve the operational efficiency of the demand response transit service in the region. | Operating expense per passenger trip |
| Transit Operations and Management: Demand Responsive Transit | Improve the operational efficiency of the demand response transit service in the region. | Passenger miles per vehicle |
| Transit Operations and Management: Demand Responsive Transit | Improve the operational efficiency of the demand response transit service in the region. | Passenger trips per vehicle |
| Transit Operations and Management: Demand Responsive Transit | Increase customer satisfaction with the region's demand response transit service by X percent over Y years. | Customer satisfaction ratings |

**APTS03 – Demand Response Transit Operations**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Transit Fare Collection Management (APTS04)

This service package manages transit fare collection on-board transit vehicles and at transit stops using electronic means. It allows transit users to use a traveler card or other electronic payment device. Readers located either in the infrastructure or on-board the transit vehicles enable electronic fare payment. Data is processed, stored, and displayed on the transit vehicle and communicated as needed to the Transit Management Subsystem. Two other service packages, ATMS10: Electronic Toll Collection and ATMS16: Parking Facility Management, also provide electronic payment services. These three service packages in combination provide an integrated electronic payment system for transportation services.

Table 2.2.3-10: APTS04 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Remote Transit Fare Management | Remote Traveler Support |
| Transit Center Fare Management | Transit Management |
| On-board Transit Fare Management | Transit Vehicle |

Table 2.2.3-11: APTS04 Associated Planning Factors and Goals

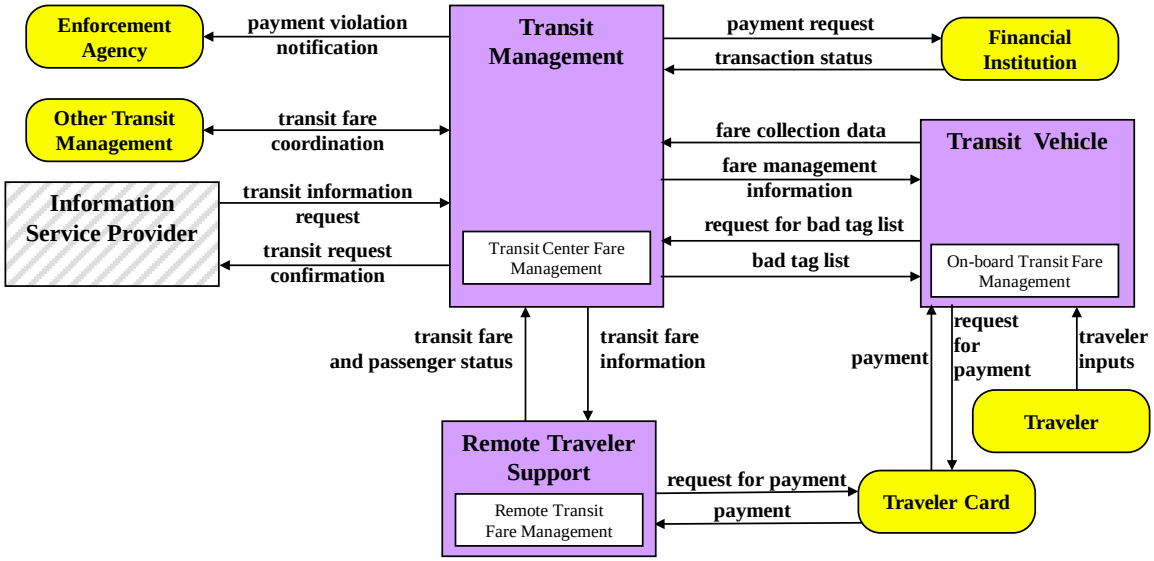
| MetroFactor | Goal |
|---|---|
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |

Table 2.2.3-12: APTS04 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Trip Connectivity | Reduce cost of transfer fees paid by X percent by year Y. | Average cost of transfers. |
| System Efficiency: Trip Connectivity | Reduce door-to-door trip time by X percent by year Y. | Average door-to-door trip time. |
| System Options: Mode Share | Achieve X percent alternative (non-SOV) mode share in transit station communities (or other destinations) by year Y. | Percent of all trips made using alternative modes in transit station communities. |
| System Options: Mode Share | Increase alternative (non-SOV) mode share for all trips by X percent within the next Y years. | Share of trips by each mode of travel. |
| System Options: Transit Use | Increase average transit load factor by X percent by year Y. | Number of riders on various transit units per trip at peak travel times. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Options: Transit Use | Increase passenger miles traveled per capita on transit by X percent by year Y. | Number of passenger miles traveled per capita. |
| System Options: Transit Use | Increase transit mode share by X percent by year Y during peak periods. | Percent of all peak-period trips made by transit. |
| System Options: Transit Use | Increase transit mode share by X percent by year Y. | Percent of all trips made by transit. |
| System Options: Travel Time - Transit Compared to Auto | Improve average transit travel time compared to auto in major corridors by X minutes per year for Y years. | Transit to auto travel time differential for a given period (daily, hourly, or peak hours), on a given portion of the system (system wide, by facility type, or by corridor). |
| System Options: Travel Time - Transit Compared to Auto | Maintain a travel time differential between transit and auto during peak periods of X percent for Y years. | Transit to auto travel time differential for a given period (daily, hourly, or peak hours), on a given portion of the system (system wide, by facility type, or by corridor). |
| System Options: Travel Time - Transit Compared to Auto | Reduce the travel time differential between transit and auto during peak periods by X percent per year for Y years. | Transit to auto travel time differential for a given period (daily, hourly, or peak hours), on a given portion of the system (system wide, by facility type, or by corridor). |
| Transit Operations and Management: Automated Fare Collection | Implement an automated fare collection system in Y years for X percent of transit providers in the region. | Percent of transit providers using the region's automated fare collection system. |
| Transit Operations and Management: Automated Fare Collection | Increase by X percentage points, every Y years, the percent of transfers performed with automated fare cards. | Percent of total transfers performed with automated fare cards. |
| Transit Operations and Management: Automated Fare Collection | Increase use of system by X percent per year. | Percent of fares collected using automated fare collection. |
| Transit Operations and Management: Automated Fare Collection | Integrate X additional modes/services into automated fare collection system by Y years. | Number of additional modes/service integrated into the fare collection system. |

**APTS04 – Transit Fare Collection Management**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

**Transit Security (APTS05)**
This service package provides for the physical security of transit passengers and transit vehicle operators. On-board equipment is deployed to perform surveillance and sensor monitoring in order to warn of potentially hazardous situations. The surveillance equipment includes video (e.g., CCTV cameras), audio systems and/or event recorder systems. The sensor equipment includes threat sensors (e.g., chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors) and object detection sensors (e.g., metal detectors). Transit user or transit vehicle operator activated alarms are provided on-board. Public areas (e.g., transit stops, park and ride lots, stations) are also monitored with similar surveillance and sensor equipment and provided with transit user activated alarms. In addition this service package provides surveillance and sensor monitoring of non-public areas of transit facilities (e.g., transit yards) and transit infrastructure such as bridges, tunnels, and transit railways or bus rapid transit (BRT) guideways. The surveillance equipment includes video and/or audio systems. The sensor equipment includes threat sensors and object detection sensors as described above as well as, intrusion or motion detection sensors and infrastructure integrity monitoring (e.g., rail track continuity checking or bridge structural integrity monitoring).

The surveillance and sensor information is transmitted to the Emergency Management Subsystem, as are transit user activated alarms in public secure areas. On-board alarms, activated by transit users or transit vehicle operators are transmitted to both the Emergency Management Subsystem and the Transit Management Subsystem, indicating two possible approaches to implementing this service package.

In addition the service package supports remote transit vehicle disabling by the Transit Management Subsystem and transit vehicle operator authentication.

Table 2.2.3-13: APTS05 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Center Secure Area Alarm Support | Emergency Management |
| Center Secure Area Sensor Management | Emergency Management |
| Center Secure Area Surveillance | Emergency Management |
| Emergency Response Management | Emergency Management |
| Remote Traveler Security | Remote Traveler Support |
| Traveler Secure Area Sensor Monitoring | Remote Traveler Support |
| Traveler Secure Area Surveillance | Remote Traveler Support |
| Field Secure Area Sensor Monitoring | Security Monitoring |
| Field Secure Area Surveillance | Security Monitoring |
| Transit Center Security | Transit Management |
| On-board Transit Security | Transit Vehicle |

Table 2.2.3-14: APTS05 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |
| Increase the security of the transportation system for motorized and nonmotorized users; | Improve the security of the transportation system |

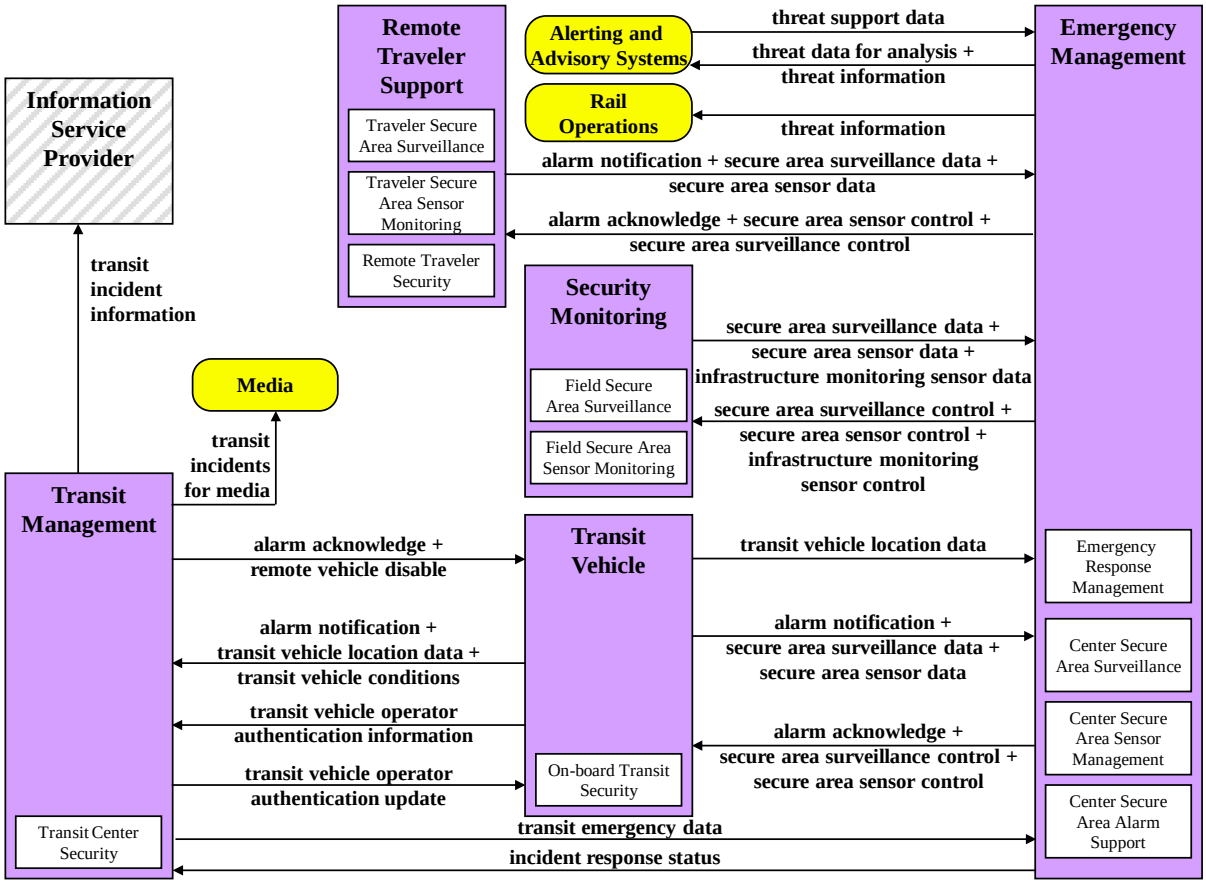
Table 2.2.3-15: APTS05 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Emergency/Incident Management: Incident Duration | Reduce mean incident notification time (defined as the time between the first agency's awareness of an incident and the time to notify needed response agencies) by X percent over Y years (i.e., through "Motorist Assist" roving patrol programs, reduction of inaccurate verifications, etc.). | Average incident notification time of necessary response agencies. |
| Emergency/Incident Management: Incident Duration | Reduce mean time of incident duration (from awareness of incident to resumed traffic flow) on transit services and arterial and expressway facilities by X percent in Y years. | Mean time of incident duration. |
| Security: Crime | Reduce security risks to motorists and travelers | Number of critical sites with security surveillance |
| Security: Crime | Reduce security risks to motorists and travelers | Number of security incidents on roadways |
| Security: Crime | Reduce security risks to transit passengers and transit vehicle operators | Number of security incidents at transit facilities |
| Security: Crime | Reduce security risks to transit passengers and transit vehicle operators | Number of security incidents on transit vehicles |
| Security: Crime | Reduce security risks to transit passengers and transit vehicle operators | Number of transit facilities and vehicles under security surveillance |
| Security: Crime | Reduce security risks to transportation infrastructure | Number of critical sites with hardened security enhancements |
| Security: Crime | Reduce security risks to transportation infrastructure | Number of critical sites with security surveillance |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Security: Crime | Reduce security risks to transportation infrastructure | Number of security incidents on transportation infrastructure |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to motorists and travelers | Number of critical sites with security surveillance |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to motorists and travelers | Number of security incidents on roadways |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transit passengers and transit vehicle operators | Number of security incidents at transit facilities |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transit passengers and transit vehicle operators | Number of security incidents on transit vehicles |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transit passengers and transit vehicle operators | Number of transit facilities and vehicles under security surveillance |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transportation infrastructure | Number of critical sites with hardened security enhancements |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transportation infrastructure | Number of critical sites with security surveillance |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transportation infrastructure | Number of security incidents on transportation infrastructure |
| Transit Operations and Management: Customer Service/Safety | Decrease by X percent on an annual basis the number of complaints per 1,000 boarding passengers. | Complaint rate. |
| Transit Operations and Management: Customer Service/Safety | Decrease the number of personal safety incidents by X percent within Y years. | Number of reported personal safety incidents. |
| Transit Operations and Management: Customer Service/Safety | Increase customer service and personal safety ratings by X percent within Y years. | Personal safety and customer service ratings. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Transit Operations and Management: Customer Service/Safety | Increase the number of closed circuit television (CCTV) cameras installed by X percent in Y years on platforms, park-n-ride lots, vehicles, and other transit facilities. | Number of CCTV cameras on platforms, park-n-ride lots, vehicles, and other transit facilities. |

**APTS05 - Transit Security**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Transit Fleet Management (APTS06)

This service package supports automatic transit maintenance scheduling and monitoring. On-board condition sensors monitor 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 preventative and corrective maintenance. The service package also supports the day to day management of the transit fleet inventory, including the assignment of specific transit vehicles to blocks.

Table 2.2.3-16: APTS06 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Transit Garage Maintenance | Transit Management |
| Transit Vehicle Assignment | Transit Management |
| On-board Maintenance | Transit Vehicle |
| On-board Schedule Management | Transit Vehicle |

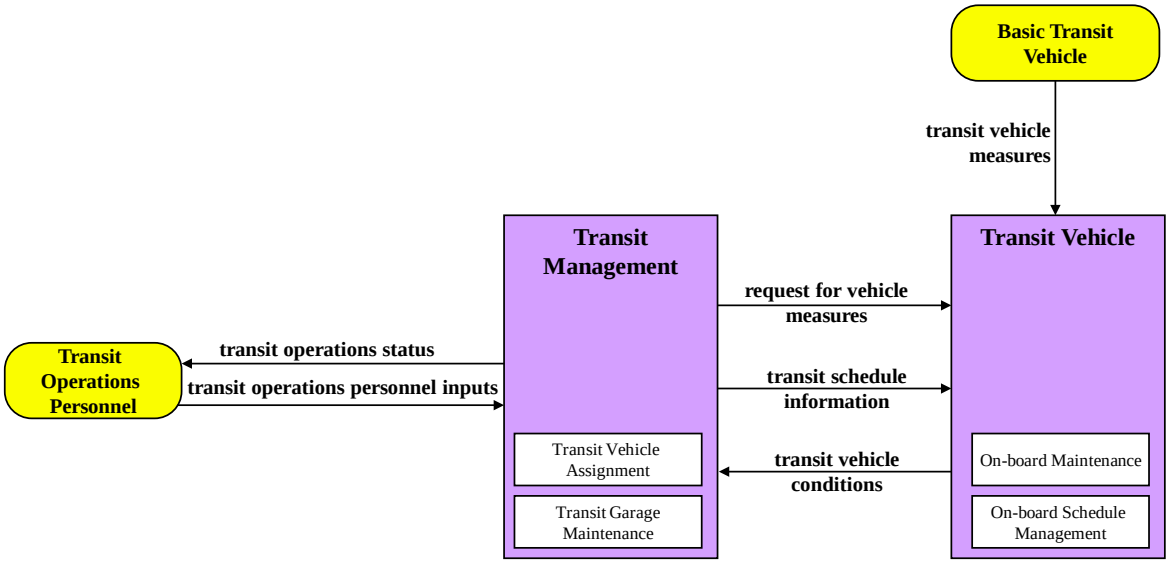
Table 2.2.3-17: APTS06 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Emphasize the preservation of the existing transportation system. | Preserve the transportation system |

Table 2.2.3-18: APTS06 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Preservation: Transit Maintenance | Enhance garage operations efficiency | Number of fleet vehicles with maintenance diagnostic equipment |
| Preservation: Transit Maintenance | Enhance garage operations efficiency | Number of vehicles operating under computer-aided dispatch. |
| Preservation: Transit Maintenance | Increase the average number of miles between service calls for transit service in the region to X miles | Average number of transit miles per service call |

**APTS06 - Transit Fleet Management**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## Multi-modal Coordination (APTS07)

This service package establishes two way communications between multiple transit and traffic agencies to improve service coordination. Multimodal coordination between transit agencies can increase traveler convenience at transit transfer points and clusters (a collection of stops, stations, or terminals where transfers can be made conveniently) and also improve operating efficiency. Transit transfer information is shared between Multimodal Transportation Service Providers and Transit Agencies.

Table 2.2.3-19: APTS07 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| TMC Multimodal Coordination | Traffic Management |
| Transit Center Multi-Modal Coordination | Transit Management |
| On-board Schedule Management | Transit Vehicle |

Table 2.2.3-20: APTS07 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight; | Enhance the integration and connectivity of the transportation system |
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns; | Reduce environmental impacts |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.3-21: APTS07 Associated Objectives and Performance Measures

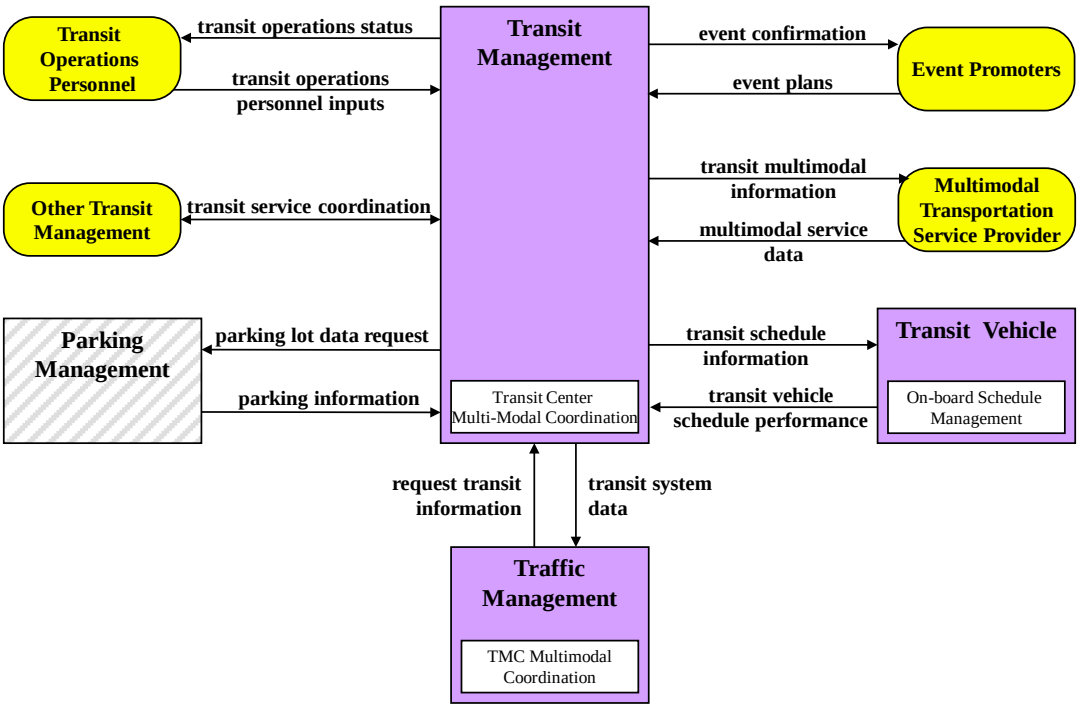
| Objective Category | Objective | Performance Measure |
|---|---|---|
| Integration: Connectivity | Reduce cost of transfer fees paid by X percent by year Y. | Average cost of transfers. |
| Integration: Connectivity | Reduce door-to-door trip time by X percent by year Y. | Average door-to-door trip time. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Special Event Management: Entry/Exit Travel Times | Reduce average time to clear event's exiting queue by X percent in Y years. | Average time to clear event's exiting queue by year per event. |
| Special Event Management: Entry/Exit Travel Times | Reduce average travel time into and out of the event by X percent in Y years. | Average travel time away from selected special events to a set of locations over a year. |
| Special Event Management: Entry/Exit Travel Times | Reduce average travel time into and out of the event by X percent in Y years. | Average travel time to selected special events from a set of locations in the area over a year. |
| Special Event Management: Entry/Exit Travel Times | Reduce buffer time index for travelers to multiple similar special events by X percent in Y years. | Buffer time index for travelers to multiple similar special events. |
| Special Event Management: Entry/Exit Travel Times | Reduce non-special event VMT in the event area during events by X percent in Y years. | Non-special event VMT in the event area during events over a year. |
| Special Event Management: Mode Shift from SOV | Decrease the percent of special event attendees traveling to the event in single-occupancy vehicles by X percent in Y years. | Percent of special event attendees using single-occupancy vehicles each year for selected events. |
| Special Event Management: Mode Shift from SOV | Increase the percent of special event attendees using park & ride lots by X percent in Y years. | Percent of special event attendees utilizing park & ride lots each year for selected events. |
| Special Event Management: Mode Shift from SOV | Increase the percent of special events with dedicated shuttle service by X percent in Y years. | Percent of special events with dedicated shuttle service for selected events during a 1-year period. |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay per capita. |
| System Efficiency: Energy Consumption | Reduce excess fuel consumed due to congestion by X percent by year Y. | Excess fuel consumed (total or per capita). |
| System Efficiency: Energy Consumption | Reduce total energy consumption per capita for transportation by X percent by year Y. | Total energy consumed per capita for transportation. |
| System Efficiency: Energy Consumption | Reduce total fuel consumption per capita for transportation by X percent by year Y. | Total fuel consumed per capita for transportation. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Intensity of Congestion (Travel Time Index) | Reduce the regional average travel time index by X percent per year. | Travel time index (the average travel time during the peak period, using congested speeds, divided by the off-peak period travel time, using posted or free-flow speeds). |
| System Efficiency: Travel Time | Annual rate of change in regional average commute travel time will not exceed regional rate of population growth through the year Y. | Average commute trip travel time (minutes). |
| System Efficiency: Travel Time | Improve average travel time during peak periods by X percent by year Y. | Average travel time during peak periods (minutes). |
| System Efficiency: Trip Connectivity | Reduce cost of transfer fees paid by X percent by year Y. | Average cost of transfers. |
| System Efficiency: Trip Connectivity | Reduce door-to-door trip time by X percent by year Y. | Average door-to-door trip time. |
| System Efficiency: Vehicle Miles Traveled | Reduce vehicle miles traveled per capita by X percent by year Y. | Average VMT per capita per day, per week, or per year. |
| System Options: Modal Options for Individuals with Disabilities | Increase the availability of transit to individuals with disabilities by X percent by year Y. | The percent of individuals with disabilities that can access transit. |
| System Options: Mode Share | Achieve X percent alternative (non-SOV) mode share in transit station communities (or other destinations) by year Y. | Percent of all trips made using alternative modes in transit station communities. |
| System Options: Mode Share | Increase active (bicycle/pedestrian) mode share by X percent by year Y. | Share of trips by each mode of travel. |
| System Options: Mode Share | Increase alternative (non-SOV) mode share for all trips by X percent within the next Y years. | Share of trips by each mode of travel. |
| System Options: Mode Share | Reduce per capita SOV commute trip rate by X percent in Y years. | SOV commute trips per capita. |
| System Options: Transit Use | Increase average transit load factor by X percent by year Y. | Number of riders on various transit units per trip at peak travel times. |
| System Options: Transit Use | Increase passenger miles traveled per capita on transit by X percent by year Y. | Number of passenger miles traveled per capita. |
| System Options: Transit Use | Increase transit mode share by X percent by year Y during peak periods. | Percent of all peak-period trips made by transit. |
| System Options: Transit Use | Increase transit mode share by X percent by year Y. | Percent of all trips made by transit. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Options: Travel Time - Transit Compared to Auto | Improve average transit travel time compared to auto in major corridors by X minutes per year for Y years. | Transit to auto travel time differential for a given period (daily, hourly, or peak hours), on a given portion of the system (system wide, by facility type, or by corridor). |
| System Options: Travel Time - Transit Compared to Auto | Maintain a travel time differential between transit and auto during peak periods of X percent for Y years. | Transit to auto travel time differential for a given period (daily, hourly, or peak hours), on a given portion of the system (system wide, by facility type, or by corridor). |
| System Options: Travel Time - Transit Compared to Auto | Reduce the travel time differential between transit and auto during peak periods by X percent per year for Y years. | Transit to auto travel time differential for a given period (daily, hourly, or peak hours), on a given portion of the system (system wide, by facility type, or by corridor). |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by all transient events such as traffic incidents, special events, and work zones. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by scheduled events, work zones, or system maintenance by x hours in y years. | Travel time delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by unscheduled disruptions to travel. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |
| Transit Operations and Management: Park-and-Ride Support | Increase traveler awareness of park-and-ride lots by X percent within Y years. | Number of users aware of park-and-ride lots in their region. |
| Transit Operations and Management: Service Directness | At least X percent of trips can be made with no more than Y transfers. | Percent of trips with no more than Y transfers. |
| Transit Operations and Management: Service Directness | Scheduled transfer times between routes should be no longer than X minutes. | Scheduled transfer times between routes. |

**APTS07 – Multi-modal Coordination**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## Transit Traveler Information (APTS08)

This service 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 service package.

Table 2.2.3-22: APTS08 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Infrastructure Provided Trip Planning | Information Service Provider |
| ISP Traveler Data Collection | Information Service Provider |
| Personal Interactive Information Reception | Personal Information Access |
| Remote Transit Information Services | Remote Traveler Support |
| Transit Center Information Services | Transit Management |
| On-board Transit Information Services | Transit Vehicle |

Table 2.2.3-23: APTS08 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |

Table 2.2.3-24: APTS08 Associated Objectives and Performance Measures

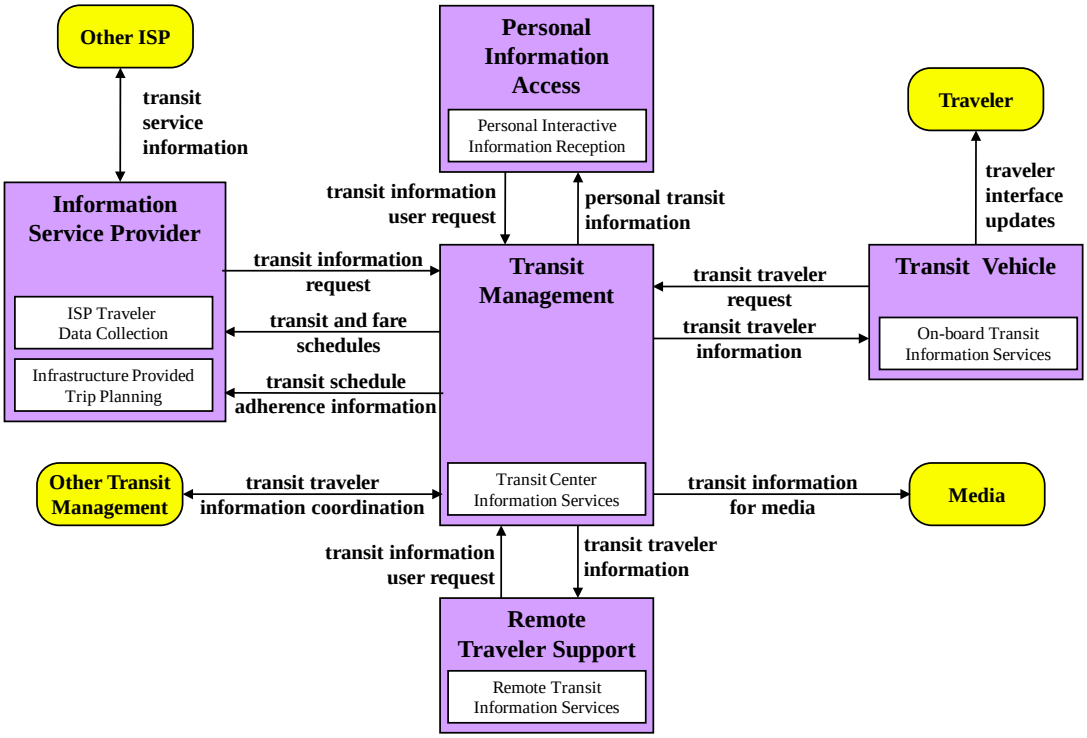
| Objective Category | Objective | Performance Measure |
|---|---|---|
| Special Event Management: Mode Shift from SOV | Decrease the percent of special event attendees traveling to the event in single-occupancy vehicles by X percent in Y years. | Percent of special event attendees using single-occupancy vehicles each year for selected events. |
| Special Event Management: Mode Shift from SOV | Increase the percent of special event attendees using park & ride lots by X percent in Y years. | Percent of special event attendees utilizing park & ride lots each year for selected events. |
| Special Event Management: Mode Shift from SOV | Increase the percent of special events with dedicated shuttle service by X percent in Y years. | Percent of special events with dedicated shuttle service for selected events during a 1-year period. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Special Event Management: Traveler Information | Increase the methods of effectively disseminating special event information to travelers by X percent in Y years (e.g., media releases, highway advisory radio, dynamic message signs, commercial AM and FM radio). | Number of effective methods to disseminate special event information to travelers. |
| Special Event Management: Traveler Information | Increase the percentage of planned special events (with attendance above Z) with information on anticipated and actual travel conditions being disseminated to the traveling public at least X hours prior to the event. | Percent of special events with expected attendance over Z that traveler information is disseminated at least X hours prior to the event. |
| System Efficiency: Vehicle Miles Traveled | Reduce vehicle miles traveled per capita by X percent by year Y. | Average VMT per capita per day, per week, or per year. |
| System Options: Modal Options for Individuals with Disabilities | Increase the availability of transit to individuals with disabilities by X percent by year Y. | The percent of individuals with disabilities that can access transit. |
| System Options: Mode Share | Achieve X percent alternative (non-SOV) mode share in transit station communities (or other destinations) by year Y. | Percent of all trips made using alternative modes in transit station communities. |
| System Options: Mode Share | Increase alternative (non-SOV) mode share for all trips by X percent within the next Y years. | Share of trips by each mode of travel. |
| System Options: Transit Use | Increase average transit load factor by X percent by year Y. | Number of riders on various transit units per trip at peak travel times. |
| System Options: Transit Use | Increase passenger miles traveled per capita on transit by X percent by year Y. | Number of passenger miles traveled per capita. |
| System Options: Transit Use | Increase transit mode share by X percent by year Y during peak periods. | Percent of all peak-period trips made by transit. |
| System Options: Transit Use | Increase transit mode share by X percent by year Y. | Percent of all trips made by transit. |
| Transit Operations and Management: Park-and-Ride Support | Increase traveler awareness of park-and-ride lots by X percent within Y years. | Number of users aware of park-and-ride lots in their region. |
| Transit Operations and Management: Traveler Information | All stops have up-to-date schedule information available within X days of schedule changes. | Percent of stops with up-to-date schedule information available within X days of schedule changes. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Transit Operations and Management: Traveler Information | Equip X shelters/platforms with real-time arrival displays annually. | Number of shelters/platforms equipped with real-time arrival displays per year. |
| Transit Operations and Management: Traveler Information | Increase the number of web-based trip planner requests each year by X percent. | Number of web-based trip planner requests per year. |
| Transit Operations and Management: Traveler Information | Install Wi-Fi service on X number of routes annually. | The number of routes in which Wi-Fi service was installed. |
| Transit Operations and Management: Traveler Information | Transit traveler information is available in the region via 511 web and phone service by year Y. | Availability of transit traveler information on 511 web and phone service. |
| Travel Demand Management: Marketing | Construct visitor information centers in X communities by year Y. | Number of communities in which visitor information centers are constructed. |
| Travel Demand Management: Marketing | Create a transportation access guide, which provides concise directions to reach destinations by alternative modes (transit, walking, bike, etc.) by year Y. | Implementation of transportation access guide. |
| Travel Demand Management: Marketing | Develop and enhance (e.g., through ease of navigation techniques) X number of web-based traveler information tools. | Number of web-based traveler information tools developed or enhanced. |
| Travel Demand Management: Marketing | Develop and provide travel option services to X identified communities and audiences within Y years. | Number of communities receiving travel option services. |
| Traveler Information: Customer Satisfaction | Increase customer satisfaction rating of the timeliness, accuracy, and usefulness of traveler information in the region by W, X, and Z percent, respectively, over Y years. | Customer satisfaction ratings of timeliness, accuracy, and usefulness of traveler information. |
| Traveler Information: Information Dissemination | Increase number of 511 calls per year by X percent in Y years. | Number of 511 calls per year. |
| Traveler Information: Information Dissemination | Increase number of users of notifications for traveler information (e.g., e-mail, text message) by X percent in Y years. | Number of users of notifications for traveler information (e.g., e-mail, text message) per year. |
| Traveler Information: Information Dissemination | Increase number of visitors to traveler information website per year by X percent in Y years. | Number of visitors to traveler information website per year. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Traveler Information: Information Dissemination | Increase number of Web 2.0 (e.g., Twitter, Facebook) followers by X percent in Y months. | Number of Web 2.0 (e.g., Twitter, Facebook) followers. |
| Traveler Information: Information Dissemination | Increase the accuracy and completeness of traveler information posted (on variable message signs, websites, and/or web 2.0 technologies) by reducing the number of incomplete and inaccurate reports by X percent in Y years. | Number of complaints received from system users about inaccurate or missing information. |
| Traveler Information: Trip Planning Tools | Enhance regional multimodal trip planning tools to X data sources by year Y. | The number of data sources providing information for multi-modal trip planning tools. |
| Traveler Information: Trip Planning Tools | Increase the ease of use of trip planning tools by X percent by year Y. | Trip planning tools ease of use rating. |
| Traveler Information: Trip Planning Tools | Increase the number of uses of multimodal trip planning tools by X percent by year Y. | Number of uses of trip planning tools. |

**APTS08 - Transit Traveler Information**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## Transit Signal Priority (APTS09)

This service package determines the need for transit priority on routes and at certain intersections and requests transit vehicle priority at these locations. The signal priority may result from limited local coordination between the transit vehicle and the individual intersection for signal priority or may result from coordination between transit management and traffic management centers. 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.

Table 2.2.3-25: APTS09 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Roadway Signal Priority | Roadway |
| TMC Multimodal Coordination | Traffic Management |
| TMC Signal Control | Traffic Management |
| Transit Center Signal Priority | Transit Management |
| On-board Transit Signal Priority | Transit Vehicle |

Table 2.2.3-26: APTS09 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns; | Reduce environmental impacts |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

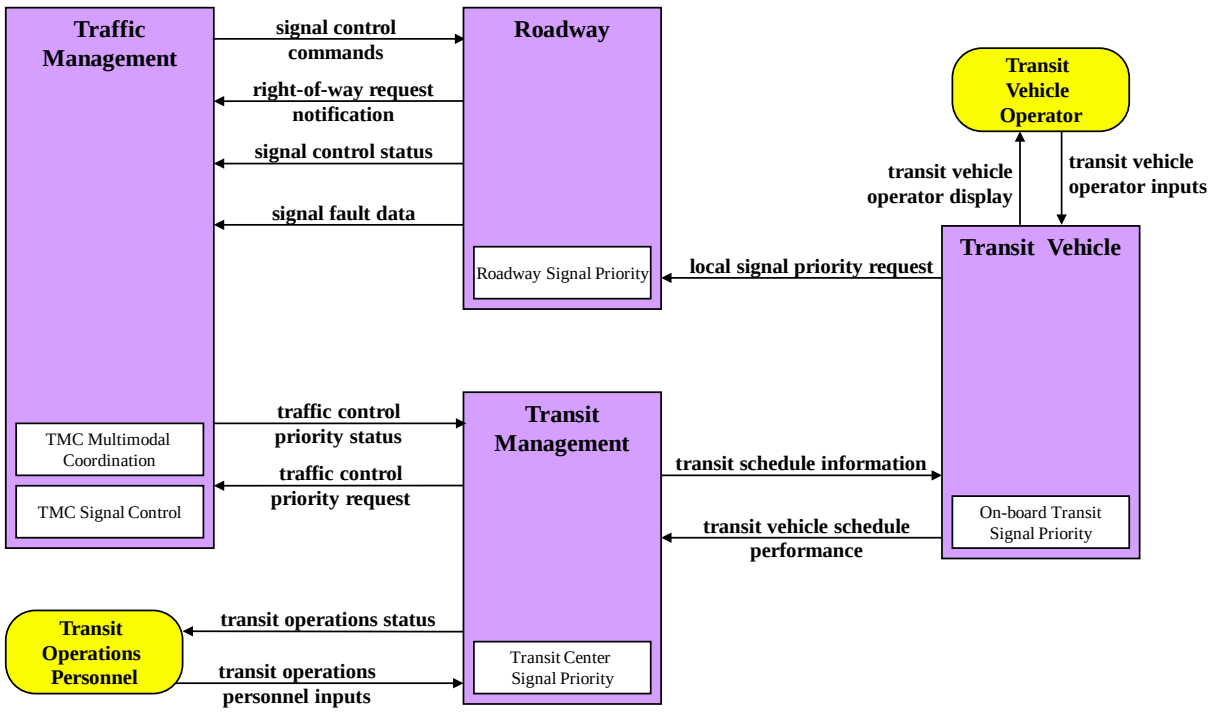
Table 2.2.3-27: APTS09 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay per capita. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Energy Consumption | Reduce excess fuel consumed due to congestion by X percent by year Y. | Excess fuel consumed (total or per capita). |
| System Efficiency: Energy Consumption | Reduce total energy consumption per capita for transportation by X percent by year Y. | Total energy consumed per capita for transportation. |
| System Efficiency: Energy Consumption | Reduce total fuel consumption per capita for transportation by X percent by year Y. | Total fuel consumed per capita for transportation. |
| System Efficiency: Intensity of Congestion (Travel Time Index) | Reduce the regional average travel time index by X percent per year. | Travel time index (the average travel time during the peak period, using congested speeds, divided by the off-peak period travel time, using posted or free-flow speeds). |
| System Efficiency: Travel Time | Annual rate of change in regional average commute travel time will not exceed regional rate of population growth through the year Y. | Average commute trip travel time (minutes). |
| System Efficiency: Travel Time | Improve average travel time during peak periods by X percent by year Y. | Average travel time during peak periods (minutes). |
| System Efficiency: Vehicle Miles Traveled | Reduce vehicle miles traveled per capita by X percent by year Y. | Average VMT per capita per day, per week, or per year. |
| System Options: Travel Time - Transit Compared to Auto | Improve average transit travel time compared to auto in major corridors by X minutes per year for Y years. | Transit to auto travel time differential for a given period (daily, hourly, or peak hours), on a given portion of the system (system wide, by facility type, or by corridor). |
| System Options: Travel Time - Transit Compared to Auto | Maintain a travel time differential between transit and auto during peak periods of X percent for Y years. | Transit to auto travel time differential for a given period (daily, hourly, or peak hours), on a given portion of the system (system wide, by facility type, or by corridor). |
| System Options: Travel Time - Transit Compared to Auto | Reduce the travel time differential between transit and auto during peak periods by X percent per year for Y years. | Transit to auto travel time differential for a given period (daily, hourly, or peak hours), on a given portion of the system (system wide, by facility type, or by corridor). |
| System Reliability: Transit On-Time Performance | Improve average on-time performance for specified transit routes/facilities by X percent within Y years. | On-time performance of transit. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Transit Operations and Management: Transit Signal Priority | Decrease system-wide signal delay on transit routes by X percent per year. | System-wide signalized stop delay on transit routes. |
| Transit Operations and Management: Transit Signal Priority | Increase implementation of transit signal priority strategies on X number of routes (or X number of intersections) over the next Y years. | Number of transit routes/intersections equipped with transit signal priority capability. |

**APTS09 – Transit Signal Priority**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## Transit Passenger Counting (APTS10)

This service package counts the number of passengers entering and exiting a transit vehicle using sensors mounted on the vehicle and communicates the collected passenger data back to the management center. The collected data can be used to calculate reliable ridership figures and measure passenger load information at particular stops.

Table 2.2.3-28: APTS10 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Transit Center Passenger Counting | Transit Management |
| On-board Passenger Counting | Transit Vehicle |

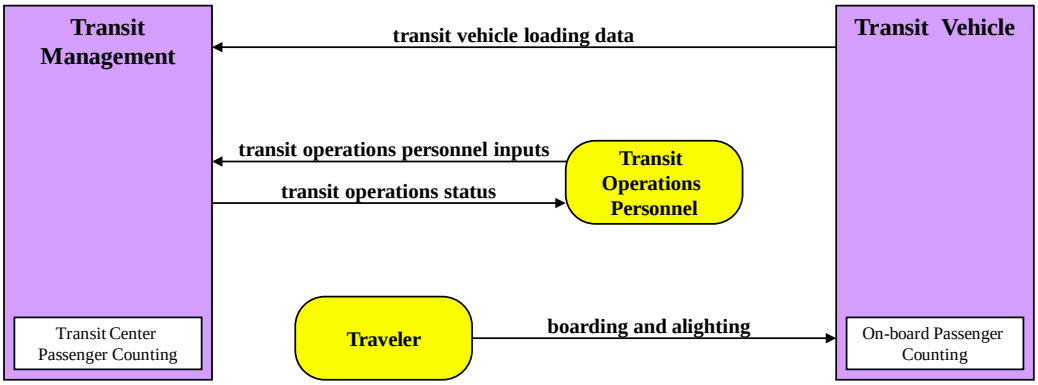
Table 2.2.3-29: APTS10 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |

Table 2.2.3-30: APTS10 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Transit Operations and Management: Loading Standards | Load factors for (route type) routes at each route's busiest point should not exceed X on any vehicle (or on the average vehicle) during peak/off-peak periods. | Load factor. |
| Transit Operations and Management: Loading Standards | No more than X standees should be present at each route's busiest point on any vehicle (or on the average vehicle) during peak/off-peak periods. | Maximum standees. |
| Transit Operations and Management: Loading Standards | No passenger will have to stand for more than X minutes during their journey. | Duration of standee time. |
| Transit Operations and Management: Loading Standards | Passenger loads on (route type) routes at each route's busiest point should not exceed X passengers on any vehicle (or on average) during the hour during peak/off-peak periods | Maximum passenger loads. |

**APTS10 – Transit Passenger Counting**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## Multimodal Connection Protection (APTS11)

This service package supports the coordination of multimodal services to optimize the travel time of travelers as they move from mode to mode (or to different routes within a single mode). A near term function supported by this service package would be for a single transit agency to coordinate crossing routes so that passengers on one route would have the opportunity to transfer with minimum wait time to another route within the same transit system. The next level of complexity of this service package would be for this coordination to occur across transit agencies, or between transit agencies and other modes of transportation. The most advanced functions of this service package would be to track the route of an individual traveler and ensure that connections are properly scheduled on an individual basis. This final capability represents a long-term functionality, which could be managed either through an Information Serviced Provider or through a Transit Management subsystem.

Table 2.2.3-31: APTS11 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Infrastructure Provided Trip Planning | Information Service Provider |
| Personal Trip Planning and Route Guidance | Personal Information Access |
| Remote Transit Information Services | Remote Traveler Support |
| Transit Center Connection Protection | Transit Management |
| On-board Connection Protection | Transit Vehicle |
| On-board Transit Fare Management | Transit Vehicle |

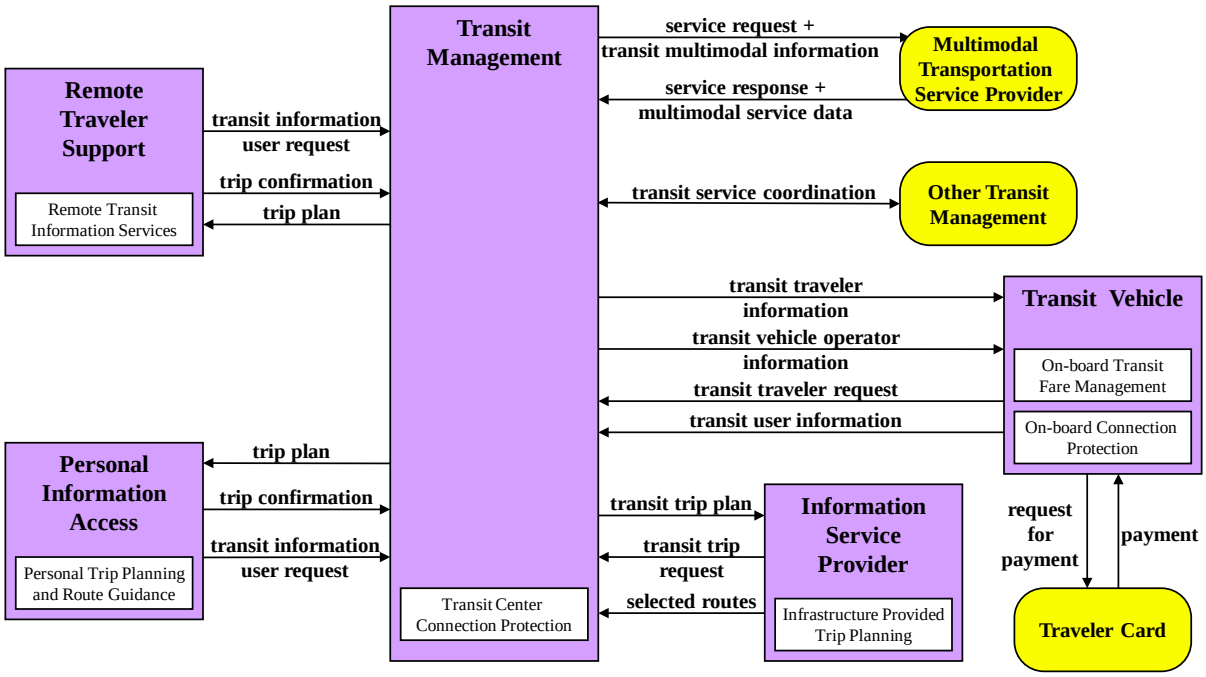
Table 2.2.3-32: APTS11 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight; | Enhance the integration and connectivity of the transportation system |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |

Table 2.2.3-33: APTS11 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Integration: Connectivity | Reduce door-to-door trip time by X percent by year Y. | Average door-to-door trip time. |
| System Efficiency: Trip Connectivity | Reduce door-to-door trip time by X percent by year Y. | Average door-to-door trip time. |

**APTS11 – Multimodal Connection Protection**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## 2.2.4 Traveler Information Service Packages

### Broadcast Traveler Information (ATIS01)

This service package collects traffic conditions, advisories, general public transportation, toll and parking information, incident information, roadway maintenance and construction information, air quality and weather information, and broadcasts the information to travelers using technologies such as FM subcarrier, satellite radio, cellular data broadcasts, and Internet web casts. The information may be provided directly to travelers or provided to merchants and other traveler service providers so that they can better inform their customers of travel conditions. Different from the service package ATMS06 - Traffic Information Dissemination, which provides localized HAR and DMS information capabilities, ATIS01 provides a wide area digital broadcast service. Successful deployment of this service package relies on availability of real-time traveler information from roadway instrumentation, probe vehicles or other sources.

Table 2.2.4-1: ATIS01 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Basic Information Broadcast | Information Service Provider |
| ISP Traveler Data Collection | Information Service Provider |
| Personal Basic Information Reception | Personal Information Access |
| Remote Basic Information Reception | Remote Traveler Support |
| Basic Vehicle Reception | Vehicle |

Table 2.2.4-2: ATIS01 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.4-3: ATIS01 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Emergency/Incident Management: Person Hours of Delay | Reduce the person hours (or vehicle hours) of total delay associated with traffic incidents by X percent over Y years. | Person hours (or vehicle hours) of delay associated with traffic incidents. |
| Emergency/Incident Management: Traveler Information | Increase number of repeat visitors to traveler information website (or 511 system) by X percent in Y years. | Number of repeat visitors to traveler information website (or 511 system). |
| Emergency/Incident Management: Traveler Information | Reduce the time between recovery from incident and removal of traveler alerts for that incident. | Time between recovery from incident and removal of traveler alerts. |
| Emergency/Incident Management: Traveler Information | Reduce time between incident/emergency verification and posting a traveler alert to traveler information outlets (e.g., variable message signs, agency website, 511 system) by X minutes in Y years. | Time to alert motorists of an incident/emergency. |
| Freeway Management: Efficiency | Reduce the number of person hours (or vehicle hours) of delay experienced by travelers on the freeway system. | Hours of delay (vehicle-hours or person-hours). |
| Freeway Management: Efficiency | Reduce the number of person hours (or vehicle hours) of delay experienced by travelers on the freeway system. | Hours of delay per capita or driver. |
| Freeway Management: Efficiency | Reduce the share of freeway miles at Level of Service (LOS) X by Y by year Z. | Miles at LOS X or V/C > 1.0 (or other threshold). |
| Freight Management: Detours and Routing | Provide freight operators with traveler alerts and alternate routes in the case of incidents, special events, weather, construction, and severe congestion at choke points on X percent of freight-significant routes by year Y. | Percent of freight-significant routes where traveler alerts and alternate route information is provided in the case of incidents, special events, weather, construction, and severe congestion at choke points. |
| Special Event Management: Entry/Exit Travel Times | Reduce average time to clear event's exiting queue by X percent in Y years. | Average time to clear event's exiting queue by year per event. |
| Special Event Management: Entry/Exit Travel Times | Reduce average travel time into and out of the event by X percent in Y years. | Average travel time away from selected special events to a set of locations over a year. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Special Event Management: Entry/Exit Travel Times | Reduce average travel time into and out of the event by X percent in Y years. | Average travel time to selected special events from a set of locations in the area over a year. |
| Special Event Management: Entry/Exit Travel Times | Reduce buffer time index for travelers to multiple similar special events by X percent in Y years. | Buffer time index for travelers to multiple similar special events. |
| Special Event Management: Entry/Exit Travel Times | Reduce non-special event VMT in the event area during events by X percent in Y years. | Non-special event VMT in the event area during events over a year. |
| Special Event Management: Traveler Information | Increase the methods of effectively disseminating special event information to travelers by X percent in Y years (e.g., media releases, highway advisory radio, dynamic message signs, commercial AM and FM radio). | Number of effective methods to disseminate special event information to travelers. |
| Special Event Management: Traveler Information | Increase the percentage of planned special events (with attendance above Z) with information on anticipated and actual travel conditions being disseminated to the traveling public at least X hours prior to the event. | Percent of special events with expected attendance over Z that traveler information is disseminated at least X hours prior to the event. |
| System Efficiency: Cost of Congestion | Reduce the annual monetary cost of congestion per capita for the next X years. | Cost (in dollars) of congestion or delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay per driver. |
| System Efficiency: Intensity of Congestion (Travel Time Index) | Reduce the regional average travel time index by X percent per year. | Travel time index (the average travel time during the peak period, using congested speeds, divided by the off-peak period travel time, using posted or free-flow speeds). |
| System Options: Transit Use | Increase average transit load factor by X percent by year Y. | Number of riders on various transit units per trip at peak travel times. |

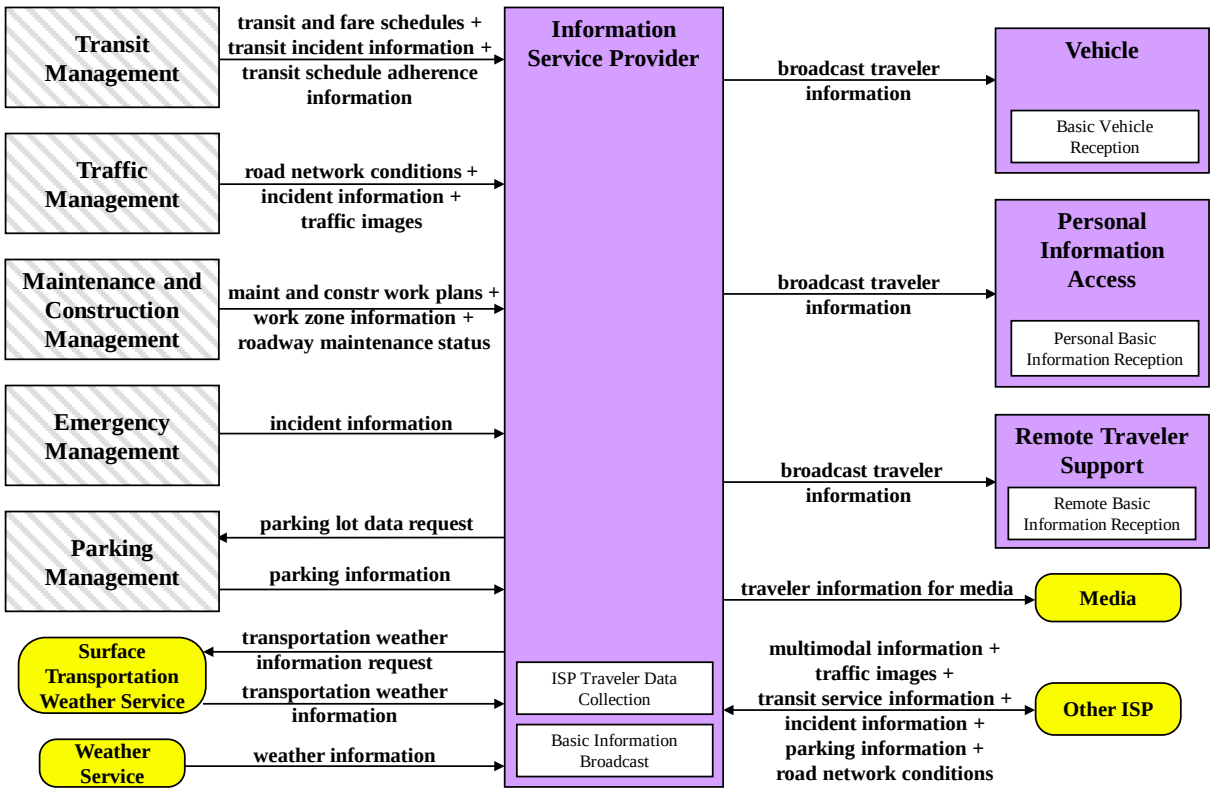
| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Options: Transit Use | Increase passenger miles traveled per capita on transit by X percent by year Y. | Number of passenger miles traveled per capita. |
| System Options: Transit Use | Increase transit mode share by X percent by year Y during peak periods. | Percent of all peak-period trips made by transit. |
| System Options: Transit Use | Increase transit mode share by X percent by year Y. | Percent of all trips made by transit. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by all transient events such as traffic incidents, special events, and work zones. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by scheduled events, work zones, or system maintenance by x hours in y years. | Travel time delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by unscheduled disruptions to travel. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Planning Time Index | Reduce the average planning time for (specific routes in region) by X minutes over the next Y years. | The planning time index represents the time that must be added to travel time at free-flow speeds or the posted speed limit to ensure on time arrivals for 95 percent of the trips. Planning time = 95th percentile travel time (minutes) – Travel time at free-flow speed or posted speed limit. Average planning time index or planning time can be computed using a weighted average over person miles traveled. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Planning Time Index | Reduce the average planning time index for (specific routes in region) by X (no units) over the next Y years. | The planning time index represents the time that must be added to travel time at free-flow speeds or the posted speed limit to ensure on time arrivals for 95 percent of the trips. Planning time = 95th percentile travel time (minutes) – Travel time at free-flow speed or posted speed limit. Average planning time index or planning time can be computed using a weighted average over person miles traveled. |
| System Reliability: Travel Time 90th/95th Percentile | Reduce the 90th (or 95th) percentile travel times for each route selected by X percent over Y years. | 95th or 90th percentile travel times for selected routes. |
| System Reliability: Travel Time 90th/95th Percentile | Reduce the average of the 90th (or 95th) percentile travel times for (a group of specific travel routes or trips in the region) by X minutes in Y years. | 95th or 90th percentile travel times for selected routes. |
| System Reliability: Travel Time Buffer Index | Decrease the average buffer index for (multiple routes or trips) by X percent over Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Travel Time Buffer Index | Decrease the buffer index for (specific travel routes) by X percent over the next Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Travel Time Buffer Index | Reduce the average buffer time needed to arrive on-time for 95 percent of trips on (specified routes) by X minutes over Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Variability | Reduce the variability of travel time on specified routes by X percent during peak and off-peak periods by year Y. | Variance of travel time. Variance is the sum of the squared deviations from the mean. This can also be calculated as the standard deviation of travel time. Standard deviation is the square root of variance. |
| Traveler Information: Customer Satisfaction | Increase customer satisfaction rating of the timeliness, accuracy, and usefulness of traveler information in the region by W, X, and Z percent, respectively, over Y years. | Customer satisfaction ratings of timeliness, accuracy, and usefulness of traveler information. |
| Traveler Information: Information Dissemination | Increase number of users of notifications for traveler information (e.g., e-mail, text message) by X percent in Y years. | Number of users of notifications for traveler information (e.g., e-mail, text message) per year. |
| Traveler Information: Information Dissemination | Increase number of visitors to traveler information website per year by X percent in Y years. | Number of visitors to traveler information website per year. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Traveler Information: Information Dissemination | Increase the accuracy and completeness of traveler information posted (on variable message signs, websites, and/or web 2.0 technologies) by reducing the number of incomplete and inaccurate reports by X percent in Y years. | Number of complaints received from system users about inaccurate or missing information. |
| Work Zone Management: Traveler Information | Provide traveler information regarding work zones using variable message signs (VMS), 511, traveler information websites, and/or Web 2.0 technologies for at least X percent of work zones on major arterials, freeways, and transit routes over the next Y years. | Percent of work zones on major arterials, freeways, and transit routes for which traveler information is available via variable message signs (VMS), 511, traveler information websites, and/or Web 2.0 technologies. |
| Work Zone Management: Traveler Information | Provide travelers with information on multimodal alternatives to avoid work zones for at least X percent of work zones on major arterials, freeways, and transit routes over the next Y years. | Percent of work zones on major arterials, freeways, and transit routes for which information on multimodal alternatives to avoid work zones is available to travelers. |
| Work Zone Management: Traveler Information | Provide work zone information (for upcoming and ongoing construction projects) to all impacted businesses or tenants of business centers with X employees or more by year Y. | Number of impacted businesses or tenants of business centers of X employees or more receiving work zone information (for upcoming and ongoing construction projects). |

**ATIS01 – Broadcast Traveler Information**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Interactive Traveler Information (ATIS02)

This service 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, roadway maintenance and construction, transit services, ride share/ride match, parking management, detours and pricing information. Although the Internet is the predominate network used for traveler information dissemination, a range of two-way wide-area wireless and fixed-point to fixed-point communications systems may be used to support the required data communications between the traveler and Information Service Provider. A variety of interactive devices may be used by the traveler to access information prior to a trip or en route including phone via a 511-like portal and web pages via kiosk, personal digital assistant, personal computer, and a variety of in-vehicle devices. This service package also allows value-added resellers to collect transportation information that can be aggregated and be available to their personal devices or remote traveler systems to better inform their customers of transportation conditions. Successful deployment of this service package relies on availability of real-time transportation data from roadway instrumentation, transit, probe vehicles or other means. A traveler may also input personal preferences and identification information via a “traveler card” that can convey information to the system about the traveler as well as receive updates from the system so the card can be updated over time.

Table 2.2.4-4: ATIS02 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Interactive Infrastructure Information | Information Service Provider |
| ISP Traveler Data Collection | Information Service Provider |
| ISP Traveler Information Alerts | Information Service Provider |
| Traveler Telephone Information | Information Service Provider |
| Personal Interactive Information Reception | Personal Information Access |
| Remote Interactive Information Reception | Remote Traveler Support |
| Interactive Vehicle Reception | Vehicle |

Table 2.2.4-5: ATIS02 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |

| MetroFactor | Goal |
|---|---|
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.4-6: ATIS02 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Emergency/Incident Management: Person Hours of Delay | Reduce the person hours (or vehicle hours) of total delay associated with traffic incidents by X percent over Y years. | Person hours (or vehicle hours) of delay associated with traffic incidents. |
| Emergency/Incident Management: Traveler Information | Increase number of repeat visitors to traveler information website (or 511 system) by X percent in Y years. | Number of repeat visitors to traveler information website (or 511 system). |
| Emergency/Incident Management: Traveler Information | Reduce the time between recovery from incident and removal of traveler alerts for that incident. | Time between recovery from incident and removal of traveler alerts. |
| Emergency/Incident Management: Traveler Information | Reduce time between incident/emergency verification and posting a traveler alert to traveler information outlets (e.g., variable message signs, agency website, 511 system) by X minutes in Y years. | Time to alert motorists of an incident/emergency. |
| Freeway Management: Efficiency | Reduce the number of person hours (or vehicle hours) of delay experienced by travelers on the freeway system. | Hours of delay (vehicle-hours or person-hours). |
| Freeway Management: Efficiency | Reduce the number of person hours (or vehicle hours) of delay experienced by travelers on the freeway system. | Hours of delay per capita or driver. |
| Freeway Management: Efficiency | Reduce the share of freeway miles at Level of Service (LOS) X by Y by year Z. | Miles at LOS X or V/C > 1.0 (or other threshold). |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Freight Management: Detours and Routing | Provide freight operators with traveler alerts and alternate routes in the case of incidents, special events, weather, construction, and severe congestion at choke points on X percent of freight-significant routes by year Y. | Percent of freight-significant routes where traveler alerts and alternate route information is provided in the case of incidents, special events, weather, construction, and severe congestion at choke points. |
| Special Event Management: Entry/Exit Travel Times | Reduce average time to clear event's exiting queue by X percent in Y years. | Average time to clear event's exiting queue by year per event. |
| Special Event Management: Entry/Exit Travel Times | Reduce average travel time into and out of the event by X percent in Y years. | Average travel time away from selected special events to a set of locations over a year. |
| Special Event Management: Entry/Exit Travel Times | Reduce average travel time into and out of the event by X percent in Y years. | Average travel time to selected special events from a set of locations in the area over a year. |
| Special Event Management: Entry/Exit Travel Times | Reduce buffer time index for travelers to multiple similar special events by X percent in Y years. | Buffer time index for travelers to multiple similar special events. |
| Special Event Management: Entry/Exit Travel Times | Reduce non-special event VMT in the event area during events by X percent in Y years. | Non-special event VMT in the event area during events over a year. |
| Special Event Management: Traveler Information | Increase the methods of effectively disseminating special event information to travelers by X percent in Y years (e.g., media releases, highway advisory radio, dynamic message signs, commercial AM and FM radio). | Number of effective methods to disseminate special event information to travelers. |
| Special Event Management: Traveler Information | Increase the percentage of planned special events (with attendance above Z) with information on anticipated and actual travel conditions being disseminated to the traveling public at least X hours prior to the event. | Percent of special events with expected attendance over Z that traveler information is disseminated at least X hours prior to the event. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Cost of Congestion | Reduce the annual monetary cost of congestion per capita for the next X years. | Cost (in dollars) of congestion or delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay per driver. |
| System Efficiency: Intensity of Congestion (Travel Time Index) | Reduce the regional average travel time index by X percent per year. | Travel time index (the average travel time during the peak period, using congested speeds, divided by the off-peak period travel time, using posted or free-flow speeds). |
| System Options: Transit Use | Increase average transit load factor by X percent by year Y. | Number of riders on various transit units per trip at peak travel times. |
| System Options: Transit Use | Increase passenger miles traveled per capita on transit by X percent by year Y. | Number of passenger miles traveled per capita. |
| System Options: Transit Use | Increase transit mode share by X percent by year Y during peak periods. | Percent of all peak-period trips made by transit. |
| System Options: Transit Use | Increase transit mode share by X percent by year Y. | Percent of all trips made by transit. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by all transient events such as traffic incidents, special events, and work zones. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by scheduled events, work zones, or system maintenance by x hours in y years. | Travel time delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by unscheduled disruptions to travel. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |

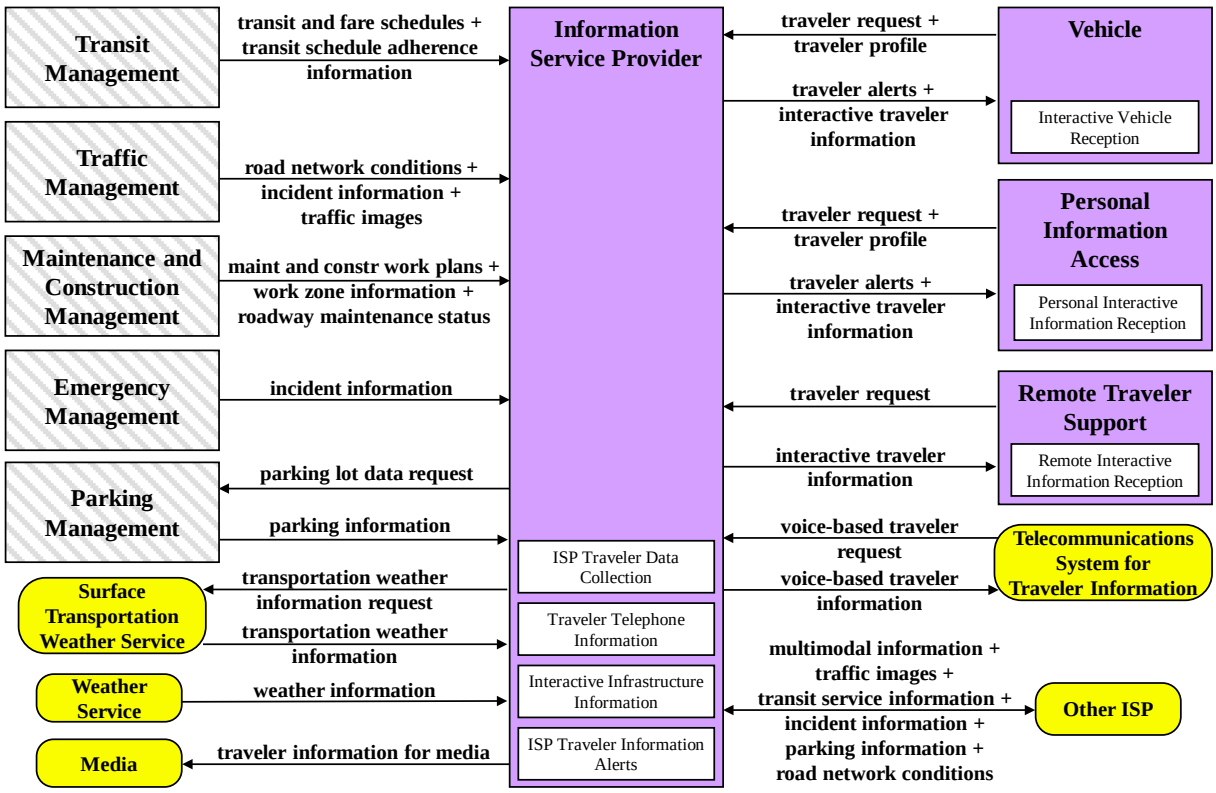
| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Planning Time Index | Reduce the average planning time for (specific routes in region) by X minutes over the next Y years. | The planning time index represents the time that must be added to travel time at free-flow speeds or the posted speed limit to ensure on time arrivals for 95 percent of the trips. Planning time = 95th percentile travel time (minutes) – Travel time at free-flow speed or posted speed limit. Average planning time index or planning time can be computed using a weighted average over person miles traveled. |
| System Reliability: Planning Time Index | Reduce the average planning time index for (specific routes in region) by X (no units) over the next Y years. | The planning time index represents the time that must be added to travel time at free-flow speeds or the posted speed limit to ensure on time arrivals for 95 percent of the trips. Planning time = 95th percentile travel time (minutes) – Travel time at free-flow speed or posted speed limit. Average planning time index or planning time can be computed using a weighted average over person miles traveled. |
| System Reliability: Travel Time 90th/95th Percentile | Reduce the 90th (or 95th) percentile travel times for each route selected by X percent over Y years. | 95th or 90th percentile travel times for selected routes. |
| System Reliability: Travel Time 90th/95th Percentile | Reduce the average of the 90th (or 95th) percentile travel times for (a group of specific travel routes or trips in the region) by X minutes in Y years. | 95th or 90th percentile travel times for selected routes. |
| System Reliability: Travel Time Buffer Index | Decrease the average buffer index for (multiple routes or trips) by X percent over Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Travel Time Buffer Index | Decrease the buffer index for (specific travel routes) by X percent over the next Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Travel Time Buffer Index | Reduce the average buffer time needed to arrive on-time for 95 percent of trips on (specified routes) by X minutes over Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Variability | Reduce the variability of travel time on specified routes by X percent during peak and off-peak periods by year Y. | Variance of travel time. Variance is the sum of the squared deviations from the mean. This can also be calculated as the standard deviation of travel time. Standard deviation is the square root of variance. |
| Travel Weather Management: Disseminating Information | Reduce time to alert travelers of travel weather impacts (using variable message signs, 511, road weather information systems, public information broadcasts, the agency's website, Web 2.0 technologies, etc.) by X (time period or percent) in Y years. | Time from beginning of weather event to posting of traveler information on (variable message signs, 511, Road Weather Information Systems, public information broadcasts etc.). |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Travel Weather Management: Disseminating Information | Reduce time to alert travelers of travel weather impacts (using variable message signs, 511, road weather information systems, public information broadcasts, the agency's website, Web 2.0 technologies, etc.) by X (time period or percent) in Y years. | Time from beginning of weather event to posting of traveler information on agency website. |
| Traveler Information: Customer Satisfaction | Increase customer satisfaction rating of the timeliness, accuracy, and usefulness of traveler information in the region by W, X, and Z percent, respectively, over Y years. | Customer satisfaction ratings of timeliness, accuracy, and usefulness of traveler information. |
| Traveler Information: Information Dissemination | Increase number of 511 calls per year by X percent in Y years. | Number of 511 calls per year. |
| Traveler Information: Information Dissemination | Increase number of users of notifications for traveler information (e.g., e-mail, text message) by X percent in Y years. | Number of users of notifications for traveler information (e.g., e-mail, text message) per year. |
| Traveler Information: Information Dissemination | Increase number of visitors to traveler information website per year by X percent in Y years. | Number of visitors to traveler information website per year. |
| Traveler Information: Information Dissemination | Increase number of Web 2.0 (e.g., Twitter, Facebook) followers by X percent in Y months. | Number of Web 2.0 (e.g., Twitter, Facebook) followers. |
| Traveler Information: Information Dissemination | Increase the accuracy and completeness of traveler information posted (on variable message signs, websites, and/or web 2.0 technologies) by reducing the number of incomplete and inaccurate reports by X percent in Y years. | Number of complaints received from system users about inaccurate or missing information. |
| Traveler Information: Trip Planning Tools | Enhance regional multimodal trip planning tools to X data sources by year Y. | The number of data sources providing information for multi-modal trip planning tools. |
| Traveler Information: Trip Planning Tools | Increase the ease of use of trip planning tools by X percent by year Y. | Trip planning tools ease of use rating. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Traveler Information: Trip Planning Tools | Increase the number of uses of multimodal trip planning tools by X percent by year Y. | Number of uses of trip planning tools. |
| Work Zone Management: Traveler Information | Provide traveler information regarding work zones using variable message signs (VMS), 511, traveler information websites, and/or Web 2.0 technologies for at least X percent of work zones on major arterials, freeways, and transit routes over the next Y years. | Percent of work zones on major arterials, freeways, and transit routes for which traveler information is available via variable message signs (VMS), 511, traveler information websites, and/or Web 2.0 technologies. |
| Work Zone Management: Traveler Information | Provide travelers with information on multimodal alternatives to avoid work zones for at least X percent of work zones on major arterials, freeways, and transit routes over the next Y years. | Percent of work zones on major arterials, freeways, and transit routes for which information on multimodal alternatives to avoid work zones is available to travelers. |
| Work Zone Management: Traveler Information | Provide work zone information (for upcoming and ongoing construction projects) to all impacted businesses or tenants of business centers with X employees or more by year Y. | Number of impacted businesses or tenants of business centers of X employees or more receiving work zone information (for upcoming and ongoing construction projects). |

**ATIS02 – Interactive Traveler Information**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Autonomous Route Guidance (ATIS03)

This service 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.

Table 2.2.4-7: ATIS03 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Personal Autonomous Route Guidance | Personal Information Access |
| Personal Location Determination | Personal Information Access |
| Vehicle Autonomous Route Guidance | Vehicle |
| Vehicle Location Determination | Vehicle |

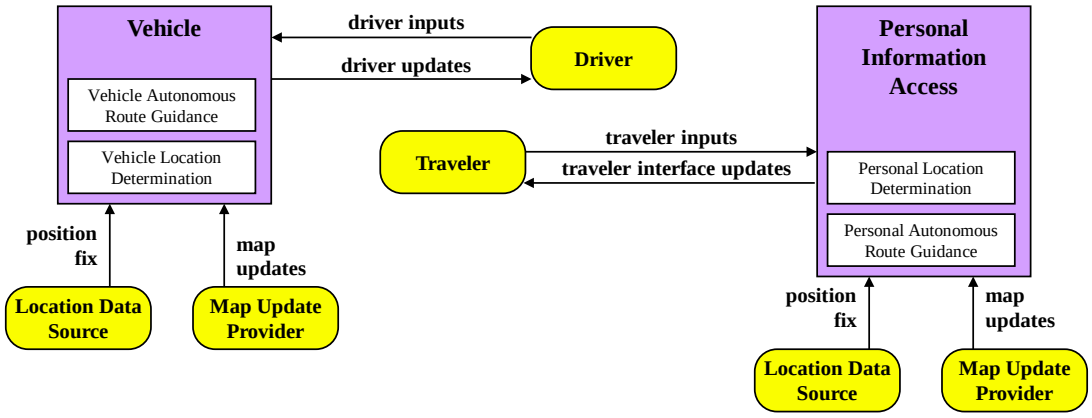
Table 2.2.4-8: ATIS03 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |

Table 2.2.4-9: ATIS03 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Vehicle Miles Traveled | Reduce vehicle miles traveled per capita by X percent by year Y. | Average VMT per capita per day, per week, or per year. |
| System Options: Mode Share | Reduce per capita SOV commute trip rate by X percent in Y years. | SOV commute trips per capita. |

**ATIS03 – Autonomous Route Guidance**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## Dynamic Route Guidance (ATIS04)

This service package offers advanced route planning and guidance that 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.

Table 2.2.4-10: ATIS04 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Basic Information Broadcast | Information Service Provider |
| ISP Traveler Data Collection | Information Service Provider |
| Personal Autonomous Route Guidance | Personal Information Access |
| Personal Basic Information Reception | Personal Information Access |
| Personal Location Determination | Personal Information Access |
| Basic Vehicle Reception | Vehicle |
| Vehicle Autonomous Route Guidance | Vehicle |
| Vehicle Location Determination | Vehicle |

Table 2.2.4-11: ATIS04 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns; | Reduce environmental impacts |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.4-12: ATIS04 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Emergency/Incident Management: Person Hours of Delay | Reduce the person hours (or vehicle hours) of total delay associated with traffic incidents by X percent over Y years. | Person hours (or vehicle hours) of delay associated with traffic incidents. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Freeway Management: Efficiency | Reduce the number of person hours (or vehicle hours) of delay experienced by travelers on the freeway system. | Hours of delay (vehicle-hours or person-hours). |
| Freeway Management: Efficiency | Reduce the number of person hours (or vehicle hours) of delay experienced by travelers on the freeway system. | Hours of delay per capita or driver. |
| Freeway Management: Efficiency | Reduce the share of freeway miles at Level of Service (LOS) X by Y by year Z. | Miles at LOS X or V/C > 1.0 (or other threshold). |
| Freight Management: Detours and Routing | Provide freight operators with traveler alerts and alternate routes in the case of incidents, special events, weather, construction, and severe congestion at choke points on X percent of freight-significant routes by year Y. | Percent of freight-significant routes where traveler alerts and alternate route information is provided in the case of incidents, special events, weather, construction, and severe congestion at choke points. |
| Freight Management: Travel Time Reliability | Reduce buffer index on regional freight routes during peak and off-peak periods by X percent in Y years. | Buffer Index on regional freight routes during peak and off-peak period. |
| Special Event Management: Entry/Exit Travel Times | Reduce average time to clear event's exiting queue by X percent in Y years. | Average time to clear event's exiting queue by year per event. |
| Special Event Management: Entry/Exit Travel Times | Reduce average travel time into and out of the event by X percent in Y years. | Average travel time away from selected special events to a set of locations over a year. |
| Special Event Management: Entry/Exit Travel Times | Reduce average travel time into and out of the event by X percent in Y years. | Average travel time to selected special events from a set of locations in the area over a year. |
| Special Event Management: Entry/Exit Travel Times | Reduce buffer time index for travelers to multiple similar special events by X percent in Y years. | Buffer time index for travelers to multiple similar special events. |
| Special Event Management: Entry/Exit Travel Times | Reduce non-special event VMT in the event area during events by X percent in Y years. | Non-special event VMT in the event area during events over a year. |
| System Efficiency: Cost of Congestion | Reduce the annual monetary cost of congestion per capita for the next X years. | Cost (in dollars) of congestion or delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay per capita. |

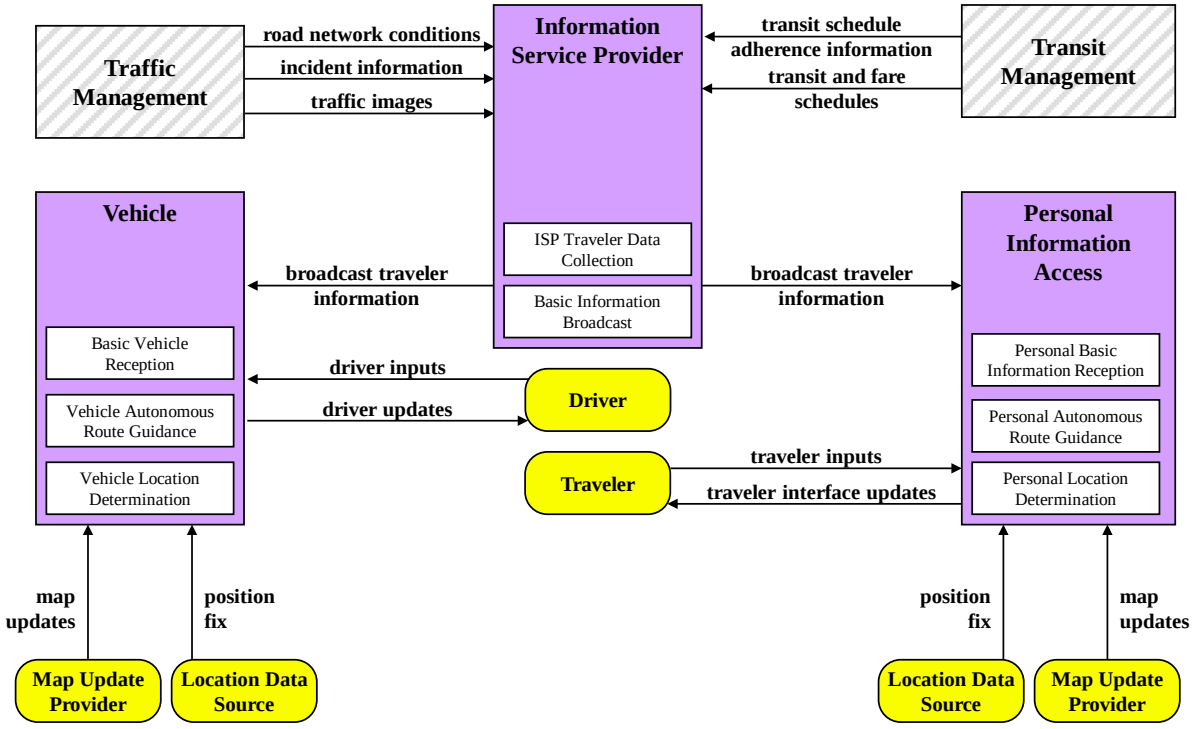
| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay per driver. |
| System Efficiency: Energy Consumption | Reduce excess fuel consumed due to congestion by X percent by year Y. | Excess fuel consumed (total or per capita). |
| System Efficiency: Energy Consumption | Reduce total energy consumption per capita for transportation by X percent by year Y. | Total energy consumed per capita for transportation. |
| System Efficiency: Energy Consumption | Reduce total fuel consumption per capita for transportation by X percent by year Y. | Total fuel consumed per capita for transportation. |
| System Efficiency: Intensity of Congestion (Travel Time Index) | Reduce the regional average travel time index by X percent per year. | Travel time index (the average travel time during the peak period, using congested speeds, divided by the off-peak period travel time, using posted or free-flow speeds). |
| System Efficiency: Travel Time | Annual rate of change in regional average commute travel time will not exceed regional rate of population growth through the year Y. | Average commute trip travel time (minutes). |
| System Efficiency: Travel Time | Improve average travel time during peak periods by X percent by year Y. | Average travel time during peak periods (minutes). |
| System Efficiency: Vehicle Miles Traveled | Reduce vehicle miles traveled per capita by X percent by year Y. | Average VMT per capita per day, per week, or per year. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by all transient events such as traffic incidents, special events, and work zones. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by scheduled events, work zones, or system maintenance by x hours in y years. | Travel time delay during scheduled and/or unscheduled disruptions to travel. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by unscheduled disruptions to travel. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Planning Time Index | Reduce the average planning time for (specific routes in region) by X minutes over the next Y years. | The planning time index represents the time that must be added to travel time at free-flow speeds or the posted speed limit to ensure on time arrivals for 95 percent of the trips. Planning time = 95th percentile travel time (minutes) – Travel time at free-flow speed or posted speed limit. Average planning time index or planning time can be computed using a weighted average over person miles traveled. |
| System Reliability: Planning Time Index | Reduce the average planning time index for (specific routes in region) by X (no units) over the next Y years. | The planning time index represents the time that must be added to travel time at free-flow speeds or the posted speed limit to ensure on time arrivals for 95 percent of the trips. Planning time = 95th percentile travel time (minutes) – Travel time at free-flow speed or posted speed limit. Average planning time index or planning time can be computed using a weighted average over person miles traveled. |
| System Reliability: Travel Time 90th/95th Percentile | Reduce the 90th (or 95th) percentile travel times for each route selected by X percent over Y years. | 95th or 90th percentile travel times for selected routes. |
| System Reliability: Travel Time 90th/95th Percentile | Reduce the average of the 90th (or 95th) percentile travel times for (a group of specific travel routes or trips in the region) by X minutes in Y years. | 95th or 90th percentile travel times for selected routes. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Travel Time Buffer Index | Decrease the average buffer index for (multiple routes or trips) by X percent over Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Travel Time Buffer Index | Decrease the buffer index for (specific travel routes) by X percent over the next Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Travel Time Buffer Index | Reduce the average buffer time needed to arrive on-time for 95 percent of trips on (specified routes) by X minutes over Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Variability | Reduce the variability of travel time on specified routes by X percent during peak and off-peak periods by year Y. | Variance of travel time. Variance is the sum of the squared deviations from the mean. This can also be calculated as the standard deviation of travel time. Standard deviation is the square root of variance. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Work Zone Management: Traveler Information | Provide traveler information regarding work zones using variable message signs (VMS), 511, traveler information websites, and/or Web 2.0 technologies for at least X percent of work zones on major arterials, freeways, and transit routes over the next Y years. | Percent of work zones on major arterials, freeways, and transit routes for which traveler information is available via variable message signs (VMS), 511, traveler information websites, and/or Web 2.0 technologies. |
| Work Zone Management: Traveler Information | Provide travelers with information on multimodal alternatives to avoid work zones for at least X percent of work zones on major arterials, freeways, and transit routes over the next Y years. | Percent of work zones on major arterials, freeways, and transit routes for which information on multimodal alternatives to avoid work zones is available to travelers. |

**ATIS04 – Dynamic Route Guidance**



*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### ISP Based Trip Planning and Route Guidance (ATIS05)

This service package offers the user trip planning and en-route guidance services. It generates a trip plan, including a multimodal route and associated service information (e.g., parking information), based on traveler preferences and constraints. Routes may be based on static information or reflect real time network conditions. Unlike ATIS3 and ATIS4, where the user equipment determines the route, the route determination functions are performed in the Information Service Provider Subsystem in this service package. The trip plan may be confirmed by the traveler and advanced payment and reservations for transit and alternate mode (e.g., airline, rail, and ferry) trip segments, and ancillary services (e.g., parking reservations) are accepted and processed. The confirmed trip plan may include specific routing information that can be supplied to the traveler as general directions or as turn-by-turn route guidance depending on the level of user equipment.

Table 2.2.4-13: ATIS05 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Infrastructure Provided Trip Planning | Information Service Provider |
| ISP Traveler Data Collection | Information Service Provider |
| Personal Location Determination | Personal Information Access |
| Personal Trip Planning and Route Guidance | Personal Information Access |
| Remote Interactive Information Reception | Remote Traveler Support |
| Vehicle Location Determination | Vehicle |
| Vehicle Trip Planning and Route Guidance | Vehicle |

Table 2.2.4-14: ATIS05 Associated Planning Factors and Goals

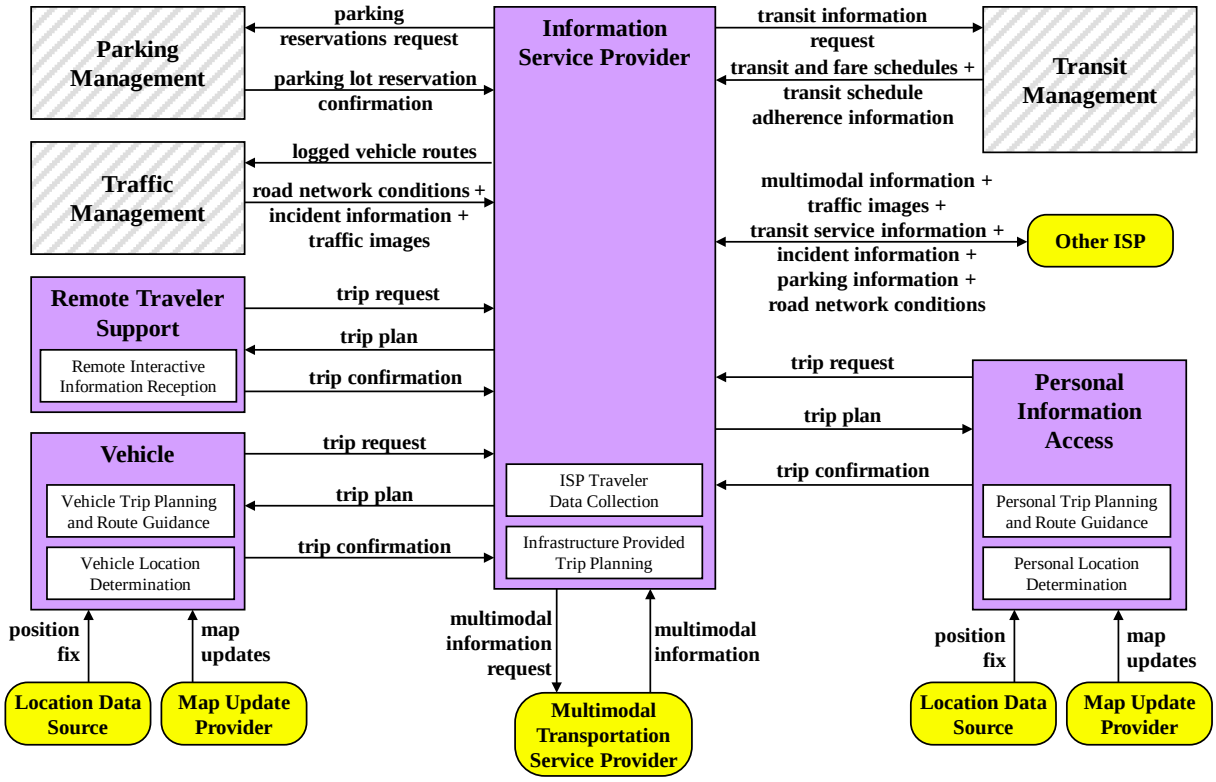
| MetroFactor | Goal |
|---|---|
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns; | Reduce environmental impacts |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.4-15: ATIS05 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Cost of Congestion | Reduce the annual monetary cost of congestion per capita for the next X years. | Cost (in dollars) of congestion or delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay per driver. |
| System Efficiency: Energy Consumption | Reduce excess fuel consumed due to congestion by X percent by year Y. | Excess fuel consumed (total or per capita). |
| System Efficiency: Energy Consumption | Reduce total energy consumption per capita for transportation by X percent by year Y. | Total energy consumed per capita for transportation. |
| System Efficiency: Energy Consumption | Reduce total fuel consumption per capita for transportation by X percent by year Y. | Total fuel consumed per capita for transportation. |
| System Efficiency: Intensity of Congestion (Travel Time Index) | Reduce the regional average travel time index by X percent per year. | Travel time index (the average travel time during the peak period, using congested speeds, divided by the off-peak period travel time, using posted or free-flow speeds). |
| System Efficiency: Travel Time | Annual rate of change in regional average commute travel time will not exceed regional rate of population growth through the year Y. | Average commute trip travel time (minutes). |
| System Efficiency: Travel Time | Improve average travel time during peak periods by X percent by year Y. | Average travel time during peak periods (minutes). |
| System Efficiency: Vehicle Miles Traveled | Reduce vehicle miles traveled per capita by X percent by year Y. | Average VMT per capita per day, per week, or per year. |
| Travel Demand Management: Walking/Bicycling | Annually update bicycle/pedestrian map for accuracy. | Number of months since the last update of the bicycle/pedestrian map. |
| Travel Demand Management: Walking/Bicycling | Increase the number of available tools for travelers that incorporate a bicycle/pedestrian component by X percent by year Y. | Number of traveler tools with a bicycle/pedestrian component. |
| Travel Demand Management: Walking/Bicycling | Increase the number of travelers commuting via walking and/or bicycling by X percent over Y years. | Number of travelers commuting via walking and/or bicycling. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Traveler Information: Customer Satisfaction | Increase customer satisfaction rating of the timeliness, accuracy, and usefulness of traveler information in the region by W, X, and Z percent, respectively, over Y years. | Customer satisfaction ratings of timeliness, accuracy, and usefulness of traveler information. |
| Traveler Information: Trip Planning Tools | Enhance regional multimodal trip planning tools to X data sources by year Y. | The number of data sources providing information for multi-modal trip planning tools. |
| Traveler Information: Trip Planning Tools | Increase the ease of use of trip planning tools by X percent by year Y. | Trip planning tools ease of use rating. |
| Traveler Information: Trip Planning Tools | Increase the number of uses of multimodal trip planning tools by X percent by year Y. | Number of uses of trip planning tools. |
| Work Zone Management: Traveler Information | Provide traveler information regarding work zones using variable message signs (VMS), 511, traveler information websites, and/or Web 2.0 technologies for at least X percent of work zones on major arterials, freeways, and transit routes over the next Y years. | Percent of work zones on major arterials, freeways, and transit routes for which traveler information is available via variable message signs (VMS), 511, traveler information websites, and/or Web 2.0 technologies. |
| Work Zone Management: Traveler Information | Provide travelers with information on multimodal alternatives to avoid work zones for at least X percent of work zones on major arterials, freeways, and transit routes over the next Y years. | Percent of work zones on major arterials, freeways, and transit routes for which information on multimodal alternatives to avoid work zones is available to travelers. |

**ATIS05 – ISP Based Trip Planning and Route Guidance**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Transportation Operations Data Sharing (ATIS06)

This service package makes real-time transportation operations data available to transportation system operators. The Information Service Provider collects, processes, and stores current information on traffic and travel conditions and other information about the current state of the transportation network and makes this information available to transportation system operators, facilitating the exchange of qualified, real-time information between agencies. Using the provided information, transportation system operators can manage their individual systems based on an overall view of the regional transportation system. The regional transportation operations data resource represented by the Information Service Provider may be implemented as a web application that provides a web-based access to system operators, an enterprise database that provides a network interface to remote center applications, or any implementation that supports regional sharing of real-time transportation operations data.

Table 2.2.4-16: ATIS06 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Emergency Transportation Operations Data Collection | Emergency Management |
| ISP Operational Data Repository | Information Service Provider |
| ISP Traveler Data Collection | Information Service Provider |
| MCM Transportation Operations Data Collection | Maintenance and Construction Management |
| TMC Transportation Operations Data Collection | Traffic Management |
| Transit Transportation Operations Data Collection | Transit Management |

Table 2.2.4-17: ATIS06 Associated Planning Factors and Goals

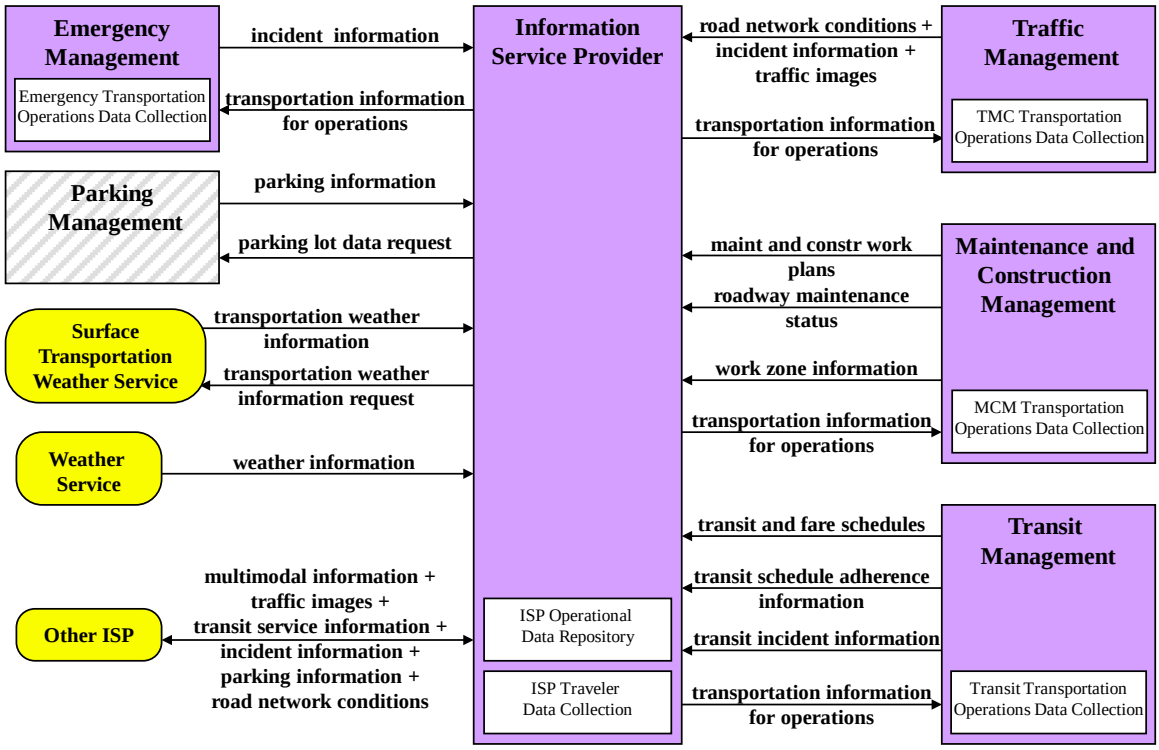
| MetroFactor | Goal |
|---|---|
| Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight; | Enhance the integration and connectivity of the transportation system |
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |

Table 2.2.4-18: ATIS06 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Integration: Transportation Data Collection | Enhance planning with better data | Amount of data gathered from ITS enhancements used in infrastructure and operations planning |
| Integration: Transportation Data Collection | Enhance planning with better data | Number of planning activities using data from ITS systems |
| Integration: Transportation Data Collection | Enhance planning with better data | Years of data in database that is easily searchable and extractable |
| System Efficiency: Trip Connectivity | Reduce cost of transfer fees paid by X percent by year Y. | Average cost of transfers. |
| System Efficiency: Trip Connectivity | Reduce door-to-door trip time by X percent by year Y. | Average door-to-door trip time. |
| Traveler Information: Data Collection and Sharing on Travel Conditions | Increase the percent of modes in the region that share their traveler information with other modes in the region to 100 percent by Y year. | Percent of modes in the region that share their traveler information with other modes. |
| Traveler Information: Data Collection and Sharing on Travel Conditions | Increase the percent of the transportation system in which travel conditions can be detected remotely via CCTV, speed detectors, etc. to X percent by Y year. | Percent of the transportation system in which travel conditions can be detected remotely via CCTV, speed detectors, etc. |
| Traveler Information: Data Collection and Sharing on Travel Conditions | Increase the percent of transportation facilities whose owners share their traveler information with other agencies in the region to X percent by Y year. | Percent of transportation facilities whose owners share their traveler information with other agencies in the region. |

**ATIS06 –Transportation Operations Data Sharing**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Travel Services Information and Reservation (ATIS07)

This service package provides travel information and reservation services to the user. These additional traveler services may be provided using the same basic user equipment used for Interactive Traveler Information. This service package provides multiple ways for accessing information either while en route in a vehicle using wide-area wireless communications or pre-trip via fixed-point to fixed-point connections.

Table 2.2.4-19: ATIS07 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| ISP Travel Services Information and Reservation | Information Service Provider |
| ISP Traveler Data Collection | Information Service Provider |
| Personal Interactive Information Reception | Personal Information Access |
| Remote Interactive Information Reception | Remote Traveler Support |
| Interactive Vehicle Reception | Vehicle |

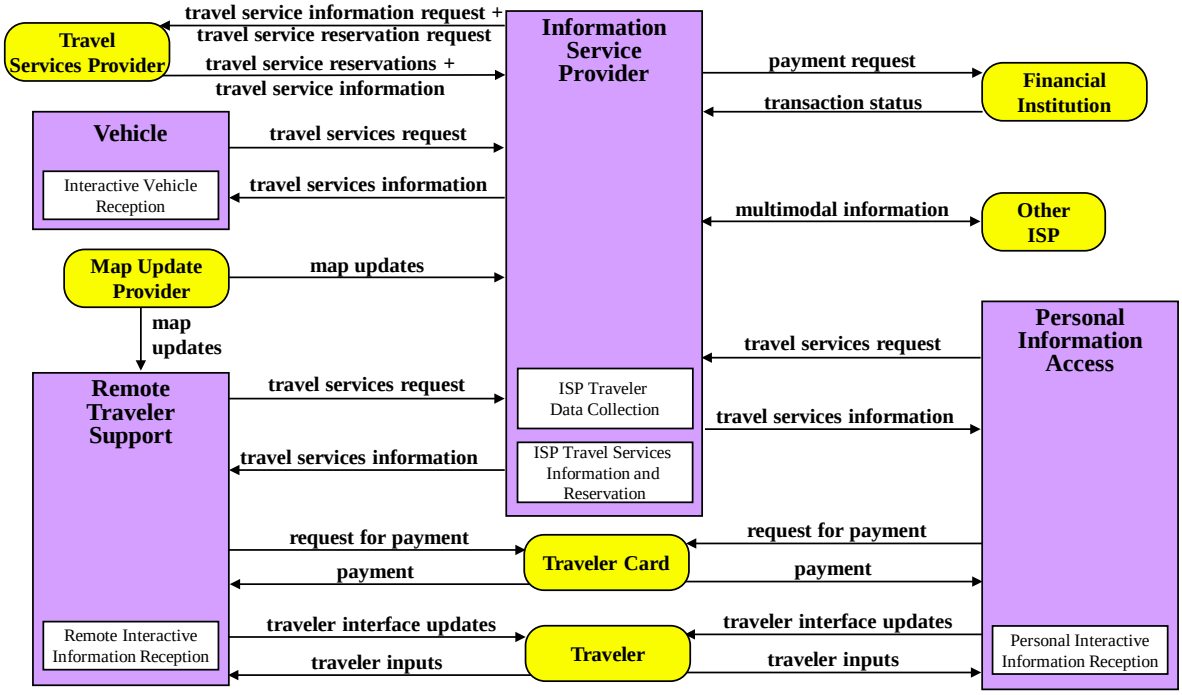
Table 2.2.4-20: ATIS07 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |

Table 2.2.4-21: ATIS07 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Options: Mode Share | Achieve X percent alternative (non-SOV) mode share in transit station communities (or other destinations) by year Y. | Percent of all trips made using alternative modes in transit station communities. |
| System Options: Transit Use | Increase transit mode share by X percent by year Y. | Percent of all trips made by transit. |

**ATIS07 – Travel Services Information and Reservation**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## Dynamic Ridesharing (ATIS08)

This service package provides dynamic ridesharing/ride matching services to travelers. This service could allow near real time ridesharing reservations to be made through the same basic user equipment used for Interactive Traveler Information. This ridesharing/ride matching capability also includes arranging connections to transit or other multimodal services.

Table 2.2.4-22: ATIS08 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Infrastructure Provided Dynamic Ridesharing | Information Service Provider |
| Infrastructure Provided Trip Planning | Information Service Provider |
| ISP Traveler Data Collection | Information Service Provider |
| Personal Interactive Information Reception | Personal Information Access |
| Remote Interactive Information Reception | Remote Traveler Support |
| Vehicle Trip Planning and Route Guidance | Vehicle |

Table 2.2.4-23: ATIS08 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns; | Reduce environmental impacts |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

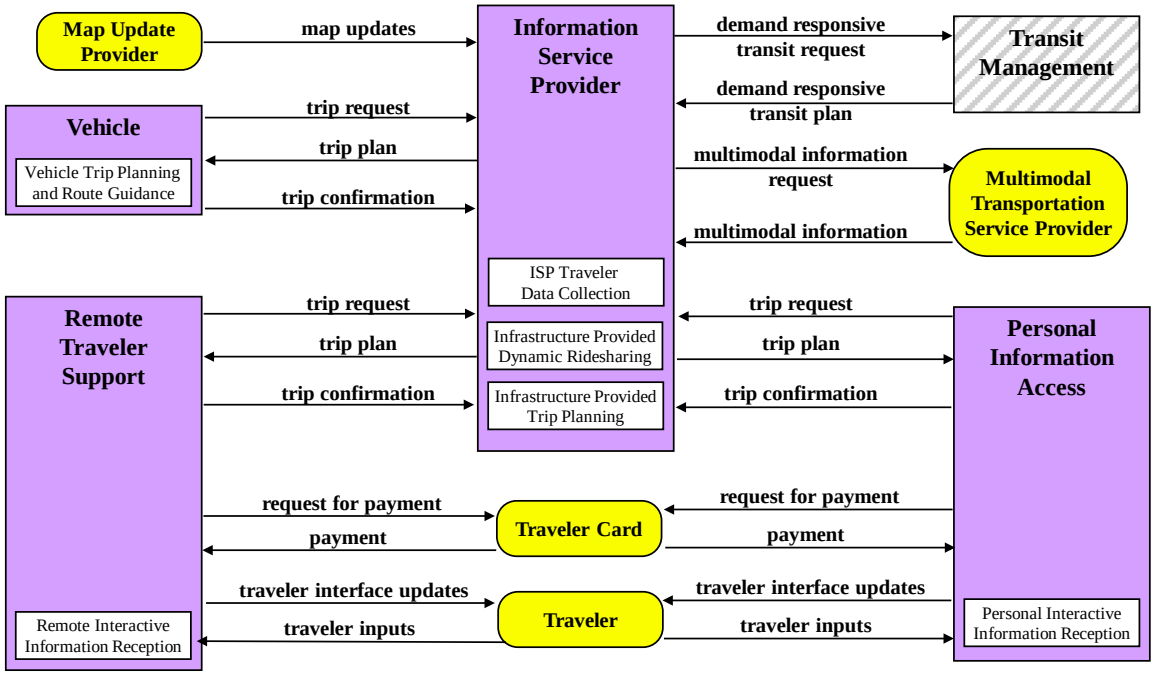
Table 2.2.4-24: ATIS08 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Special Event Management: Mode Shift from SOV | Decrease the percent of special event attendees traveling to the event in single-occupancy vehicles by X percent in Y years. | Percent of special event attendees using single-occupancy vehicles each year for selected events. |
| Special Event Management: Mode Shift from SOV | Increase the percent of special event attendees using park & ride lots by X percent in Y years. | Percent of special event attendees utilizing park & ride lots each year for selected events. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Special Event Management: Mode Shift from SOV | Increase the percent of special events with dedicated shuttle service by X percent in Y years. | Percent of special events with dedicated shuttle service for selected events during a 1-year period. |
| System Efficiency: Cost of Congestion | Reduce the annual monetary cost of congestion per capita for the next X years. | Cost (in dollars) of congestion or delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay per driver. |
| System Efficiency: Duration of Congestion | Reduce the daily hours of recurring congestion on major freeways from X to Y by year Z. | Hours per day at LOS F or V/C > 1.0 (or other threshold). |
| System Efficiency: Duration of Congestion | Reduce the number of hours per day that the top 20 most congested roadways experience recurring congestion by X percent by year Y. | Hours per day at LOS F or V/C > 1.0 (or other threshold). |
| System Efficiency: Energy Consumption | Reduce excess fuel consumed due to congestion by X percent by year Y. | Excess fuel consumed (total or per capita). |
| System Efficiency: Energy Consumption | Reduce total energy consumption per capita for transportation by X percent by year Y. | Total energy consumed per capita for transportation. |
| System Efficiency: Energy Consumption | Reduce total fuel consumption per capita for transportation by X percent by year Y. | Total fuel consumed per capita for transportation. |
| System Efficiency: Extent of Congestion | Maintain the rate of growth in facility miles experiencing recurring congestion as less than the population growth rate (or employment growth rate). | Percent of lane-miles (or rail) operating at LOS F or V/C > 1.0 |
| System Efficiency: Extent of Congestion | Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period by X percent by year Y. | Percent of lane-miles (or rail) operating at LOS F or V/C > 1.0 |
| System Efficiency: Extent of Congestion | Reduce the share of major intersections operating at LOS Z by X percent by year Y. | Percent of intersections operating at LOS F or V/C > 1.0 |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Intensity of Congestion (Travel Time Index) | Reduce the regional average travel time index by X percent per year. | Travel time index (the average travel time during the peak period, using congested speeds, divided by the off-peak period travel time, using posted or free-flow speeds). |
| System Efficiency: Travel Time | Annual rate of change in regional average commute travel time will not exceed regional rate of population growth through the year Y. | Average commute trip travel time (minutes). |
| System Efficiency: Travel Time | Improve average travel time during peak periods by X percent by year Y. | Average travel time during peak periods (minutes). |
| System Efficiency: Vehicle Miles Traveled | Reduce vehicle miles traveled per capita by X percent by year Y. | Average VMT per capita per day, per week, or per year. |
| System Options: Mode Share | Achieve X percent alternative (non-SOV) mode share in transit station communities (or other destinations) by year Y. | Percent of all trips made using alternative modes in transit station communities. |
| System Options: Mode Share | Increase alternative (non-SOV) mode share for all trips by X percent within the next Y years. | Share of trips by each mode of travel. |
| System Options: Mode Share | Reduce SOV vehicle trips by X percent through travel demand management strategies (e.g., employer or residential rideshare) by year Y. | Share of employees walking, biking, telecommuting, carpooling/vanpooling, riding transit, driving alone. |
| Travel Demand Management: Carpool/Vanpool | Create and share regional carpool/vanpool database with Z number of employers per year. | Number of employers with access to regional carpool/vanpool database. |
| Travel Demand Management: Carpool/Vanpool | Increase the number of carpools by X percent over the next Y years. | Share of household trips by each mode of travel. |
| Travel Demand Management: Carpool/Vanpool | Increase use of vanpools by X percent over the next Y years. | Share of household trips by each mode of travel. |
| Travel Demand Management: Carpool/Vanpool | Provide carpool/vanpool matching and ridesharing information services by year Y. | Availability of carpool/vanpool matching and ridesharing information services. |
| Travel Demand Management: Carpool/Vanpool | Reduce trips per year in region by X percent through carpools/vanpools. | Number of person trips by carpool/vanpool in region. |
| Travel Demand Management: Carpool/Vanpool | Reduce trips per year in region by X percent through carpools/vanpools. | Number of trips in region. |

**ATIS08 - Dynamic Ridesharing**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### In Vehicle Signing (ATIS09)

This service package augments regulatory, warning, and informational signs and signals by providing information directly to drivers through in-vehicle devices. The information provided would include static sign information (e.g., stop, curve warning, guide signs, service signs, and directional signs) and dynamic information (e.g., current signal states including highway intersection and highway-rail intersection status and local conditions warnings identified by local environmental sensors). It includes short range communications between field equipment and the vehicle and connections to the Traffic Management Subsystem for monitoring and control. This service package also includes the capability for maintenance and construction, transit, and emergency vehicles to transmit sign information to vehicles in the vicinity so that in vehicle signing can be used without fixed infrastructure in work zones, around incidents, and in areas where transit operations impacts traffic.

Table 2.2.4-25: ATIS09 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| On-board EV Incident Management Communication | Emergency Vehicle |
| MCV Vehicle Safety Monitoring | Maintenance and Construction Vehicle |
| Parking Short Range Traveler Information Communications | Parking Management |
| Roadway Equipment Coordination | Roadway |
| Roadway Short Range Traveler Information Communications | Roadway |
| TMC In-Vehicle Signing Management | Traffic Management |
| On-board Transit In Vehicle Signing Communications | Transit Vehicle |
| Vehicle Short Range Traveler Information Reception | Vehicle |

Table 2.2.4-26: ATIS09 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |

| MetroFactor | Goal |
|---|---|
| Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns; | Reduce environmental impacts |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.4-27: ATIS09 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Arterial Management: Reliability | Reduce delay associated with incidents on arterials by X percent by year Y. | Hours of delay associated with incidents. |
| Emergency/Incident Management: Person Hours of Delay | Reduce the person hours (or vehicle hours) of total delay associated with traffic incidents by X percent over Y years. | Person hours (or vehicle hours) of delay associated with traffic incidents. |
| Emergency/Incident Management: Traveler Information | Reduce the time between recovery from incident and removal of traveler alerts for that incident. | Time between recovery from incident and removal of traveler alerts. |
| Emergency/Incident Management: Traveler Information | Reduce time between incident/emergency verification and posting a traveler alert to traveler information outlets (e.g., variable message signs, agency website, 511 system) by X minutes in Y years. | Time to alert motorists of an incident/emergency. |
| Freeway Management: Efficiency | Reduce the number of person hours (or vehicle hours) of delay experienced by travelers on the freeway system. | Hours of delay (vehicle-hours or person-hours). |
| Freeway Management: Efficiency | Reduce the number of person hours (or vehicle hours) of delay experienced by travelers on the freeway system. | Hours of delay per capita or driver. |
| Freeway Management: Efficiency | Reduce the share of freeway miles at Level of Service (LOS) X by Y by year Z. | Miles at LOS X or V/C > 1.0 (or other threshold). |
| Freeway Management: Reliability | Reduce buffer index on the freeway system during peak and off-peak periods by X percent in Y years. | The buffer index (represents the extra time (buffer) travelers add to their average travel time when planning trips in order to arrive on-time 95 percent of the time). |

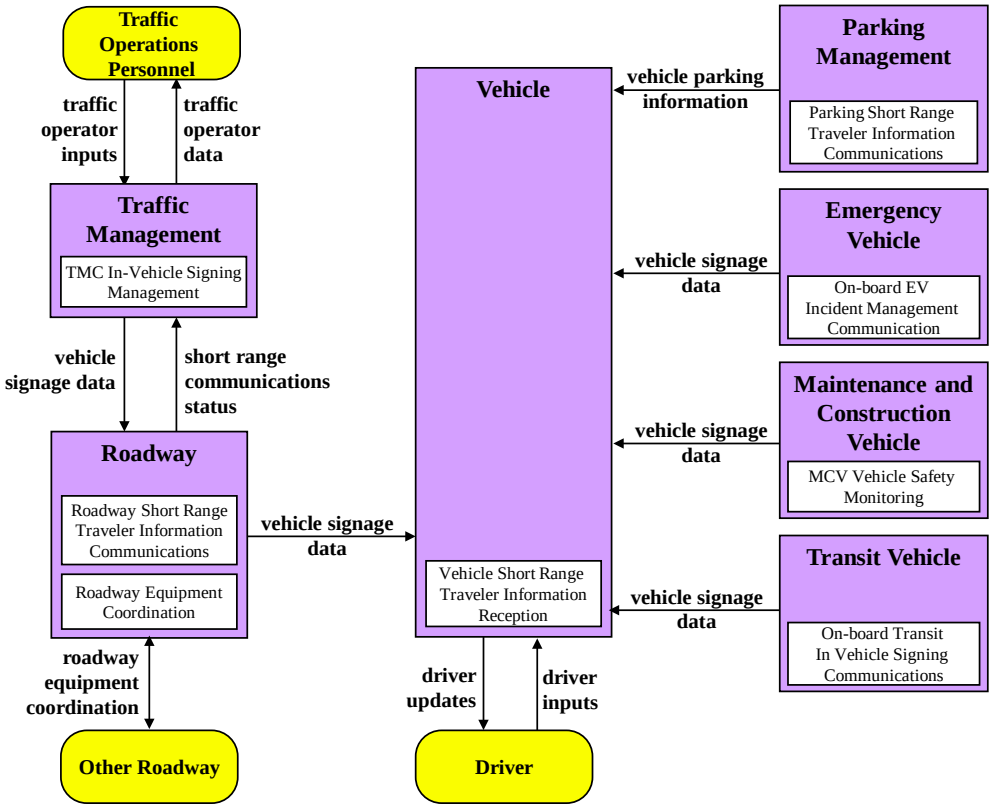
| Objective Category | Objective | Performance Measure |
|---|---|---|
| Freeway Management: Reliability | Reduce delay associated with incidents on the freeway system by X percent by year Y. | Hours of delay associated with incidents. |
| Freight Management: Detours and Routing | Provide freight operators with traveler alerts and alternate routes in the case of incidents, special events, weather, construction, and severe congestion at choke points on X percent of freight-significant routes by year Y. | Percent of freight-significant routes where traveler alerts and alternate route information is provided in the case of incidents, special events, weather, construction, and severe congestion at choke points. |
| System Efficiency: Cost of Congestion | Reduce the annual monetary cost of congestion per capita for the next X years. | Cost (in dollars) of congestion or delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay per driver. |
| System Efficiency: Energy Consumption | Reduce excess fuel consumed due to congestion by X percent by year Y. | Excess fuel consumed (total or per capita). |
| System Efficiency: Energy Consumption | Reduce total energy consumption per capita for transportation by X percent by year Y. | Total energy consumed per capita for transportation. |
| System Efficiency: Energy Consumption | Reduce total fuel consumption per capita for transportation by X percent by year Y. | Total fuel consumed per capita for transportation. |
| System Efficiency: Intensity of Congestion (Travel Time Index) | Reduce the regional average travel time index by X percent per year. | Travel time index (the average travel time during the peak period, using congested speeds, divided by the off-peak period travel time, using posted or free-flow speeds). |
| System Efficiency: Travel Time | Annual rate of change in regional average commute travel time will not exceed regional rate of population growth through the year Y. | Average commute trip travel time (minutes). |
| System Efficiency: Travel Time | Improve average travel time during peak periods by X percent by year Y. | Average travel time during peak periods (minutes). |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by all transient events such as traffic incidents, special events, and work zones. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by scheduled events, work zones, or system maintenance by x hours in y years. | Travel time delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by unscheduled disruptions to travel. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Travel Time 90th/95th Percentile | Reduce the 90th (or 95th) percentile travel times for each route selected by X percent over Y years. | 95th or 90th percentile travel times for selected routes. |
| System Reliability: Travel Time 90th/95th Percentile | Reduce the average of the 90th (or 95th) percentile travel times for (a group of specific travel routes or trips in the region) by X minutes in Y years. | 95th or 90th percentile travel times for selected routes. |
| System Reliability: Travel Time Buffer Index | Decrease the average buffer index for (multiple routes or trips) by X percent over Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Travel Time Buffer Index | Decrease the buffer index for (specific travel routes) by X percent over the next Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Travel Time Buffer Index | Reduce the average buffer time needed to arrive on-time for 95 percent of trips on (specified routes) by X minutes over Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Variability | Reduce the variability of travel time on specified routes by X percent during peak and off-peak periods by year Y. | Variance of travel time. Variance is the sum of the squared deviations from the mean. This can also be calculated as the standard deviation of travel time. Standard deviation is the square root of variance. |
| Travel Weather Management: Disseminating Information | Reduce time to alert travelers of travel weather impacts (using variable message signs, 511, road weather information systems, public information broadcasts, the agency's website, Web 2.0 technologies, etc.) by X (time period or percent) in Y years. | Time from beginning of weather event to posting of traveler information on (variable message signs, 511, Road Weather Information Systems, public information broadcasts etc.). |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Travel Weather Management: Disseminating Information | Reduce time to alert travelers of travel weather impacts (using variable message signs, 511, road weather information systems, public information broadcasts, the agency's website, Web 2.0 technologies, etc.) by X (time period or percent) in Y years. | Time from beginning of weather event to posting of traveler information on agency website. |
| Traveler Information: Information Dissemination | Increase number of users of notifications for traveler information (e.g., e-mail, text message) by X percent in Y years. | Number of users of notifications for traveler information (e.g., e-mail, text message) per year. |
| Traveler Information: Information Dissemination | Increase the accuracy and completeness of traveler information posted (on variable message signs, websites, and/or web 2.0 technologies) by reducing the number of incomplete and inaccurate reports by X percent in Y years. | Number of complaints received from system users about inaccurate or missing information. |

**ATIS09 - In Vehicle Signing**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## Short Range Communications Traveler Information (ATIS10)

This service package provides location-specific or situation-relevant information to travelers in vehicles using Dedicated Short Range Communications (DSRC) infrastructure supporting mobility applications for connected vehicles. DSRC is used to deliver real-time traveler information including travel times, incident information, road conditions, and emergency traveler information to vehicles as they pass DSRC roadside equipment along their route. This service package provides public information that is available to all equipped vehicles in the vicinity of the roadside equipment.

Table 2.2.4-28: ATIS10 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| ISP Short Range Communications Traveler Information Distribution | Information Service Provider |
| ISP Traveler Data Collection | Information Service Provider |
| Roadway Short Range Traveler Information Communications | Roadway |
| Vehicle Short Range Traveler Information Reception | Vehicle |

Table 2.2.4-29: ATIS10 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns; | Reduce environmental impacts |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.4-30: ATIS10 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Arterial Management: Reliability | Reduce delay associated with incidents on arterials by X percent by year Y. | Hours of delay associated with incidents. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Emergency/Incident Management: Person Hours of Delay | Reduce the person hours (or vehicle hours) of total delay associated with traffic incidents by X percent over Y years. | Person hours (or vehicle hours) of delay associated with traffic incidents. |
| Emergency/Incident Management: Traveler Information | Reduce the time between recovery from incident and removal of traveler alerts for that incident. | Time between recovery from incident and removal of traveler alerts. |
| Emergency/Incident Management: Traveler Information | Reduce time between incident/emergency verification and posting a traveler alert to traveler information outlets (e.g., variable message signs, agency website, 511 system) by X minutes in Y years. | Time to alert motorists of an incident/emergency. |
| Freeway Management: Efficiency | Reduce the number of person hours (or vehicle hours) of delay experienced by travelers on the freeway system. | Hours of delay (vehicle-hours or person-hours). |
| Freeway Management: Efficiency | Reduce the number of person hours (or vehicle hours) of delay experienced by travelers on the freeway system. | Hours of delay per capita or driver. |
| Freeway Management: Efficiency | Reduce the share of freeway miles at Level of Service (LOS) X by Y by year Z. | Miles at LOS X or V/C > 1.0 (or other threshold). |
| Freeway Management: Reliability | Reduce buffer index on the freeway system during peak and off-peak periods by X percent in Y years. | The buffer index (represents the extra time (buffer) travelers add to their average travel time when planning trips in order to arrive on-time 95 percent of the time). |
| Freeway Management: Reliability | Reduce delay associated with incidents on the freeway system by X percent by year Y. | Hours of delay associated with incidents. |
| Freight Management: Detours and Routing | Provide freight operators with traveler alerts and alternate routes in the case of incidents, special events, weather, construction, and severe congestion at choke points on X percent of freight-significant routes by year Y. | Percent of freight-significant routes where traveler alerts and alternate route information is provided in the case of incidents, special events, weather, construction, and severe congestion at choke points. |
| System Efficiency: Cost of Congestion | Reduce the annual monetary cost of congestion per capita for the next X years. | Cost (in dollars) of congestion or delay per capita. |

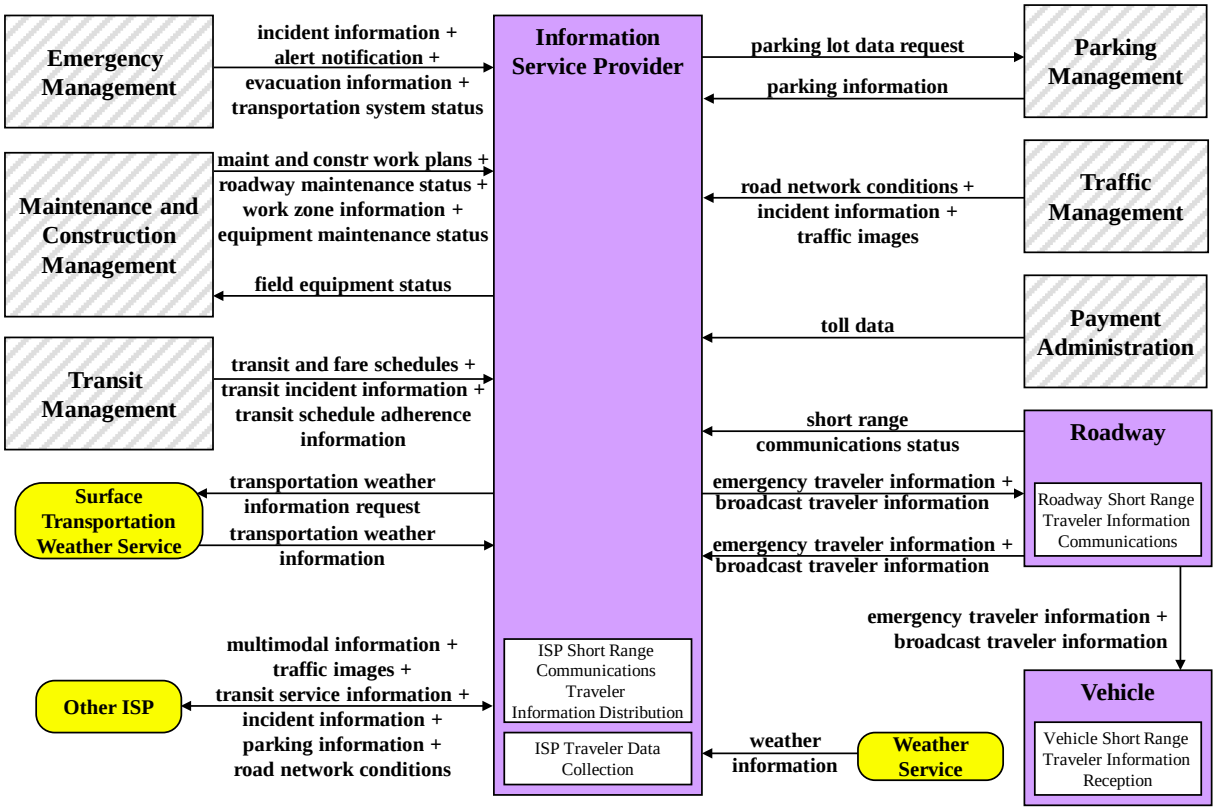
| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay per driver. |
| System Efficiency: Energy Consumption | Reduce excess fuel consumed due to congestion by X percent by year Y. | Excess fuel consumed (total or per capita). |
| System Efficiency: Energy Consumption | Reduce total energy consumption per capita for transportation by X percent by year Y. | Total energy consumed per capita for transportation. |
| System Efficiency: Energy Consumption | Reduce total fuel consumption per capita for transportation by X percent by year Y. | Total fuel consumed per capita for transportation. |
| System Efficiency: Intensity of Congestion (Travel Time Index) | Reduce the regional average travel time index by X percent per year. | Travel time index (the average travel time during the peak period, using congested speeds, divided by the off-peak period travel time, using posted or free-flow speeds). |
| System Efficiency: Travel Time | Annual rate of change in regional average commute travel time will not exceed regional rate of population growth through the year Y. | Average commute trip travel time (minutes). |
| System Efficiency: Travel Time | Improve average travel time during peak periods by X percent by year Y. | Average travel time during peak periods (minutes). |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by all transient events such as traffic incidents, special events, and work zones. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by scheduled events, work zones, or system maintenance by x hours in y years. | Travel time delay during scheduled and/or unscheduled disruptions to travel. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Non-Recurring Delay | Reduce total person hours of delay (or travel-time delay per capita) by time period (peak, off-peak) caused by unscheduled disruptions to travel. | Total person hours of delay during scheduled and/or unscheduled disruptions to travel. |
| System Reliability: Travel Time 90th/95th Percentile | Reduce the 90th (or 95th) percentile travel times for each route selected by X percent over Y years. | 95th or 90th percentile travel times for selected routes. |
| System Reliability: Travel Time 90th/95th Percentile | Reduce the average of the 90th (or 95th) percentile travel times for (a group of specific travel routes or trips in the region) by X minutes in Y years. | 95th or 90th percentile travel times for selected routes. |
| System Reliability: Travel Time Buffer Index | Decrease the average buffer index for (multiple routes or trips) by X percent over Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Travel Time Buffer Index | Decrease the buffer index for (specific travel routes) by X percent over the next Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Reliability: Travel Time Buffer Index | Reduce the average buffer time needed to arrive on-time for 95 percent of trips on (specified routes) by X minutes over Y years. | The buffer index represents the extra time (buffer) most travelers add to their average travel time when planning trips. This is the extra time between the average travel time and near-worst case travel time (95th percentile). The buffer index is stated as a percentage of the average travel time. Average buffer index or buffer time can be calculated using miles traveled as a weighting factor. Buffer time = 95th percentile travel time (min) – average travel time (min). |
| System Reliability: Variability | Reduce the variability of travel time on specified routes by X percent during peak and off-peak periods by year Y. | Variance of travel time. Variance is the sum of the squared deviations from the mean. This can also be calculated as the standard deviation of travel time. Standard deviation is the square root of variance. |
| Travel Weather Management: Disseminating Information | Reduce time to alert travelers of travel weather impacts (using variable message signs, 511, road weather information systems, public information broadcasts, the agency's website, Web 2.0 technologies, etc.) by X (time period or percent) in Y years. | Time from beginning of weather event to posting of traveler information on (variable message signs, 511, Road Weather Information Systems, public information broadcasts etc.). |
| Travel Weather Management: Disseminating Information | Reduce time to alert travelers of travel weather impacts (using variable message signs, 511, road weather information systems, public information broadcasts, the agency's website, Web 2.0 technologies, etc.) by X (time period or percent) in Y years. | Time from beginning of weather event to posting of traveler information on agency website. |
| Traveler Information: Customer Satisfaction | Increase customer satisfaction rating of the timeliness, accuracy, and usefulness of traveler information in the region by W, X, and Z percent, respectively, over Y years. | Customer satisfaction ratings of timeliness, accuracy, and usefulness of traveler information. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Traveler Information: Information Dissemination | Increase number of users of notifications for traveler information (e.g., e-mail, text message) by X percent in Y years. | Number of users of notifications for traveler information (e.g., e-mail, text message) per year. |
| Traveler Information: Information Dissemination | Increase the accuracy and completeness of traveler information posted (on variable message signs, websites, and/or web 2.0 technologies) by reducing the number of incomplete and inaccurate reports by X percent in Y years. | Number of complaints received from system users about inaccurate or missing information. |
| Work Zone Management: Traveler Information | Provide traveler information regarding work zones using variable message signs (VMS), 511, traveler information websites, and/or Web 2.0 technologies for at least X percent of work zones on major arterials, freeways, and transit routes over the next Y years. | Percent of work zones on major arterials, freeways, and transit routes for which traveler information is available via variable message signs (VMS), 511, traveler information websites, and/or Web 2.0 technologies. |
| Work Zone Management: Traveler Information | Provide travelers with information on multimodal alternatives to avoid work zones for at least X percent of work zones on major arterials, freeways, and transit routes over the next Y years. | Percent of work zones on major arterials, freeways, and transit routes for which information on multimodal alternatives to avoid work zones is available to travelers. |

**ATIS10 – Short Range Communications Traveler Information**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## 2.2.5 Commercial Vehicle Operations Service Packages

### Carrier Operations and Fleet Management (CVO01)

This service package provides the capabilities to manage a fleet of commercial vehicles. The Fleet and Freight Management subsystem provides the route for a commercial vehicle by either utilizing an in-house routing software package or an Information Service Provider. Routes generated by either approach are constrained by hazardous materials and other restrictions (such as height or weight). Any such restricted areas are determined by the Commercial Vehicle Administration. A route would be electronically sent to the Commercial Vehicle with any appropriate dispatch instructions. The location of the Commercial Vehicle can be monitored by the Fleet and Freight Management subsystem and routing changes can be made depending on current road network conditions. Once a route has been assigned, changes must be coordinated between the Fleet and Freight Management subsystem and the Commercial Vehicle. Commercial Vehicle Drivers would be alerted to any changes in route from the planned route and given an opportunity to justify a rerouting. Any unauthorized or unexpected route changes by the Commercial Vehicle will register a route deviation alert with the Fleet and Freight Management subsystem. The Fleet and Freight Management subsystem can also notify local public safety agencies of the route deviation when appropriate (e.g., if there is safety sensitive HAZMAT being carried), by sending an alarm to the Emergency Management subsystem.

Table 2.2.5-1: CVO01 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| On-board Trip Monitoring | Commercial Vehicle |
| Fleet Administration | Fleet and Freight Management |

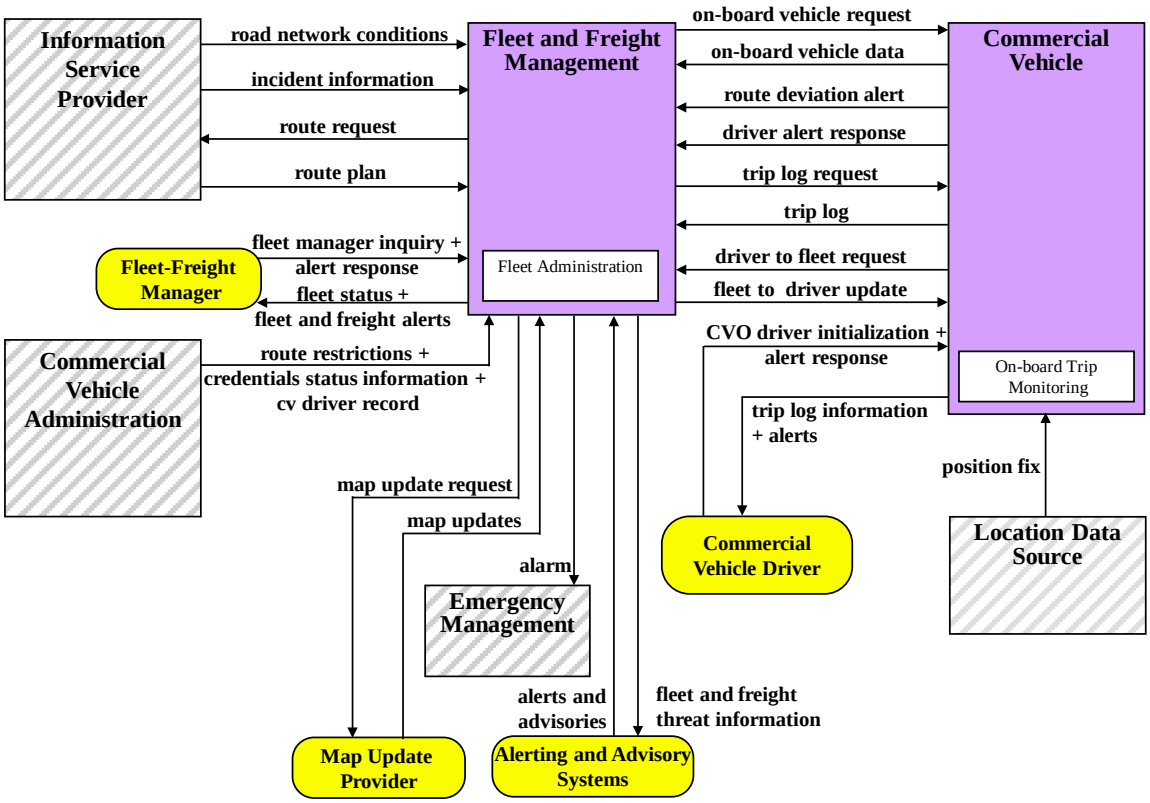
Table 2.2.5-2: CVO01 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.5-3: CVO01 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Freight Management: Customer Satisfaction | Increase ratings for customer satisfaction with freight mobility in the region among shippers, receivers, and carriers by X percent in Y years. | Percentage of customers satisfied with region's freight management practices. |
| Freight Management: Travel Time Delay | Decrease point-to-point travel times on selected freight-significant highways by Y minutes within Y years. | Point-to-point travel times on selected freight-significant highways. |

**CVO01 – Carrier Operations and Fleet Management**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Freight Administration (CVO02)

This service package tracks the movement of cargo and monitors the cargo condition. Interconnections are provided to intermodal freight shippers and intermodal freight depots for tracking of cargo from source to destination. In addition to the usual cargo monitoring required to insure that cargo gets from origin to destination, the Fleet and Freight Management subsystem monitors shipments to make sure that no tampering or breach of security occurs to the cargo on commercial vehicles. Any such tampering will be reported to the Fleet and Freight Management subsystem. In addition to exceptions (e.g., alerts) that are reported, on-going indications of the state of the various freight equipment are reported to the Fleet and Freight Management subsystem. The commercial vehicle driver is also alerted of any tampering or breach of cargo security. Freight managers may decide to take further action on the alerts and/or provide responses that explain that the alerts are false alarms. If no explanation is received, the Fleet and Freight Management subsystem may notify the Emergency Management subsystem. Commercial vehicle and freight security breaches may also be sent to the Commercial Vehicle Check subsystem.

Table 2.2.5-4: CVO02 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| On-board Cargo Monitoring | Commercial Vehicle |
| On-board CV Safety and Security | Commercial Vehicle |
| On-board Trip Monitoring | Commercial Vehicle |
| Roadside Safety and Security Inspection | Commercial Vehicle Check |
| Commercial Vehicle and Freight Security | Fleet and Freight Management |
| Fleet Administration | Fleet and Freight Management |
| Freight Administration and Management | Fleet and Freight Management |

Table 2.2.5-5: CVO02 Associated Planning Factors and Goals

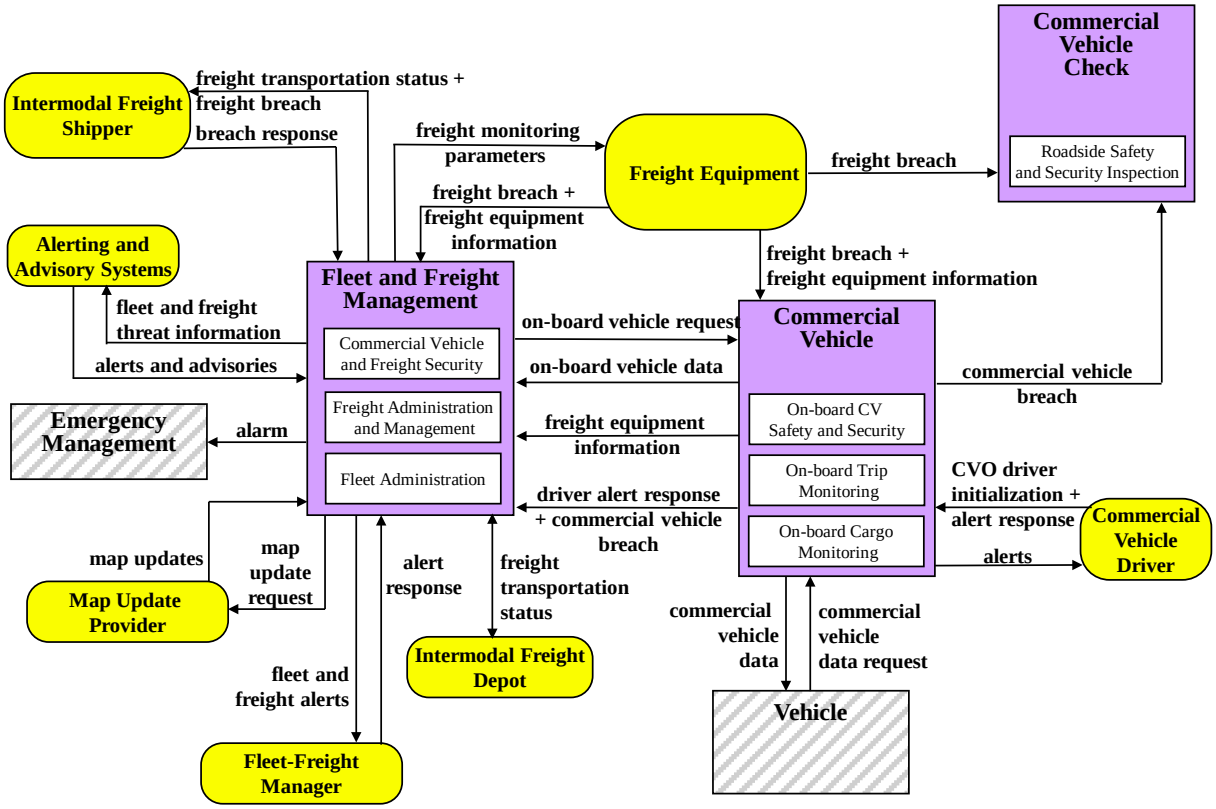
| MetroFactor | Goal |
|---|---|
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.5-6: CVO02 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Freight Management: Intermodal Facilities | Reduce the average duration of delays per month at intermodal facilities by X percent in Y years. | Average duration of delays per month at intermodal facilities. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Freight Management: Intermodal Facilities | Reduce the frequency of delays per month at intermodal facilities by X percent in Y years. | Frequency of delays per month at intermodal facilities where a delay is defined as an addition of Z minutes to free flow conditions. |

**CVO02 - Freight Administration**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## Electronic Clearance (CVO03)

This service package provides for automated clearance at roadside check facilities. The roadside check facility communicates with the Commercial Vehicle Administration subsystem to retrieve infrastructure snapshots of critical carrier, vehicle, and driver data to be used to sort passing vehicles. This allows a good driver/vehicle/carrier to pass roadside facilities at highway speeds using transponders and Field-Vehicle Communications to the roadside. Results of roadside clearance activities will be passed on to the Commercial Vehicle Administration. The roadside check facility may be equipped with Automated Vehicle Identification (AVI), weighing sensors, transponder read/write devices and computer workstations.

Table 2.2.5-7: CVO03 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| On-board CV Electronic Data | Commercial Vehicle |
| CV Information Exchange | Commercial Vehicle Administration |
| CV Safety and Security Administration | Commercial Vehicle Administration |
| Citation and Accident Electronic Recording | Commercial Vehicle Check |
| Roadside Electronic Screening | Commercial Vehicle Check |

Table 2.2.5-8: CVO03 Associated Planning Factors and Goals

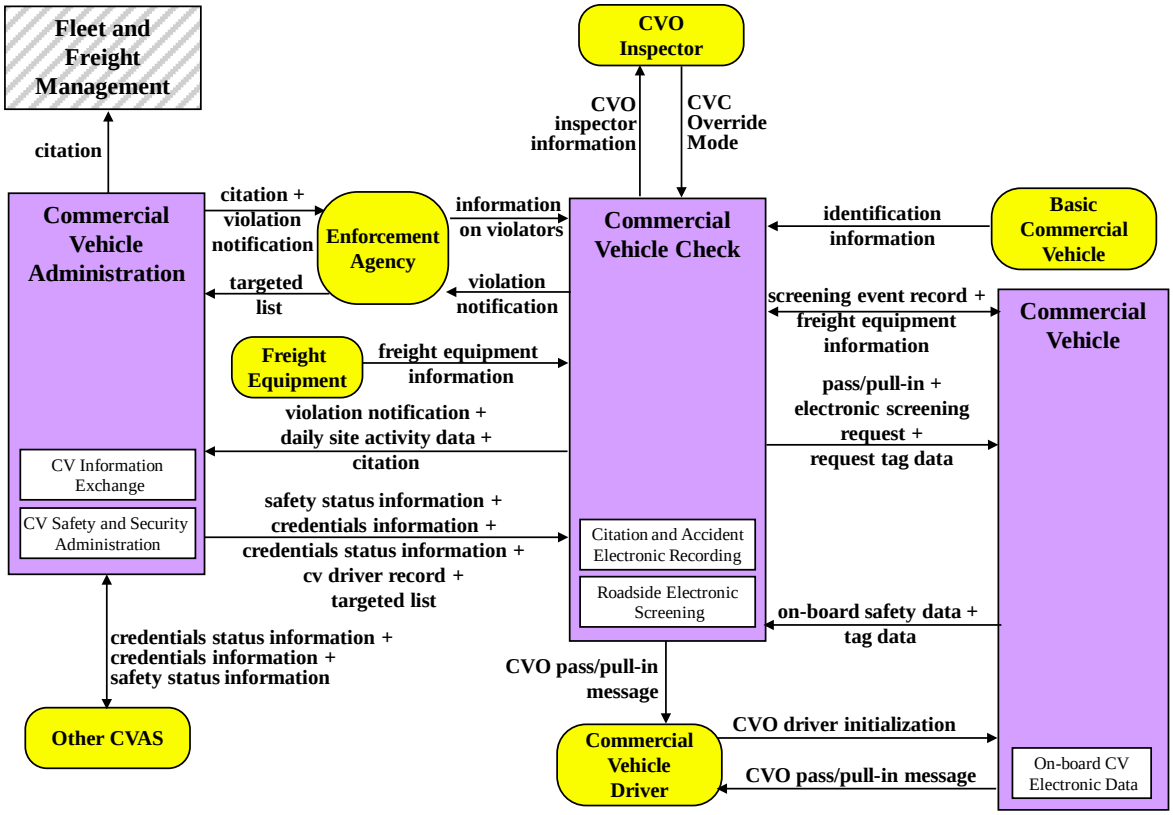
| MetroFactor | Goal |
|---|---|
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.5-9: CVO03 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Freight Management: Border Crossing | Increase the use of electronic credentialing to X percent of weigh stations and border crossings by year Y. | Percent of weigh stations and border crossings in the region that use electronic credentialing. |
| Freight Management: Customer Satisfaction | Increase ratings for customer satisfaction with freight mobility in the region among shippers, receivers, and carriers by X percent in Y years. | Percentage of customers satisfied with region's freight management practices. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Freight Management: Travel Time Delay | Decrease hours of delay per 1,000 vehicle miles traveled on selected freight-significant highways by X percent in Y years. | Hours of delay per 1,000 vehicle miles on selected freight-significant highways. |
| Freight Management: Travel Time Delay | Decrease point-to-point travel times on selected freight-significant highways by Y minutes within Y years. | Point-to-point travel times on selected freight-significant highways. |
| Freight Management: Travel Time Delay | Decrease the annual average travel time index for freight by X points in Y years. | Travel time index: ratio of observed average travel time to free-flow travel time. |
| Freight Management: Travel Time Delay | Increase the mobility index ([Ton-miles of travel] / [Vehicle-miles of travel * | |
| Average speed]) by X percent in Y years. | Mobility index for system users defined as [Ton-miles of travel] / [Vehicle-miles of travel * Average speed]. | |
| Freight Management: Travel Time Reliability | Reduce buffer index on regional freight routes during peak and off-peak periods by X percent in Y years. | Buffer Index on regional freight routes during peak and off-peak period. |

**CVO03 - Electronic Clearance**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### CV Administrative Processes (CVO04)

This service package supports program administration and enrollment and 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 a variety of programs including electronic clearance and wireless inspection programs which allow commercial vehicles to be screened at mainline speeds. Through this enrollment process, current profile databases are maintained in the Commercial Vehicle Administration subsystem and snapshots of this data are made available to the roadside check facilities. Current program status is maintained and made available to carriers, drivers, and other authorized users of the data. Enrolled carriers are provided the option to review and challenge the collected data.

Commercial Vehicle Administration subsystems can share current program status and credential information with other Commercial Vehicle Administration subsystems, so that it is possible for any Commercial Vehicle Administration subsystem to have access to all credentials, credential fees, credentials status and safety status information. In addition, it is possible for one Commercial Vehicle Administration subsystem to collect HAZMAT route restrictions information from other Commercial Vehicle Administration subsystems and then act as a clearinghouse for this route restrictions information for Information Service Providers, Map Update Providers, and Fleet and Freight Management subsystems.

Table 2.2.5-10: CVO04 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Credentials and Taxes Administration | Commercial Vehicle Administration |
| CV Information Exchange | Commercial Vehicle Administration |
| Fleet Administration | Fleet and Freight Management |
| Fleet Credentials and Taxes Management and Reporting | Fleet and Freight Management |

Table 2.2.5-11: CVO04 Associated Planning Factors and Goals

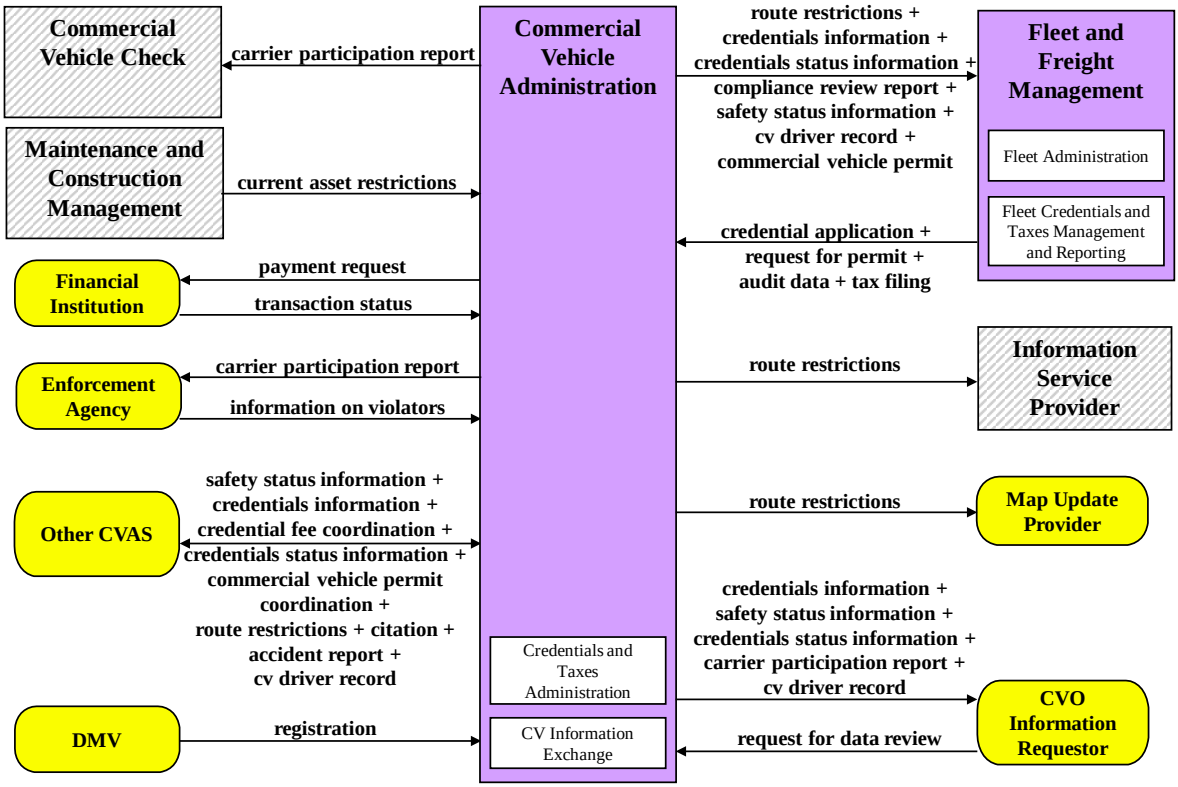
| MetroFactor | Goal |
|---|---|
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.5-12: CVO04 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Freight Management: Customer Satisfaction | Increase ratings for customer satisfaction with freight mobility in the region among shippers, receivers, and carriers by X percent in Y years. | Percentage of customers satisfied with region's freight management practices. |
| Freight Management: Travel Time Delay | Decrease hours of delay per 1,000 vehicle miles traveled on selected freight-significant highways by X percent in Y years. | Hours of delay per 1,000 vehicle miles on selected freight-significant highways. |
| Freight Management: Travel Time Delay | Decrease point-to-point travel times on selected freight-significant highways by Y minutes within Y years. | Point-to-point travel times on selected freight-significant highways. |
| Freight Management: Travel Time Delay | Decrease the annual average travel time index for freight by X points in Y years. | Travel time index: ratio of observed average travel time to free-flow travel time. |
| Freight Management: Travel Time Delay | Increase the mobility index ([Ton-miles of travel] / [Vehicle-miles of travel * | |
| Average speed]) by X percent in Y years. | Mobility index for system users defined as [Ton-miles of travel] / [Vehicle-miles of travel * Average speed]. | |

**CVO04 - CV Administrative Processes**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### International Border Electronic Clearance (CVO05)

This service package provides for automated clearance at international border crossings. It augments the Electronic Clearance service package by allowing interface with border administration and border inspection related functions. This service package processes the entry documentation for vehicle, cargo, and driver, checks compliance with import/export and immigration regulations, handles duty fee processing, and reports the results of the crossing event to manage release of commercial vehicle, cargo, and driver across an international border. It interfaces with administrative systems used by customs and border protection, immigration, carriers, and service providers (e.g., brokers) and inspection systems at international border crossings to generate, process, and store entry documentation.

Table 2.2.5-13: CVO05 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| On-board CV Electronic Data | Commercial Vehicle |
| CV Information Exchange | Commercial Vehicle Administration |
| CV Safety and Security Administration | Commercial Vehicle Administration |
| International CV Administration | Commercial Vehicle Administration |
| International Border Crossing | Commercial Vehicle Check |
| Roadside Electronic Screening | Commercial Vehicle Check |
| Freight Administration and Management | Fleet and Freight Management |

Table 2.2.5-14: CVO05 Associated Planning Factors and Goals

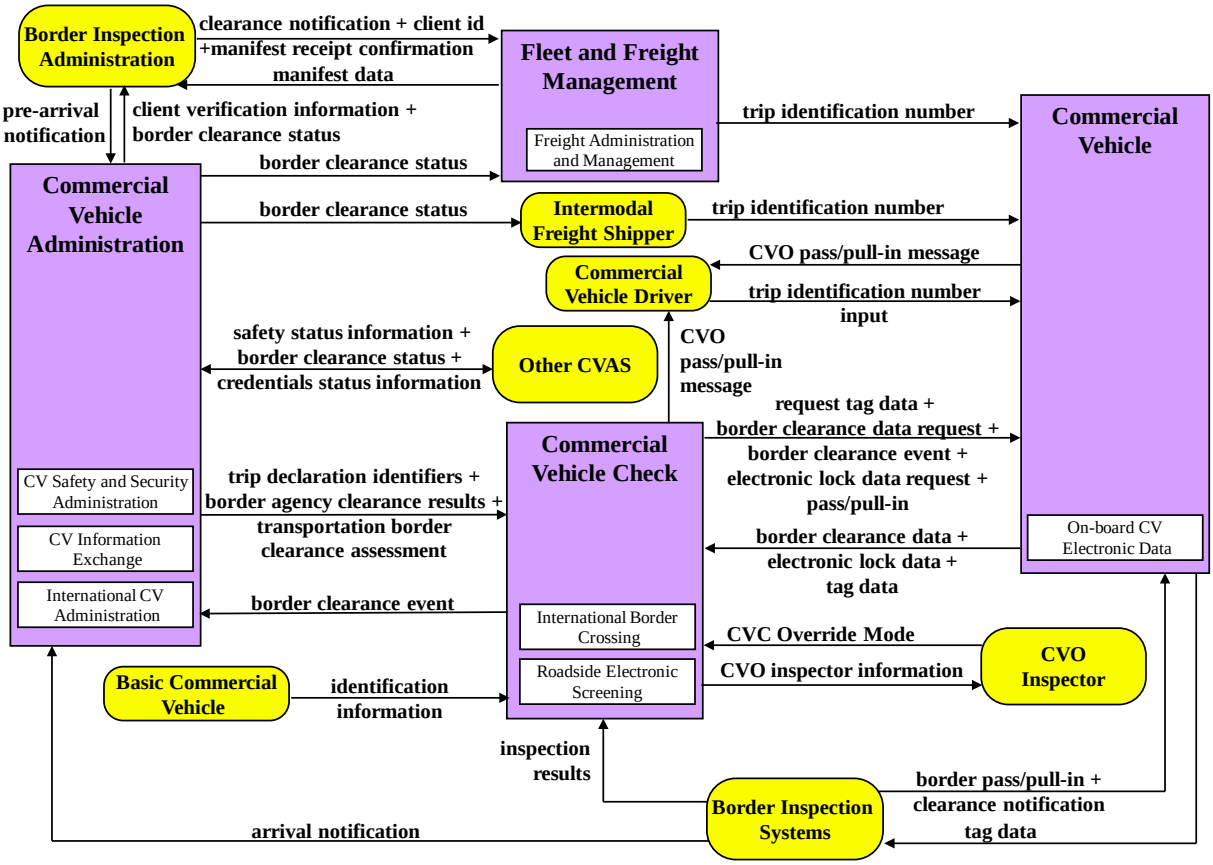
| MetroFactor | Goal |
|---|---|
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.5-15: CVO05 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Freight Management: Border Crossing | Decrease average crossing times at international borders by X minutes for each border in the region over Y years. | Average border crossing time for freight at international borders per year. |
| Freight Management: Border Crossing | Increase the use of electronic credentialing to X percent of weigh stations and border crossings by year Y. | Percent of weigh stations and border crossings in the region that use electronic credentialing. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Freight Management: Customer Satisfaction | Increase ratings for customer satisfaction with freight mobility in the region among shippers, receivers, and carriers by X percent in Y years. | Percentage of customers satisfied with region's freight management practices. |
| Freight Management: Travel Time Delay | Decrease hours of delay per 1,000 vehicle miles traveled on selected freight-significant highways by X percent in Y years. | Hours of delay per 1,000 vehicle miles on selected freight-significant highways. |
| Freight Management: Travel Time Delay | Decrease point-to-point travel times on selected freight-significant highways by Y minutes within Y years. | Point-to-point travel times on selected freight-significant highways. |
| Freight Management: Travel Time Delay | Decrease the annual average travel time index for freight by X points in Y years. | Travel time index: ratio of observed average travel time to free-flow travel time. |
| Freight Management: Travel Time Delay | Increase the mobility index ([Ton-miles of travel] / [Vehicle-miles of travel * | |
| Average speed]) by X percent in Y years. | Mobility index for system users defined as [Ton-miles of travel] / [Vehicle-miles of travel * Average speed]. | |
| Freight Management: Travel Time Reliability | Reduce buffer index on regional freight routes during peak and off-peak periods by X percent in Y years. | Buffer Index on regional freight routes during peak and off-peak period. |

## CVO05 - International Border Electronic Clearance




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## Weigh-In-Motion (CVO06)

This service package provides for high speed weigh-in-motion with or without Automated Vehicle Identification (AVI) capabilities. This service package provides the roadside equipment that could be used as a stand-alone system or to augment the Electronic Clearance (CVO03) service package.

Table 2.2.5-16: CVO06 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| On-board CV Electronic Data | Commercial Vehicle |
| Roadside WIM | Commercial Vehicle Check |

Table 2.2.5-17: CVO06 Associated Planning Factors and Goals

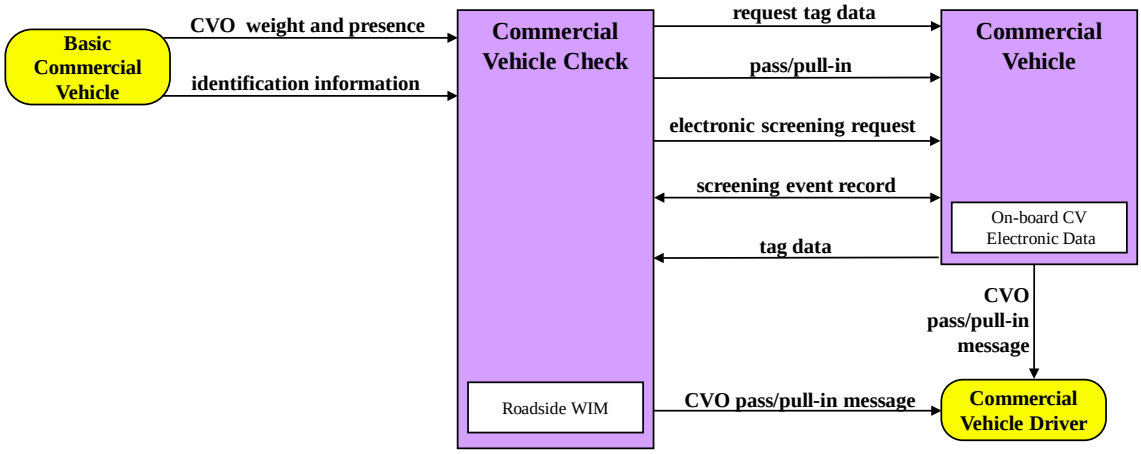
| MetroFactor | Goal |
|---|---|
| Emphasize the preservation of the existing transportation system. | Preserve the transportation system |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.5-18: CVO06 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Freight Management: Border Crossing | Increase the use of electronic credentialing to X percent of weigh stations and border crossings by year Y. | Percent of weigh stations and border crossings in the region that use electronic credentialing. |
| Freight Management: Customer Satisfaction | Increase ratings for customer satisfaction with freight mobility in the region among shippers, receivers, and carriers by X percent in Y years. | Percentage of customers satisfied with region's freight management practices. |
| Freight Management: Travel Time Delay | Decrease hours of delay per 1,000 vehicle miles traveled on selected freight-significant highways by X percent in Y years. | Hours of delay per 1,000 vehicle miles on selected freight-significant highways. |
| Freight Management: Travel Time Delay | Decrease point-to-point travel times on selected freight-significant highways by Y minutes within Y years. | Point-to-point travel times on selected freight-significant highways. |
| Freight Management: Travel Time Delay | Decrease the annual average travel time index for freight by X points in Y years. | Travel time index: ratio of observed average travel time to free-flow travel time. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Freight Management: Travel Time Delay | Increase the mobility index ([Ton-miles of travel] / [Vehicle-miles of travel * | |
| Average speed]) by X percent in Y years. | Mobility index for system users defined as [Ton-miles of travel] / [Vehicle-miles of travel * Average speed]. | |
| Freight Management: Travel Time Reliability | Reduce buffer index on regional freight routes during peak and off-peak periods by X percent in Y years. | Buffer Index on regional freight routes during peak and off-peak period. |
| Preservation: Preserve Existing Infrastructure | Distressed pavement condition lane-miles not to exceed X percent of total state highway system | Distressed pavement condition lane miles |
| Preservation: Preserve Existing Infrastructure | Maintain pavement condition index (PCI) of X or greater for local streets and roads | Pavement condition index |
| Preservation: Preserve Existing Infrastructure | Reduce commercial vehicle size and weight violations | Number of size and weight violations |
| System Reliability: Travel Time 90th/95th Percentile | Reduce the 90th (or 95th) percentile travel times for each route selected by X percent over Y years. | 95th or 90th percentile travel times for selected routes. |

**CVO06 - Weigh-In-Motion**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Roadside CVO Safety (CVO07)

This service package provides for automated roadside safety monitoring and reporting. It automates commercial vehicle safety inspections at the roadside check locations. The capabilities for performing the safety inspection are shared between this service package and the On-board CVO and Freight Safety & Security (CVO08) service package which enables a variety of implementation options. The basic option, directly supported by this service package, facilitates safety inspection of vehicles that have been pulled off the highway, perhaps as a result of the automated screening process provided by the Electronic Clearance (CVO03) service 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 and Freight Safety & Security (CVO08) service package, utilize additional on-board vehicle safety monitoring and reporting capabilities in the commercial vehicle to augment the roadside safety check.

Table 2.2.5-19: CVO07 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| On-board CV Electronic Data | Commercial Vehicle |
| On-board CV Safety and Security | Commercial Vehicle |
| Credentials and Taxes Administration | Commercial Vehicle Administration |
| CV Information Exchange | Commercial Vehicle Administration |
| CV Safety and Security Administration | Commercial Vehicle Administration |
| Citation and Accident Electronic Recording | Commercial Vehicle Check |
| Roadside Electronic Screening | Commercial Vehicle Check |
| Roadside Safety and Security Inspection | Commercial Vehicle Check |
| Fleet Administration | Fleet and Freight Management |
| Fleet Maintenance Management | Fleet and Freight Management |

Table 2.2.5-20: CVO07 Associated Planning Factors and Goals

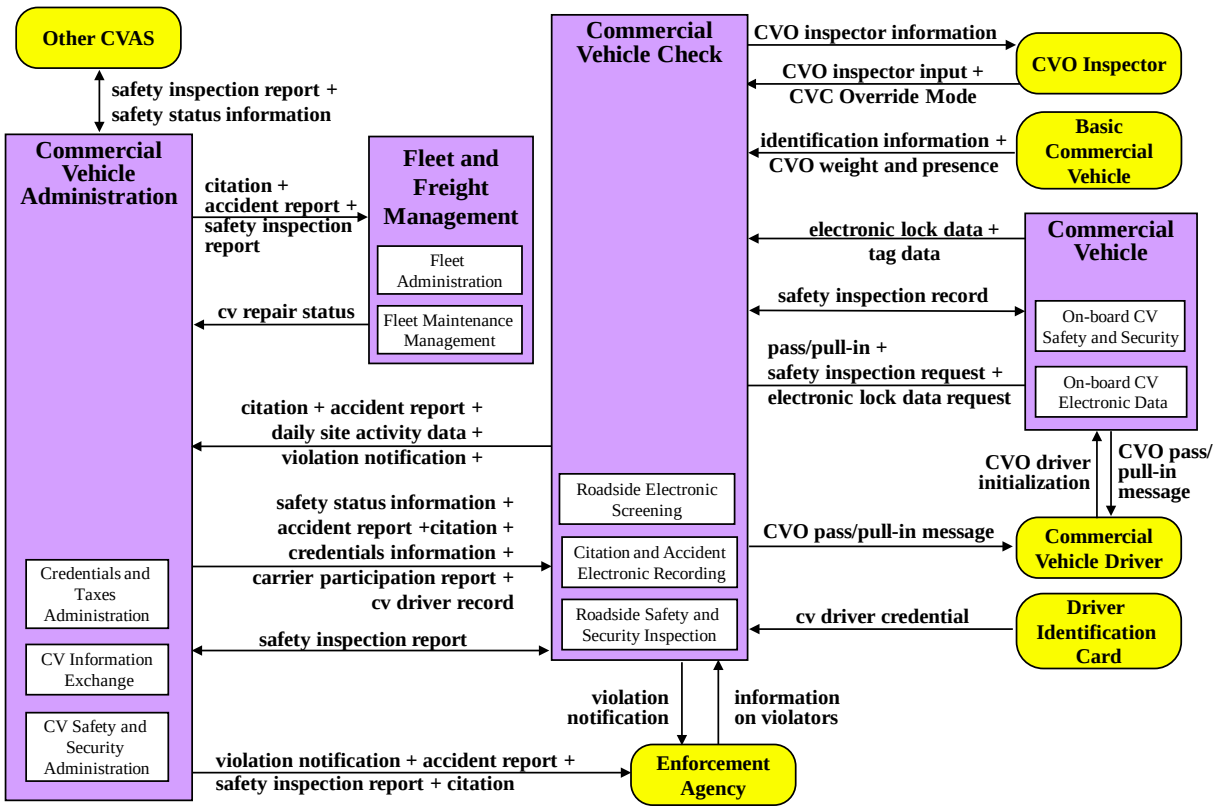
| MetroFactor | Goal |
|---|---|
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.5-21: CVO07 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Freight Management: Customer Satisfaction | Increase ratings for customer satisfaction with freight mobility in the region among shippers, receivers, and carriers by X percent in Y years. | Percentage of customers satisfied with region's freight management practices. |
| Freight Management: Travel Time Delay | Decrease hours of delay per 1,000 vehicle miles traveled on selected freight-significant highways by X percent in Y years. | Hours of delay per 1,000 vehicle miles on selected freight-significant highways. |
| Freight Management: Travel Time Delay | Decrease point-to-point travel times on selected freight-significant highways by Y minutes within Y years. | Point-to-point travel times on selected freight-significant highways. |
| Freight Management: Travel Time Delay | Decrease the annual average travel time index for freight by X points in Y years. | Travel time index: ratio of observed average travel time to free-flow travel time. |
| Freight Management: Travel Time Delay | Increase the mobility index ([Ton-miles of travel] / [Vehicle-miles of travel * | |
| Average speed]) by X percent in Y years. | Mobility index for system users defined as [Ton-miles of travel] / [Vehicle-miles of travel * Average speed]. | |

## CVO07 - Roadside CVO Safety




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### On-board CVO Safety (CVO08)

This service package provides for on-board commercial vehicle safety monitoring and reporting. It is an enhancement of the Roadside CVO Safety Service Package and includes support for collecting on-board safety data via transceivers or other means. The on-board safety data are assessed by an off-board system. In some cases the monitoring and safety assessment may occur remotely (i.e., not at a roadside site). Following the assessment, safety warnings are provided to the driver, the Commercial Vehicle Check roadside elements, and carrier. This service package allows for the Fleet and Freight Management subsystem to have access to the on-board safety data.

Table 2.2.5-22: CVO08 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| On-board Cargo Monitoring | Commercial Vehicle |
| On-board CV Safety and Security | Commercial Vehicle |
| CV Information Exchange | Commercial Vehicle Administration |
| CV Safety and Security Administration | Commercial Vehicle Administration |
| Citation and Accident Electronic Recording | Commercial Vehicle Check |
| Roadside Safety and Security Inspection | Commercial Vehicle Check |
| Fleet Administration | Fleet and Freight Management |
| Fleet Maintenance Management | Fleet and Freight Management |

Table 2.2.5-23: CVO08 Associated Planning Factors and Goals

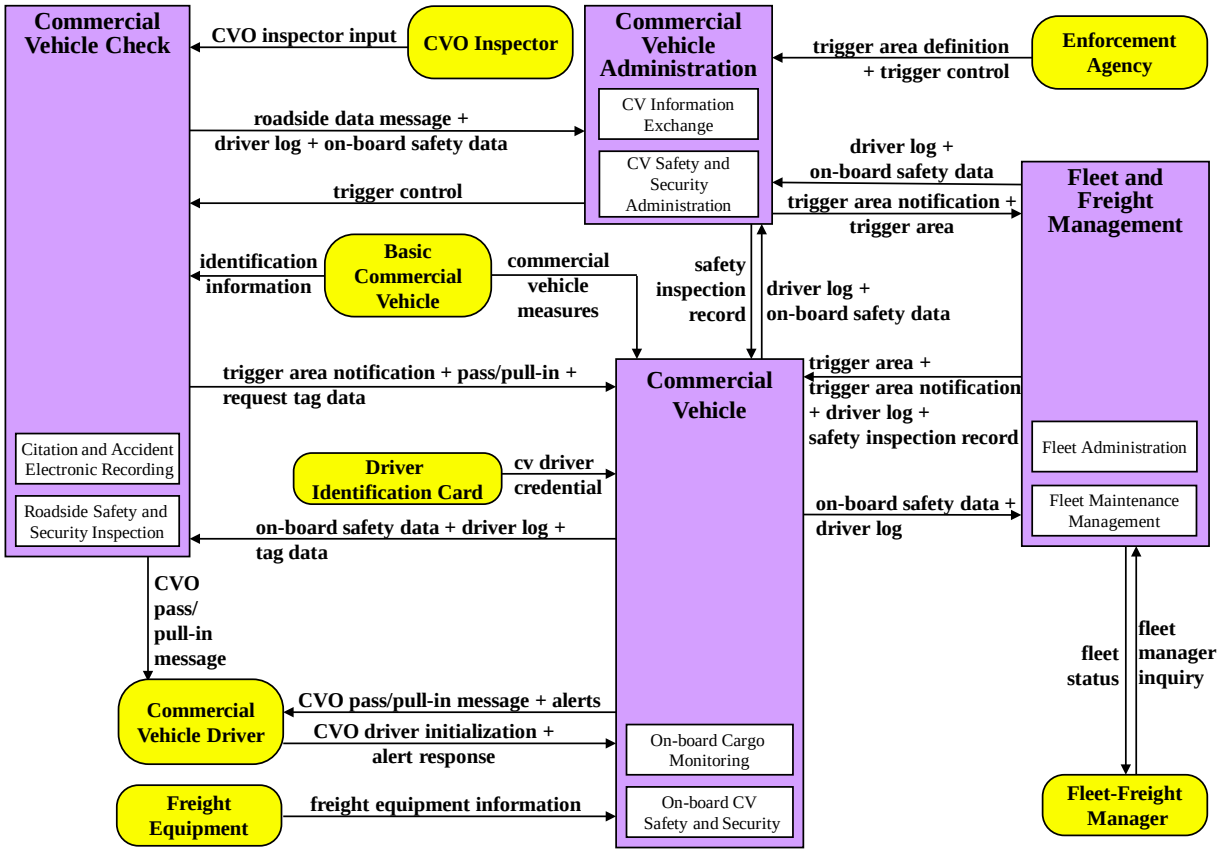
| MetroFactor | Goal |
|---|---|
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |

Table 2.2.5-24: CVO08 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driver inattention and distraction |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driving while intoxicated |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to unsafe drivers, vehicles and cargo on the transportation system | Number of crashes and fatalities due to commercial vehicle safety violations |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total fatalities per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total severe injuries per X VMT. |

**CVO08 - On-board CVO Safety**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## CVO Fleet Maintenance (CVO09)

This service package supports maintenance of CVO fleet vehicles with on-board monitoring equipment and Automated Vehicle Location (AVL) capabilities within the Fleet and Freight Management Subsystem. Records of vehicle mileage, repairs, and safety violations are maintained to assure safe vehicles on the highway.

Table 2.2.5-25: CVO09 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| On-board Trip Monitoring | Commercial Vehicle |
| Fleet Maintenance Management | Fleet and Freight Management |

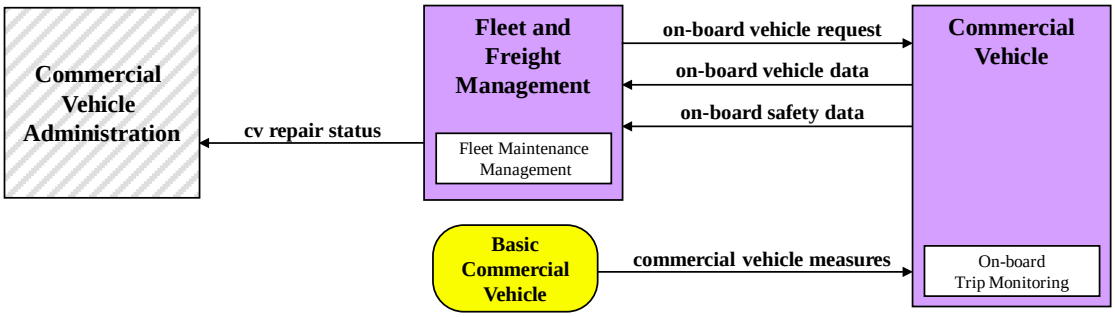
Table 2.2.5-26: CVO09 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.5-27: CVO09 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Freight Management: Customer Satisfaction | Increase ratings for customer satisfaction with freight mobility in the region among shippers, receivers, and carriers by X percent in Y years. | Percentage of customers satisfied with region's freight management practices. |

**CVO09 - CVO Fleet Maintenance**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## HAZMAT Management (CVO10)

This service 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.

Table 2.2.5-28: CVO10 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| On-Board Cargo Monitoring | Commercial Vehicle |
| Emergency Commercial Vehicle Response | Emergency Management |
| Mayday Support | Emergency Management |
| Commercial Vehicle and Freight Security | Fleet and Freight Management |
| Fleet HAZMAT Management | Fleet and Freight Management |
| Vehicle Mayday I/F | Vehicle |

Table 2.2.5-29: CVO10 Associated Planning Factors and Goals

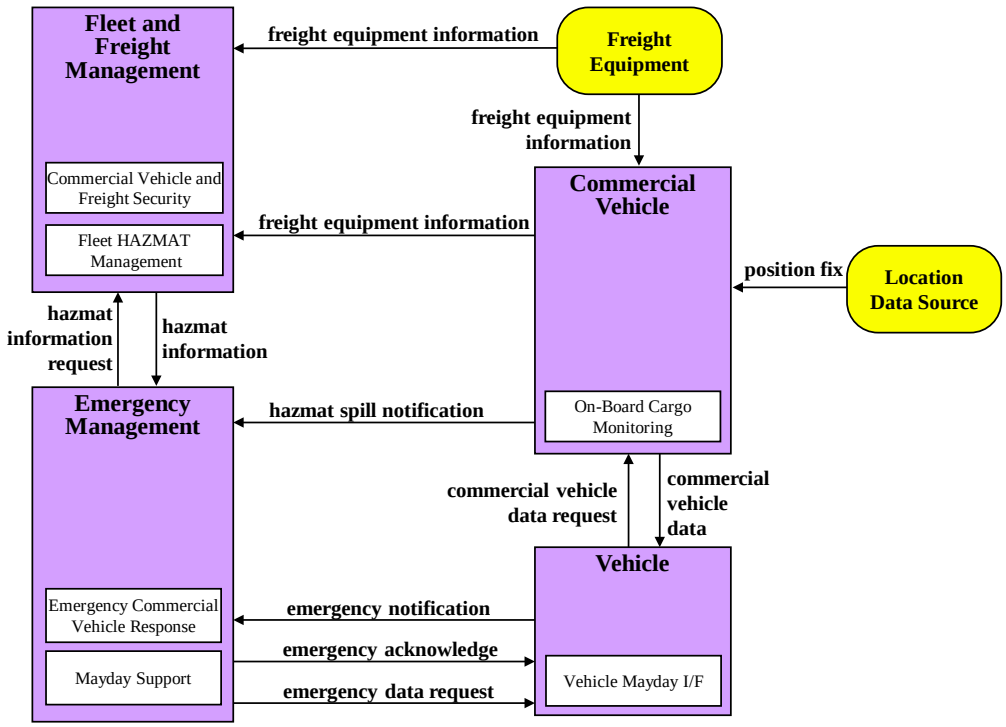
| MetroFactor | Goal |
|---|---|
| Increase the security of the transportation system for motorized and nonmotorized users; | Improve the security of the transportation system |

Table 2.2.5-30: CVO10 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Enhance tracking and monitoring of sensitive Hazmat shipments | Number of Hazmat shipments tracked in real-time |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce exposure due to Hazmat & homeland security incidents | Homeland security incident response time |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce exposure due to Hazmat & homeland security incidents | Number of Hazmat incidents |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce exposure due to Hazmat & homeland security incidents | Number of homeland security incidents |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to motorists and travelers | Number of critical sites with security surveillance |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to motorists and travelers | Number of security incidents on roadways |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transportation infrastructure | Number of critical sites with hardened security enhancements |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transportation infrastructure | Number of critical sites with security surveillance |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transportation infrastructure | Number of security incidents on transportation infrastructure |

**CVO10 - HAZMAT Management**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Roadside HAZMAT Security Detection and Mitigation (CVO11)

This service package provides the capability to detect and classify security sensitive HAZMAT on commercial vehicles using roadside sensing and imaging technology. Credentials information can be accessed to verify if the commercial driver, vehicle and carrier are permitted to transport the identified HAZMAT. If the credentials analysis and sensed HAZMAT information do not agree, the vehicle can be signaled to pull off the highway, and if required, an alarm can be sent to Emergency Management to request they monitor, traffic stop or disable the vehicle.

Table 2.2.5-31: CVO11 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Credentials and Taxes Administration | Commercial Vehicle Administration |
| Roadside HAZMAT detection | Commercial Vehicle Check |
| Emergency Commercial Vehicle Response | Emergency Management |

Table 2.2.5-32: CVO11 Associated Planning Factors and Goals

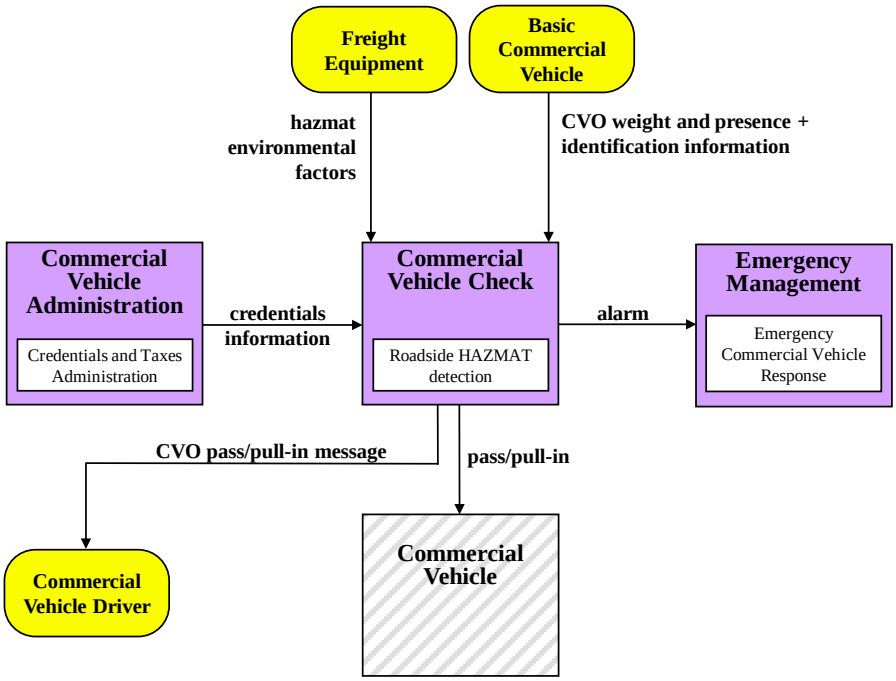
| MetroFactor | Goal |
|---|---|
| Increase the security of the transportation system for motorized and nonmotorized users; | Improve the security of the transportation system |

Table 2.2.5-33: CVO11 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Enhance tracking and monitoring of sensitive Hazmat shipments | Number of Hazmat shipments tracked in real-time |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce exposure due to Hazmat & homeland security incidents | Homeland security incident response time |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce exposure due to Hazmat & homeland security incidents | Number of Hazmat incidents |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce exposure due to Hazmat & homeland security incidents | Number of homeland security incidents |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to motorists and travelers | Number of critical sites with security surveillance |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to motorists and travelers | Number of security incidents on roadways |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transportation infrastructure | Number of critical sites with hardened security enhancements |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transportation infrastructure | Number of critical sites with security surveillance |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transportation infrastructure | Number of security incidents on transportation infrastructure |

**CVO11 – Roadside HAZMAT Security Detection and Mitigation**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## CV Driver Security Authentication (CVO12)

This service package provides the ability for Fleet and Freight Management to detect when an unauthorized commercial vehicle driver attempts to drive their vehicle based on stored driver identity information. If an unauthorized driver has been detected, Fleet and Freight Management can activate commands to safely disable the commercial vehicle. Alarms can also be sent to emergency management to inform them of a potential commercial vehicle hijacking or theft and potential hazardous situation. In addition, Emergency Management can request Fleet and Freight Management to disable a specific vehicle in their fleet.

Table 2.2.5-34: CVO12 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| On-board Driver Authentication | Commercial Vehicle |
| Roadside Safety and Security Inspection | Commercial Vehicle Check |
| Emergency Commercial Vehicle Response | Emergency Management |
| Manage CV Driver Identification | Fleet and Freight Management |

Table 2.2.5-35: CVO12 Associated Planning Factors and Goals

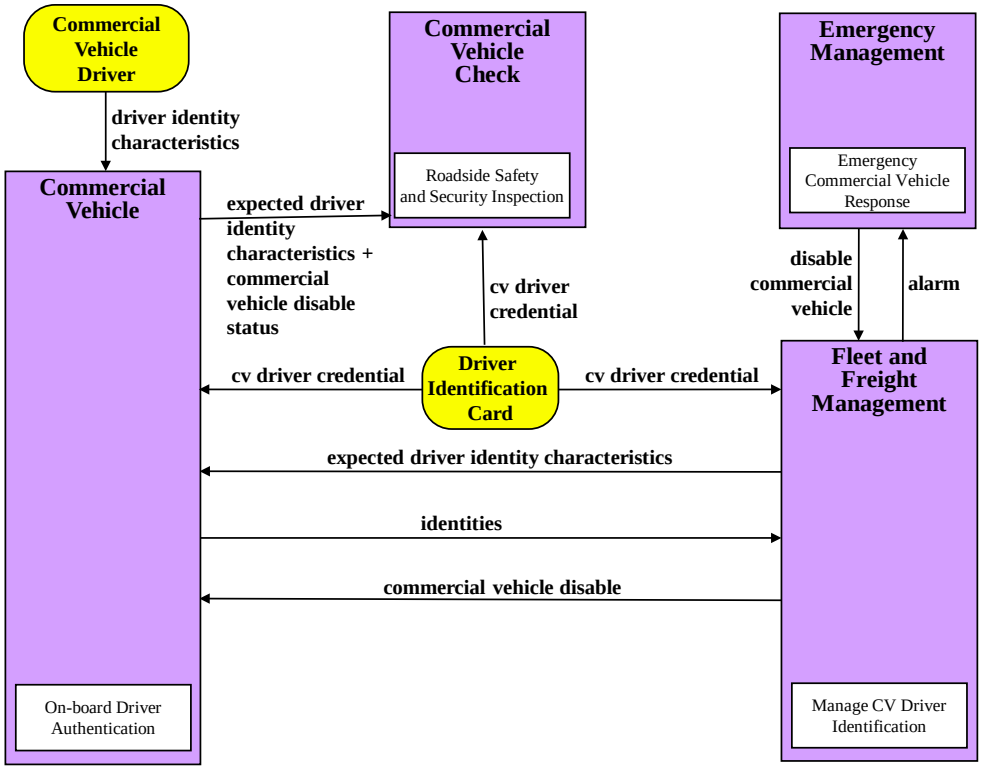
| MetroFactor | Goal |
|---|---|
| Increase the security of the transportation system for motorized and nonmotorized users; | Improve the security of the transportation system |

Table 2.2.5-36: CVO12 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Enhance tracking and monitoring of sensitive Hazmat shipments | Number of Hazmat shipments tracked in real-time |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce exposure due to Hazmat & homeland security incidents | Homeland security incident response time |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce exposure due to Hazmat & homeland security incidents | Number of Hazmat incidents |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce exposure due to Hazmat & homeland security incidents | Number of homeland security incidents |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to motorists and travelers | Number of critical sites with security surveillance |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to motorists and travelers | Number of security incidents on roadways |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transportation infrastructure | Number of critical sites with hardened security enhancements |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transportation infrastructure | Number of critical sites with security surveillance |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transportation infrastructure | Number of security incidents on transportation infrastructure |

**CVO12 – CV Driver Security Authentication**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Freight Assignment Tracking (CVO13)

This service package provides for the planning and tracking of three aspects of commercial vehicle shipments. For each shipment, the commercial vehicle, the freight equipment, and the commercial vehicle driver are monitored for consistency with the planned assignment. Any unauthorized changes are determined by the Fleet and Freight Management subsystem and then the appropriate people and subsystems are notified. Data collected by the On-board CV and Freight Safety & Security and the On-board Driver Authentication equipment packages used in other service packages are also used to monitor the three aspects of assignment for this service package. In addition to this service package, Fleet and Freight Managers may also monitor routes and itineraries and this capability is included in Fleet Administration.

Table 2.2.5-37: CVO13 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| On-board Cargo Monitoring | Commercial Vehicle |
| On-board Driver Authentication | Commercial Vehicle |
| On-board Trip Monitoring | Commercial Vehicle |
| Commercial Vehicle and Freight Security | Fleet and Freight Management |
| Fleet Administration | Fleet and Freight Management |
| Freight Administration and Management | Fleet and Freight Management |

Table 2.2.5-38: CVO13 Associated Planning Factors and Goals

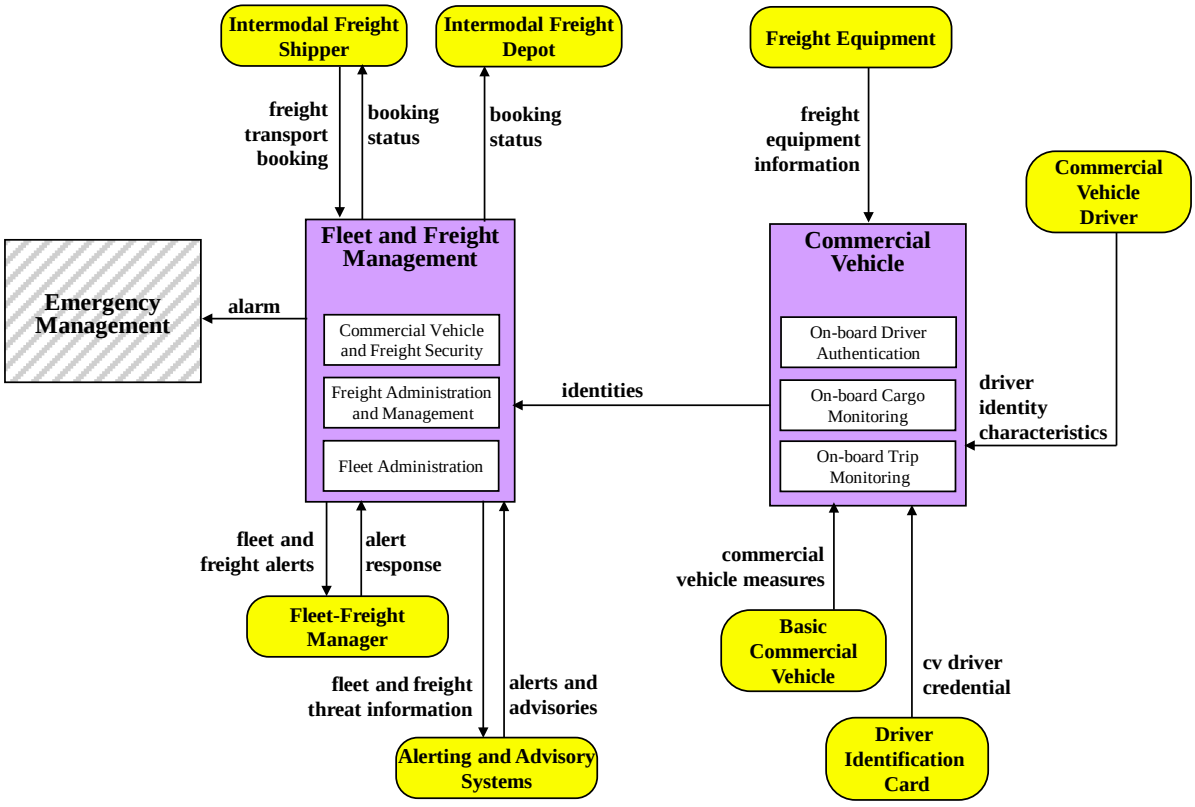
| MetroFactor | Goal |
|---|---|
| Increase the security of the transportation system for motorized and nonmotorized users; | Improve the security of the transportation system |

Table 2.2.5-39: CVO13 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Enhance tracking and monitoring of sensitive Hazmat shipments | Number of Hazmat shipments tracked in real-time |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce exposure due to Hazmat & homeland security incidents | Homeland security incident response time |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce exposure due to Hazmat & homeland security incidents | Number of Hazmat incidents |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce exposure due to Hazmat & homeland security incidents | Number of homeland security incidents |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to motorists and travelers | Number of critical sites with security surveillance |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to motorists and travelers | Number of security incidents on roadways |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transportation infrastructure | Number of critical sites with hardened security enhancements |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transportation infrastructure | Number of critical sites with security surveillance |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transportation infrastructure | Number of security incidents on transportation infrastructure |

**CVO13 – Freight Assignment Tracking**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## 2.2.6 Emergency Management Service Packages

### Emergency Call-Taking and Dispatch (EM01)

This service package provides basic public safety call-taking and dispatch services. It includes emergency vehicle equipment, equipment used to receive and route emergency calls, and wireless communications that enable safe and rapid deployment of appropriate resources to an emergency. Coordination between Emergency Management Subsystems supports emergency notification between agencies. Wide area wireless communications between the Emergency Management Subsystem and an Emergency Vehicle supports dispatch and provision of information to responding personnel.

Table 2.2.6-1: EM01 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Emergency Call-Taking | Emergency Management |
| Emergency Dispatch | Emergency Management |
| On-board EV En Route Support | Emergency Vehicle |

Table 2.2.6-2: EM01 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight; | Enhance the integration and connectivity of the transportation system |
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |
| Increase the security of the transportation system for motorized and nonmotorized users; | Improve the security of the transportation system |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

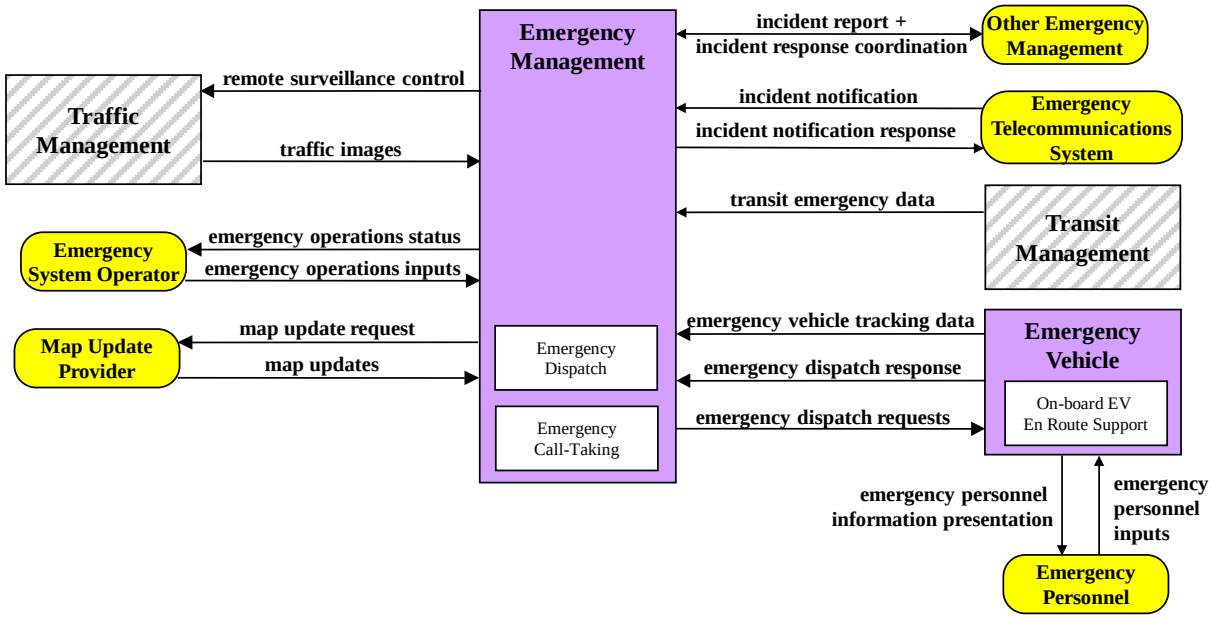
Table 2.2.6-3: EM01 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Emergency/Incident Management: Customer Satisfaction | Increase customer satisfaction with the region's incident management by X percent over Y years. | Percentage of customers satisfied with region's incident management practices. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Emergency/Incident Management: Incident Duration | Reduce mean incident clearance time per incident by X percent over Y years. (Defined as the time between awareness of an incident and the time the last responder has left the scene.) | Mean incident clearance time per incident. |
| Emergency/Incident Management: Incident Duration | Reduce mean incident notification time (defined as the time between the first agency's awareness of an incident and the time to notify needed response agencies) by X percent over Y years (i.e., through "Motorist Assist" roving patrol programs, reduction of inaccurate verifications, etc.). | Average incident notification time of necessary response agencies. |
| Emergency/Incident Management: Incident Duration | Reduce mean roadway clearance time per incident by X percent over Y years. (Defined as the time between awareness of an incident and restoration of lanes to full operational status.) | Mean roadway clearance time per incident. |
| Emergency/Incident Management: Incident Duration | Reduce mean time for needed responders to arrive on-scene after notification by X percent over Y years. | Mean time for needed responders to arrive on-scene after notification. |
| Emergency/Incident Management: Incident Duration | Reduce mean time of incident duration (from awareness of incident to resumed traffic flow) on transit services and arterial and expressway facilities by X percent in Y years. | Mean time of incident duration. |
| Emergency/Incident Management: Inter-Agency Coordination | Increase percentage of incident management agencies in the region that (participate in a multi-modal information exchange network, use interoperable voice communications, participate in a regional coordinated incident response team, etc.) by X percent in Y years. | Number of agencies in the region with interoperable voice communications. |
| Emergency/Incident Management: Inter-Agency Coordination | Increase percentage of incident management agencies in the region that (participate in a multi-modal information exchange network, use interoperable voice communications, participate in a regional coordinated incident response team, etc.) by X percent in Y years. | Number of participating agencies in a regional coordinated incident response team. |
| Emergency/Incident Management: Inter-Agency Coordination | Increase percentage of incident management agencies in the region that (participate in a multi-modal information exchange network, use interoperable voice communications, participate in a regional coordinated incident response team, etc.) by X percent in Y years. | Percentage of incident management agencies in region participating in multi-modal information exchange network. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Emergency/Incident Management: Person Hours of Delay | Reduce the person hours (or vehicle hours) of total delay associated with traffic incidents by X percent over Y years. | Person hours (or vehicle hours) of delay associated with traffic incidents. |

**EM01 – Emergency Call-Taking and Dispatch**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## Emergency Routing (EM02)

This service package supports automated vehicle location and dynamic routing of emergency vehicles. Traffic information, road conditions, and suggested routing information are provided to enhance emergency vehicle routing. Special priority or other specific emergency traffic control strategies can be coordinated to improve the safety and time-efficiency of responding vehicle travel on the selected route(s). The Emergency Management Subsystem provides the routing for the emergency fleet based on real-time conditions and has the option of requesting a route from the Traffic Management subsystem. The Emergency Vehicle may also be equipped with dedicated short range communications for local signal preemption and the transmission of alerts to surrounding vehicles. The service provides for information exchange between care facilities and both the Emergency Management Subsystem and emergency vehicles.

Table 2.2.6-4: EM02 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Emergency Routing | Emergency Management |
| On-board EV En Route Support | Emergency Vehicle |
| Roadway Signal Preemption | Roadway |
| TMC Incident Dispatch Coordination/Communication | Traffic Management |
| TMC Signal Control | Traffic Management |

Table 2.2.6-5: EM02 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight; | Enhance the integration and connectivity of the transportation system |
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |
| Increase the security of the transportation system for motorized and nonmotorized users; | Improve the security of the transportation system |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |

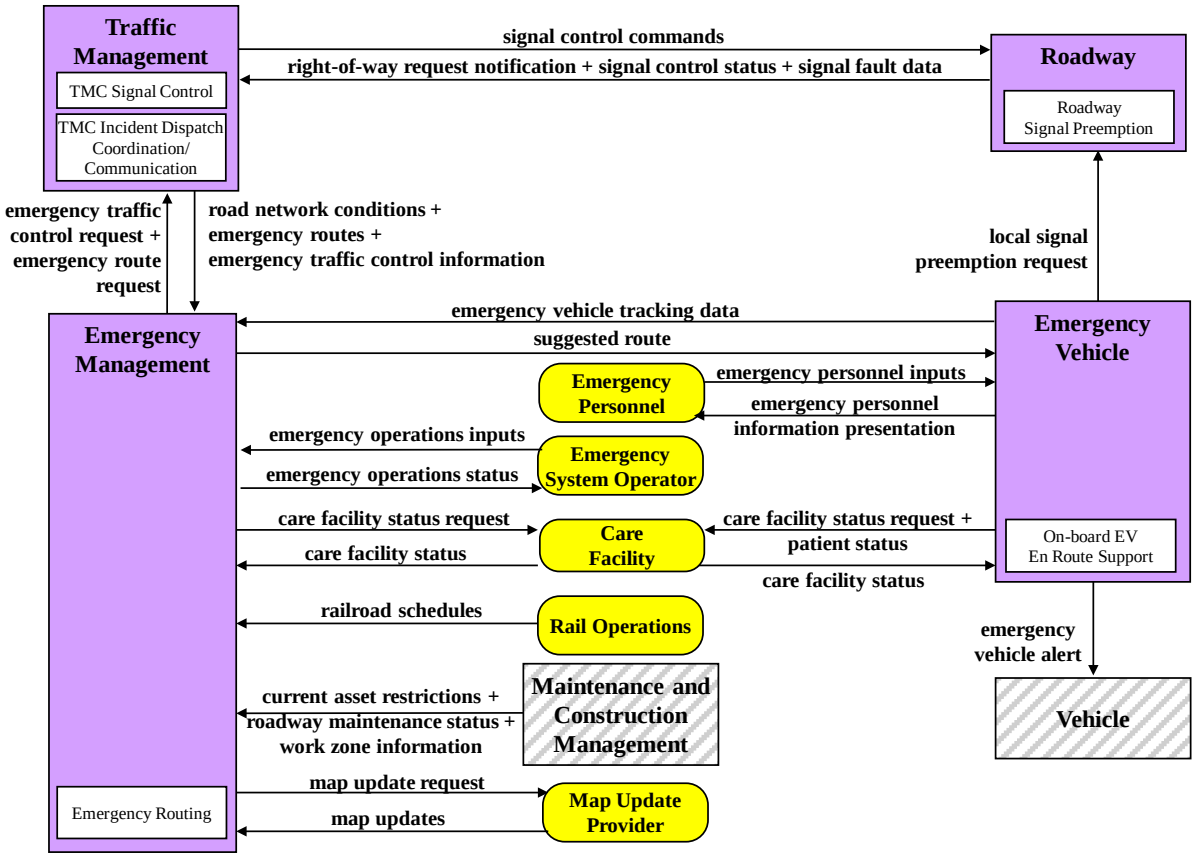
Table 2.2.6-6: EM02 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Emergency/Incident Management: Incident Duration | Reduce mean incident clearance time per incident by X percent over Y years. (Defined as the time between awareness of an incident and the time the last responder has left the scene.) | Mean incident clearance time per incident. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Emergency/Incident Management: Incident Duration | Reduce mean roadway clearance time per incident by X percent over Y years. (Defined as the time between awareness of an incident and restoration of lanes to full operational status.) | Mean roadway clearance time per incident. |
| Emergency/Incident Management: Incident Duration | Reduce mean time for needed responders to arrive on-scene after notification by X percent over Y years. | Mean time for needed responders to arrive on-scene after notification. |
| Emergency/Incident Management: Incident Duration | Reduce mean time of incident duration (from awareness of incident to resumed traffic flow) on transit services and arterial and expressway facilities by X percent in Y years. | Mean time of incident duration. |
| Emergency/Incident Management: Inter-Agency Coordination | Increase percentage of incident management agencies in the region that (participate in a multi-modal information exchange network, use interoperable voice communications, participate in a regional coordinated incident response team, etc.) by X percent in Y years. | Number of agencies in the region with interoperable voice communications. |
| Emergency/Incident Management: Inter-Agency Coordination | Increase percentage of incident management agencies in the region that (participate in a multi-modal information exchange network, use interoperable voice communications, participate in a regional coordinated incident response team, etc.) by X percent in Y years. | Number of participating agencies in a regional coordinated incident response team. |
| Emergency/Incident Management: Inter-Agency Coordination | Increase percentage of incident management agencies in the region that (participate in a multi-modal information exchange network, use interoperable voice communications, participate in a regional coordinated incident response team, etc.) by X percent in Y years. | Percentage of incident management agencies in region participating in multi-modal information exchange network. |
| Emergency/Incident Management: Use of Technology | Increase number of ITS-related assets (e.g., roadside cameras, dynamic message signs, vehicle speed detectors) in use for incident and emergency detection by X in Y years. | Number of ITS-related assets in use for incident detection. |
| Emergency/Incident Management: Use of Technology | Increase number of regional road miles covered by ITS-related assets (e.g., roadside cameras, dynamic message signs, vehicle speed detectors) in use for incident detection by X percent in Y years. | Number of regional roadway miles covered by ITS-related assets in use for incident detection. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Emergency/Incident Management: Use of Technology | Increase number of traffic signals equipped with emergency vehicle preemption by X percent in Y years. | Number of traffic signals equipped with emergency vehicle preemption. |

**EM02 – Emergency Routing**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Mayday and Alarms Support (EM03)

This service 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, gather information about the incident, and determine the appropriate response. The request for assistance may be manually initiated or automated and linked to vehicle sensors. This service package also includes general surveillance capabilities that enable the Emergency Management Subsystem to remotely monitor public areas (e.g., rest stops, parking lots) to improve security in these areas. The Emergency Management Subsystem may be operated by the public sector or by a private sector telematics service provider.

Table 2.2.6-7: EM03 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Center Secure Area Alarm Support | Emergency Management |
| Center Secure Area Surveillance | Emergency Management |
| Mayday Support | Emergency Management |
| Personal Location Determination | Personal Information Access |
| Personal Mayday I/F | Personal Information Access |
| Remote Traveler Security | Remote Traveler Support |
| Traveler Secure Area Surveillance | Remote Traveler Support |
| Vehicle Location Determination | Vehicle |
| Vehicle Mayday I/F | Vehicle |

Table 2.2.6-8: EM03 Associated Planning Factors and Goals

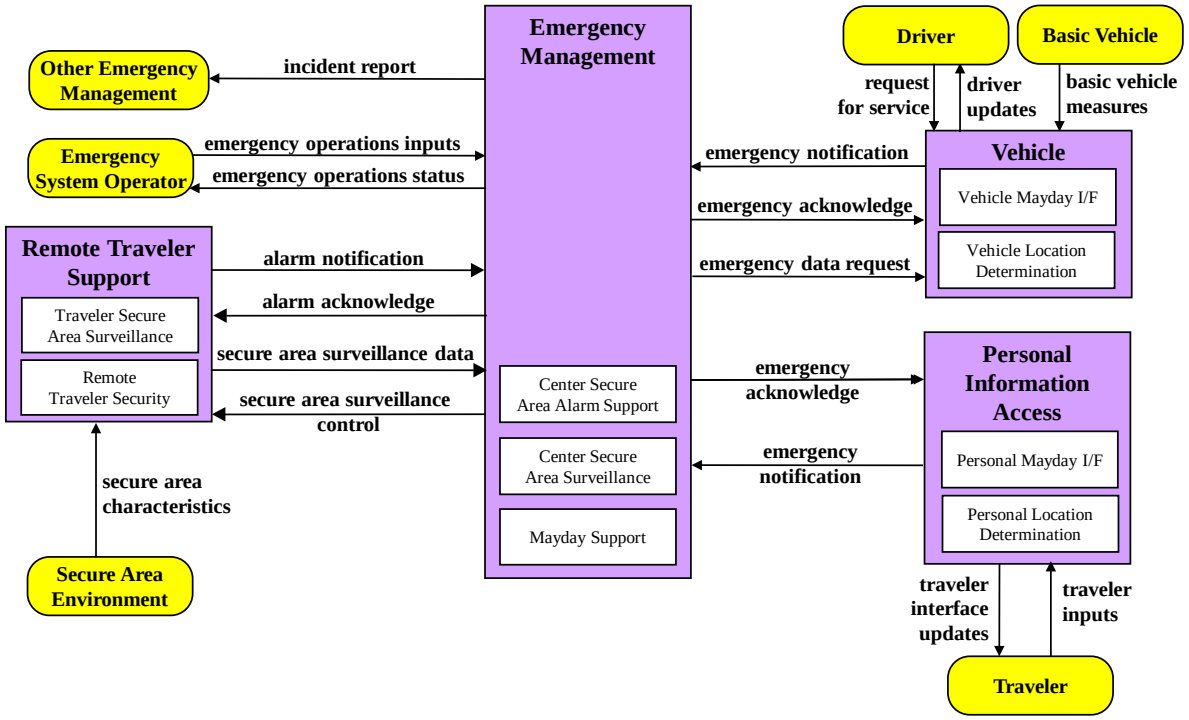
| MetroFactor | Goal |
|---|---|
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |
| Increase the security of the transportation system for motorized and nonmotorized users; | Improve the security of the transportation system |

Table 2.2.6-9: EM03 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Emergency/Incident Management: Incident Duration | Reduce mean incident clearance time per incident by X percent over Y years. (Defined as the time between awareness of an incident and the time the last responder has left the scene.) | Mean incident clearance time per incident. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Emergency/Incident Management: Incident Duration | Reduce mean incident notification time (defined as the time between the first agency's awareness of an incident and the time to notify needed response agencies) by X percent over Y years (i.e., through "Motorist Assist" roving patrol programs, reduction of inaccurate verifications, etc.). | Average incident notification time of necessary response agencies. |
| Emergency/Incident Management: Incident Duration | Reduce mean roadway clearance time per incident by X percent over Y years. (Defined as the time between awareness of an incident and restoration of lanes to full operational status.) | Mean roadway clearance time per incident. |
| Emergency/Incident Management: Incident Duration | Reduce mean time for needed responders to arrive on-scene after notification by X percent over Y years. | Mean time for needed responders to arrive on-scene after notification. |
| Emergency/Incident Management: Incident Duration | Reduce mean time of incident duration (from awareness of incident to resumed traffic flow) on transit services and arterial and expressway facilities by X percent in Y years. | Mean time of incident duration. |

**EM03 – Mayday and Alarms Support**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## Roadway Service Patrols (EM04)

This service package supports roadway service patrol vehicles that monitor roads that aid motorists, offering rapid response to minor incidents (flat tire, accidents, out of gas) to minimize disruption to the traffic stream. If problems are detected, the roadway service patrol vehicles will provide assistance to the motorist (e.g., push a vehicle to the shoulder or median). The service package monitors service patrol vehicle locations and supports vehicle dispatch to identified incident locations. Incident information collected by the service patrol is shared with traffic, maintenance and construction, and traveler information systems.

Table 2.2.6-10: EM04 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Service Patrol Management | Emergency Management |
| On-board EV En Route Support | Emergency Vehicle |
| On-board EV Incident Management Communication | Emergency Vehicle |

Table 2.2.6-11: EM04 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight; | Enhance the integration and connectivity of the transportation system |
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |
| Increase the security of the transportation system for motorized and nonmotorized users; | Improve the security of the transportation system |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

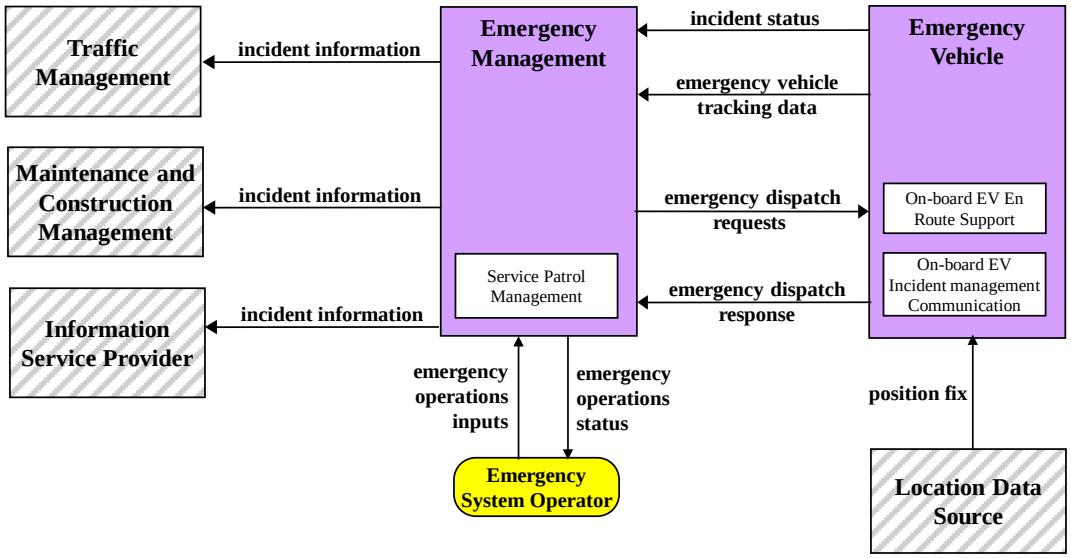
Table 2.2.6-12: EM04 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Arterial Management: Reliability | Reduce buffer index on arterials during peak and off-peak periods by X percent in Y years. | The buffer index (represents the extra time (buffer) travelers add to their average travel time when planning trips in order to arrive on-time 95 percent of the time). |
| Arterial Management: Reliability | Reduce delay associated with incidents on arterials by X percent by year Y. | Hours of delay associated with incidents. |
| Emergency/Incident Management: Customer Satisfaction | Increase customer satisfaction with the region's incident management by X percent over Y years. | Percentage of customers satisfied with region's incident management practices. |
| Emergency/Incident Management: Incident Duration | Reduce mean incident clearance time per incident by X percent over Y years. (Defined as the time between awareness of an incident and the time the last responder has left the scene.) | Mean incident clearance time per incident. |
| Emergency/Incident Management: Incident Duration | Reduce mean incident notification time (defined as the time between the first agency's awareness of an incident and the time to notify needed response agencies) by X percent over Y years (i.e., through "Motorist Assist" roving patrol programs, reduction of inaccurate verifications, etc.). | Average incident notification time of necessary response agencies. |
| Emergency/Incident Management: Incident Duration | Reduce mean roadway clearance time per incident by X percent over Y years. (Defined as the time between awareness of an incident and restoration of lanes to full operational status.) | Mean roadway clearance time per incident. |
| Emergency/Incident Management: Incident Duration | Reduce mean time for needed responders to arrive on-scene after notification by X percent over Y years. | Mean time for needed responders to arrive on-scene after notification. |
| Emergency/Incident Management: Incident Duration | Reduce mean time of incident duration (from awareness of incident to resumed traffic flow) on transit services and arterial and expressway facilities by X percent in Y years. | Mean time of incident duration. |
| Emergency/Incident Management: Inter-Agency Coordination | Increase the number of corridors in the region covered by regional coordinated incident response teams by X percent in Y years. | Number of TIM corridors in the region covered by regional coordinated incident response teams. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Emergency/Incident Management: Person Hours of Delay | Reduce the person hours (or vehicle hours) of total delay associated with traffic incidents by X percent over Y years. | Person hours (or vehicle hours) of delay associated with traffic incidents. |
| System Efficiency: Cost of Congestion | Reduce the annual monetary cost of congestion per capita for the next X years. | Cost (in dollars) of congestion or delay per capita. |

**EM04 – Roadway Service Patrols**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Transportation Infrastructure Protection (EM05)

This service package includes the monitoring of transportation infrastructure (e.g., bridges, tunnels and management centers) for potential threats using sensors and surveillance equipment and barrier and safeguard systems to control access, preclude an incident, and mitigate the impact of an incident if it occurs. Threats can result from acts of nature (e.g., hurricanes, earthquakes), terrorist attacks or other incidents causing damage to the infrastructure (e.g., stray barge hitting a bridge support). Infrastructure may be monitored with acoustic, environmental threat (such as nuclear, biological, chemical, and explosives), infrastructure condition and integrity, motion and object sensors and video and audio surveillance equipment. Data from such sensors and surveillance equipment may be processed in the field or sent to a center for processing. The data enables operators at the center to detect and verify threats. When a threat is detected, agencies are notified. Detected threats or advisories received from other agencies result in an increased level of system preparedness. In response to threats, barrier and safeguard systems may be activated by Traffic Management Subsystems to deter an incident, control access to an area or mitigate the impact of an incident. Barrier systems include gates, barriers and other automated and remotely controlled systems that manage entry to transportation infrastructure. Safeguard systems include blast shields, exhaust systems and other automated and remotely controlled systems that mitigate impact of an incident.

Table 2.2.6-13: EM05 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Center Secure Area Sensor Management | Emergency Management |
| Center Secure Area Surveillance | Emergency Management |
| On-Board EV Barrier System Control | Emergency Vehicle |
| Traveler Secure Area Sensor Monitoring | Remote Traveler Support |
| Traveler Secure Area Surveillance | Remote Traveler Support |
| Field Barrier System Control | Roadway |
| Field Safeguard System Control | Roadway |
| Field Secure Area Sensor Monitoring | Security Monitoring |
| Field Secure Area Surveillance | Security Monitoring |
| Barrier System Management | Traffic Management |
| Safeguard System Management | Traffic Management |
| TMC Incident Dispatch Coordination/Communication | Traffic Management |
| Vehicle Secure Area Access System | Vehicle |

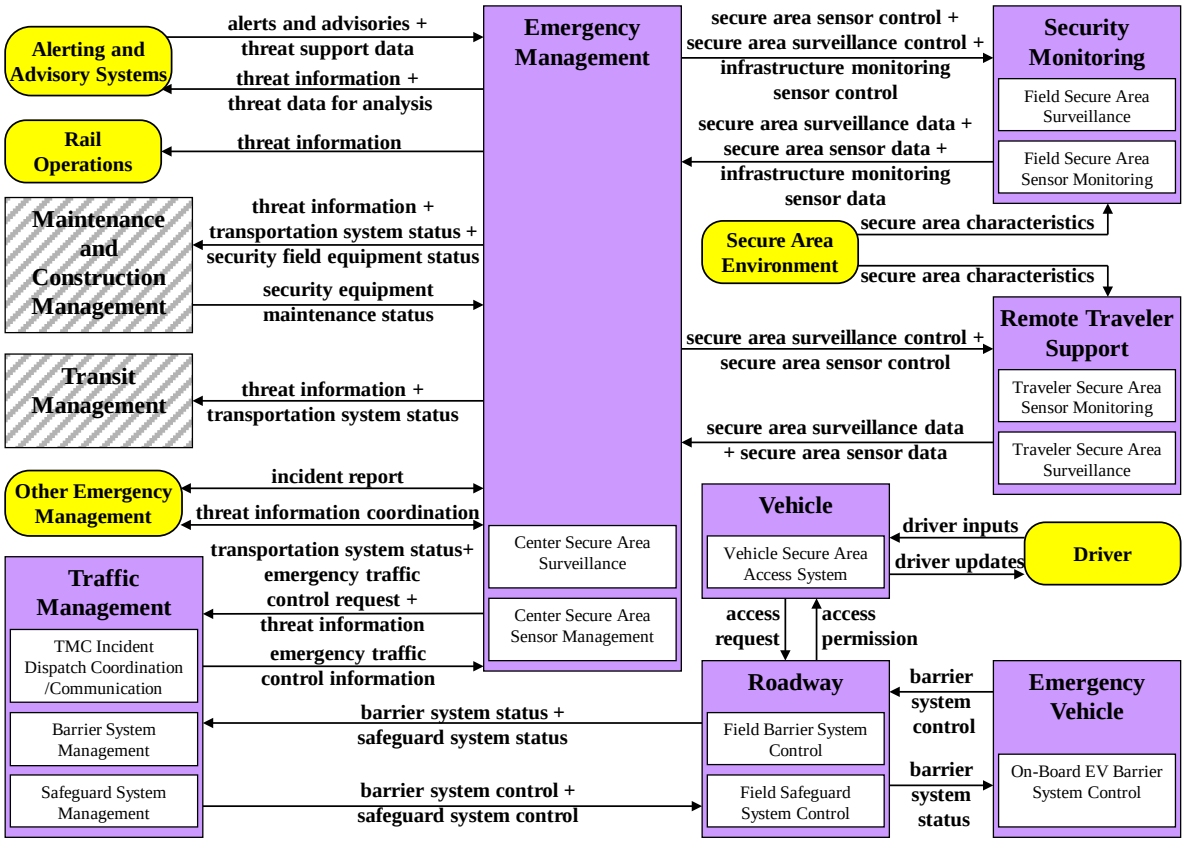
Table 2.2.6-14: EM05 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Increase the security of the transportation system for motorized and nonmotorized users; | Improve the security of the transportation system |

Table 2.2.6-15: EM05 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to motorists and travelers | Number of critical sites with security surveillance |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to motorists and travelers | Number of security incidents on roadways |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transit passengers and transit vehicle operators | Number of security incidents at transit facilities |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transit passengers and transit vehicle operators | Number of security incidents on transit vehicles |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transit passengers and transit vehicle operators | Number of transit facilities and vehicles under security surveillance |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transportation infrastructure | Number of critical sites with hardened security enhancements |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transportation infrastructure | Number of critical sites with security surveillance |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transportation infrastructure | Number of security incidents on transportation infrastructure |

**EM05 - Transportation Infrastructure Protection**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Wide-Area Alert (EM06)

This service package uses ITS driver and traveler information systems to alert the public in emergency situations such as child abductions, severe weather events, civil emergencies, and other situations that pose a threat to life and property. The alert includes information and instructions for transportation system operators and the traveling public, improving public safety and enlisting the public's help in some scenarios. The ITS technologies will supplement and support other emergency and homeland security alert systems such as the Emergency Alert System (EAS). When an emergency situation is reported and verified and the terms and conditions for system activation are satisfied, a designated agency broadcasts emergency information to traffic agencies, transit agencies, information service providers, toll operators, and others that operate ITS systems. The ITS systems, in turn, provide the alert information to transportation system operators and the traveling public using ITS technologies such as dynamic message signs, highway advisory radios, in-vehicle displays, transit displays, 511 traveler information systems, and traveler information web sites.

Table 2.2.6-16: EM06 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Emergency Early Warning System | Emergency Management |
| ISP Emergency Traveler Information | Information Service Provider |
| ISP Traveler Data Collection | Information Service Provider |
| Traveler Telephone Information | Information Service Provider |
| MCM Incident Management | Maintenance and Construction Management |
| Toll Operator Alert | Payment Administration |
| Personal Basic Information Reception | Personal Information Access |
| Remote Basic Information Reception | Remote Traveler Support |
| Remote Transit Information Services | Remote Traveler Support |
| Roadway Traffic Information Dissemination | Roadway |
| Toll Plaza Toll Collection | Roadway Payment |
| TMC Incident Dispatch Coordination/Communication | Traffic Management |
| TMC Traffic Information Dissemination | Traffic Management |
| Transit Center Information Services | Transit Management |
| Transit Center Security | Transit Management |
| Basic Vehicle Reception | Vehicle |

Table 2.2.6-17: EM06 Associated Planning Factors and Goals

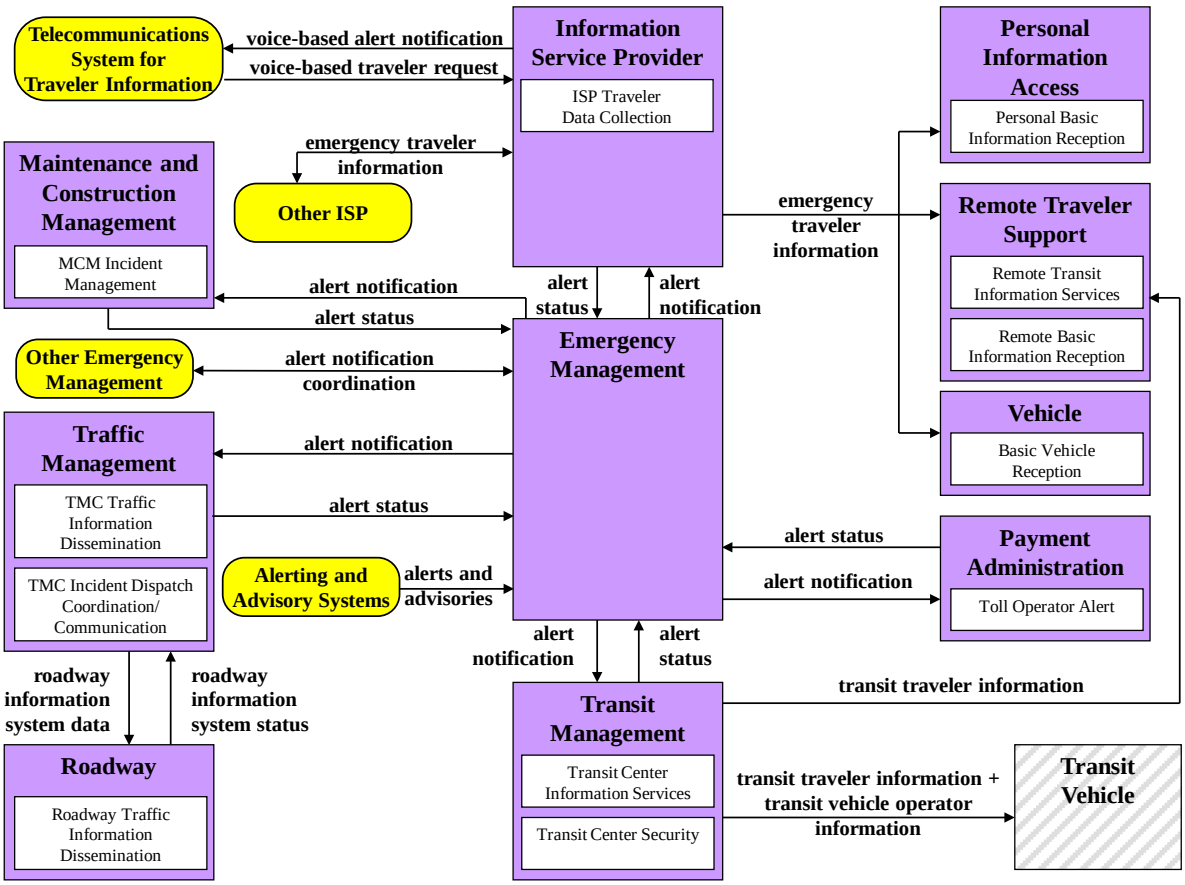
| MetroFactor | Goal |
|---|---|
| Increase the security of the transportation system for motorized and nonmotorized users; | Improve the security of the transportation system |

Table 2.2.6-18: EM06 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Security: Crime | Reduce security risks to motorists and travelers | Number of critical sites with security surveillance |
| Security: Crime | Reduce security risks to motorists and travelers | Number of security incidents on roadways |
| Security: Crime | Reduce security risks to transit passengers and transit vehicle operators | Number of security incidents at transit facilities |
| Security: Crime | Reduce security risks to transit passengers and transit vehicle operators | Number of security incidents on transit vehicles |
| Security: Crime | Reduce security risks to transit passengers and transit vehicle operators | Number of transit facilities and vehicles under security surveillance |
| Security: Crime | Reduce security risks to transportation infrastructure | Number of critical sites with hardened security enhancements |
| Security: Crime | Reduce security risks to transportation infrastructure | Number of critical sites with security surveillance |
| Security: Crime | Reduce security risks to transportation infrastructure | Number of security incidents on transportation infrastructure |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Enhance tracking and monitoring of sensitive Hazmat shipments | Number of Hazmat shipments tracked in real-time |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce exposure due to Hazmat & homeland security incidents | Homeland security incident response time |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce exposure due to Hazmat & homeland security incidents | Number of Hazmat incidents |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce exposure due to Hazmat & homeland security incidents | Number of homeland security incidents |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to motorists and travelers | Number of critical sites with security surveillance |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to motorists and travelers | Number of security incidents on roadways |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transit passengers and transit vehicle operators | Number of security incidents at transit facilities |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transit passengers and transit vehicle operators | Number of security incidents on transit vehicles |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transit passengers and transit vehicle operators | Number of transit facilities and vehicles under security surveillance |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transportation infrastructure | Number of critical sites with hardened security enhancements |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transportation infrastructure | Number of critical sites with security surveillance |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transportation infrastructure | Number of security incidents on transportation infrastructure |

**EM06 – Wide-Area Alert**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Early Warning System (EM07)

This service package monitors and detects potential, looming, and actual disasters including natural disasters (hurricanes, earthquakes, floods, winter storms, tsunamis, etc.) and technological and man-made disasters (hazardous materials incidents, nuclear power plant accidents, and acts of terrorism including nuclear, chemical, biological, and radiological weapons attacks). The service package monitors alerting and advisory systems, ITS sensors and surveillance systems, field reports, and emergency call-taking systems to identify emergencies and notifies all responding agencies of detected emergencies.

Table 2.2.6-19: EM07 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Center Secure Area Sensor Management | Emergency Management |
| Center Secure Area Surveillance | Emergency Management |
| Emergency Early Warning System | Emergency Management |
| Emergency Environmental Monitoring | Emergency Management |
| MCM Incident Management | Maintenance and Construction Management |
| Field Secure Area Sensor Monitoring | Security Monitoring |
| Field Secure Area Surveillance | Security Monitoring |
| TMC Incident Detection | Traffic Management |
| Transit Center Security | Transit Management |

Table 2.2.6-20: EM07 Associated Planning Factors and Goals

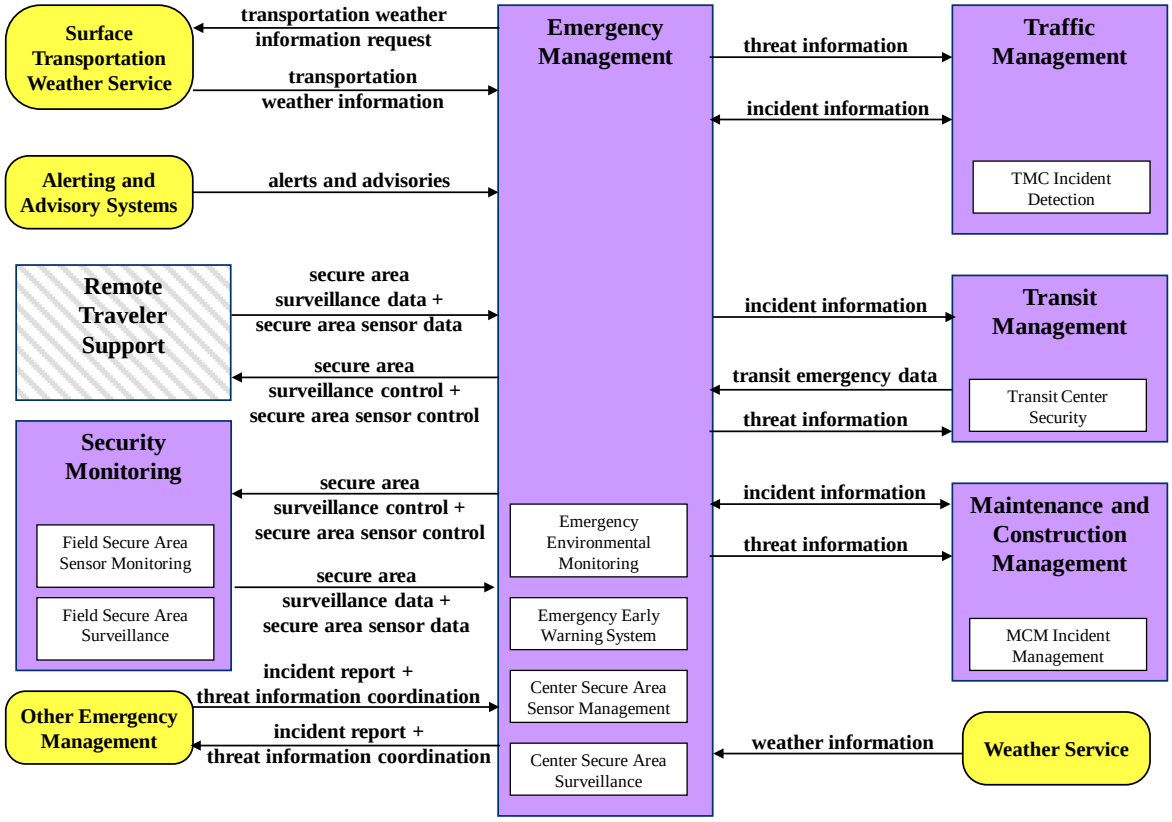
| MetroFactor | Goal |
|---|---|
| Increase the security of the transportation system for motorized and nonmotorized users; | Improve the security of the transportation system |

Table 2.2.6-21: EM07 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to motorists and travelers | Number of critical sites with security surveillance |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to motorists and travelers | Number of security incidents on roadways |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transit passengers and transit vehicle operators | Number of security incidents at transit facilities |
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transit passengers and transit vehicle operators | Number of security incidents on transit vehicles |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Security: Terrorism, Natural Disasters, and Hazardous Material Incidents | Reduce security risks to transit passengers and transit vehicle operators | Number of transit facilities and vehicles under security surveillance |

**EM07 - Early Warning System**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

**Disaster Response and Recovery (EM08)**
This service package enhances the ability of the surface transportation system to respond to and recover from disasters. It addresses the most severe incidents that require an extraordinary response from outside the local community. All types of disasters are addressed including natural disasters (hurricanes, earthquakes, floods, winter storms, tsunamis, etc.) and technological and man-made disasters (hazardous materials incidents, nuclear power plant accidents, and national security emergencies such as nuclear, chemical, biological, and radiological weapons attacks).

The service package supports coordination of emergency response plans, including general plans developed before a disaster as well as specific tactical plans with short time horizon that are developed as part of a disaster response. The service package provides enhanced access to the scene for response personnel and resources, provides better information about the transportation system in the vicinity of the disaster, and maintains situation awareness regarding the disaster itself. In addition, this service package tracks and coordinates the transportation resources - the transportation professionals, equipment, and materials - that constitute a portion of the disaster response.

The service package identifies the key points of integration between transportation systems and the public safety, emergency management, public health, and other allied organizations that form the overall disaster response. In this service package, the Emergency Management subsystem represents the federal, regional, state, and local Emergency Operations Centers and the Incident Commands that are established to respond to the disaster. The interface between the Emergency Management Subsystem and the other center subsystems provides situation awareness and resource coordination among transportation and other allied response agencies. In its role, traffic management implements special traffic control strategies and detours and restrictions to effectively manage traffic in and around the disaster. Maintenance and construction provides damage assessment of road network facilities and manages service restoration. Transit management provides a similar assessment of status for transit facilities and modifies transit operations to meet the special demands of the disaster. As immediate public safety concerns are addressed and disaster response transitions into recovery, this service package supports transition back to normal transportation system operation, recovering resources, managing on-going transportation facility repair, supporting data collection and revised plan coordination, and other recovery activities.

This service package builds on the basic traffic incident response service that is provided by ATMS08, the Traffic Incident Management service package. This service package addresses the additional complexities and coordination requirements that are associated with the most severe incidents that warrant an extraordinary response from outside the local jurisdictions and require special

measures such as the activation of one or more emergency operations centers. Many users of the National ITS Architecture will want to consider both ATMS08 and this service package since every region is concerned with both day-to-day management of traffic-related incidents and occasional management of disasters that require extraordinary response.

Disaster Response and Recovery is also supported by EM10, the "Disaster Traveler Information" service package that keeps the public informed during a disaster response. See that service package for more information.

Table 2.2.6-22: EM08 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Emergency Response Management | Emergency Management |
| Incident Command | Emergency Management |
| MCM Incident Management | Maintenance and Construction Management |
| MCM Roadway Maintenance and Construction | Maintenance and Construction Management |
| TMC Incident Dispatch Coordination/Communication | Traffic Management |
| Transit Center Security | Transit Management |

Table 2.2.6-23: EM08 Associated Planning Factors and Goals

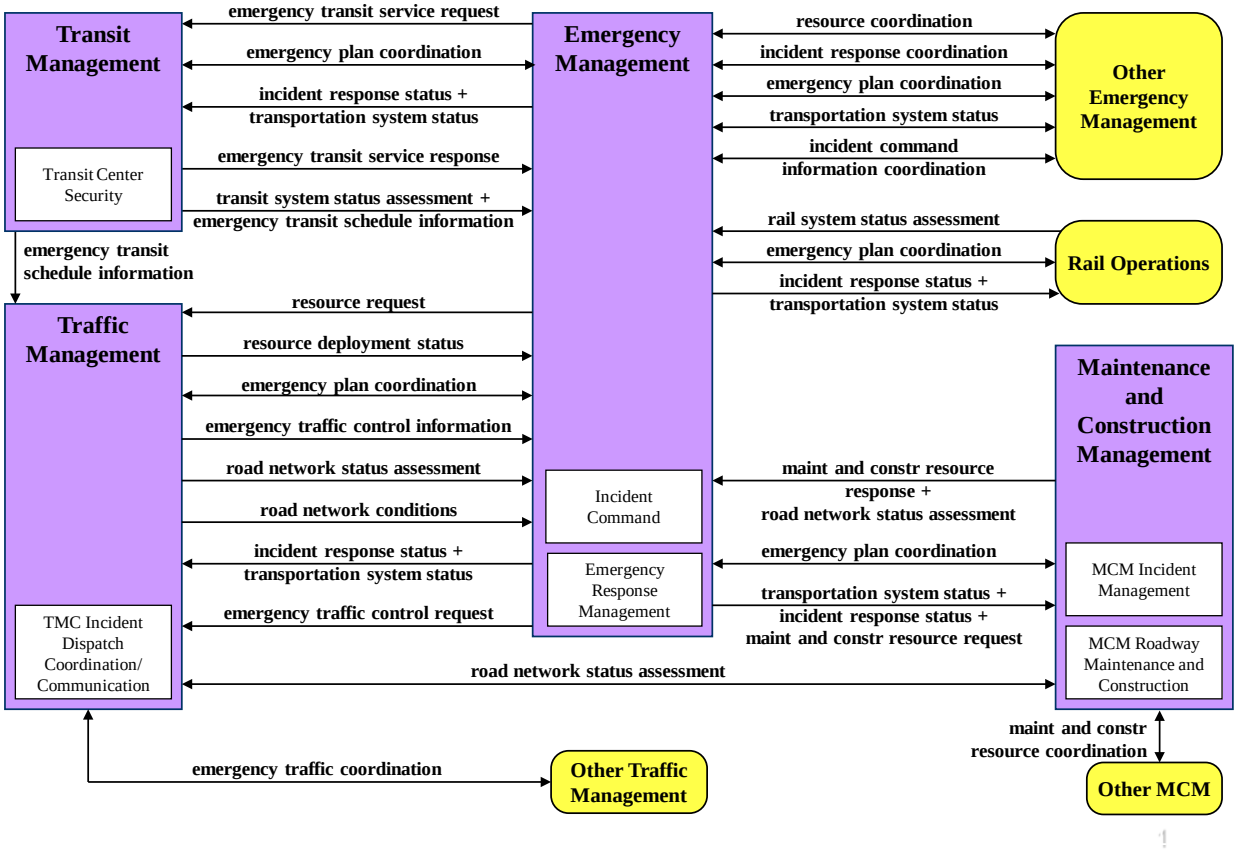
| MetroFactor | Goal |
|---|---|
| Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight; | Enhance the integration and connectivity of the transportation system |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.6-24: EM08 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Emergency/Incident Management: Inter-Agency Coordination | At least X percent of transportation operating agencies have a plan in place for a representative to be at the local or State Emergency Operations Center (EOC) to coordinate strategic activities and response planning for transportation during emergencies by year Y. | X percent of transportation operating agencies that have a plan in place for a representative to be at the local (city or county) EOC or State EOC to coordinate strategic activities and response planning for transportation during emergencies. |
| Emergency/Incident Management: Inter-Agency Coordination | Increase percentage of incident management agencies in the region that (participate in a multi-modal information exchange network, use interoperable voice communications, participate in a regional coordinated incident response team, etc.) by X percent in Y years. | Number of agencies in the region with interoperable voice communications. |
| Emergency/Incident Management: Inter-Agency Coordination | Increase percentage of incident management agencies in the region that (participate in a multi-modal information exchange network, use interoperable voice communications, participate in a regional coordinated incident response team, etc.) by X percent in Y years. | Number of participating agencies in a regional coordinated incident response team. |
| Emergency/Incident Management: Inter-Agency Coordination | Increase percentage of incident management agencies in the region that (participate in a multi-modal information exchange network, use interoperable voice communications, participate in a regional coordinated incident response team, etc.) by X percent in Y years. | Percentage of incident management agencies in region participating in multi-modal information exchange network. |

**EM08 - Disaster Response and Recovery**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

**Evacuation and Reentry Management (EM09)**
This service package supports evacuation of the general public from a disaster area and manages subsequent reentry to the disaster area. The service package addresses evacuations for all types of disasters, including disasters like hurricanes that are anticipated and occur slowly, allowing a well-planned orderly evacuation, as well as disasters like terrorist acts that occur rapidly, without warning, and allow little or no time for preparation or public warning.

This service package supports coordination of evacuation plans among the federal, state, and local transportation, emergency, and law enforcement agencies that may be involved in a large-scale evacuation. All affected jurisdictions (e.g., states and counties) at the evacuation origin, evacuation destination, and along the evacuation route are informed of the plan. Information is shared with traffic management agencies to implement special traffic control strategies and to control evacuation traffic, including traffic on local streets and arterials as well as the major evacuation routes. Reversible lanes, shoulder use, closures, special signal control strategies, and other special strategies may be implemented to maximize capacity along the evacuation routes. Transit resources play an important role in an evacuation, removing many people from an evacuated area while making efficient use of limited capacity. Additional shared transit resources may be added and managed in evacuation scenarios. Resource requirements are forecast based on the evacuation plans, and the necessary resources are located, shared between agencies if necessary, and deployed at the right locations at the appropriate times.

Evacuations are also supported by EM10, the "Disaster Traveler Information" service package, which keeps the public informed during evacuations. See that service package for more information.

Table 2.2.6-25: EM09 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Emergency Evacuation Support | Emergency Management |
| MCM Incident Management | Maintenance and Construction Management |
| TMC Evacuation Support | Traffic Management |
| Transit Evacuation Support | Transit Management |

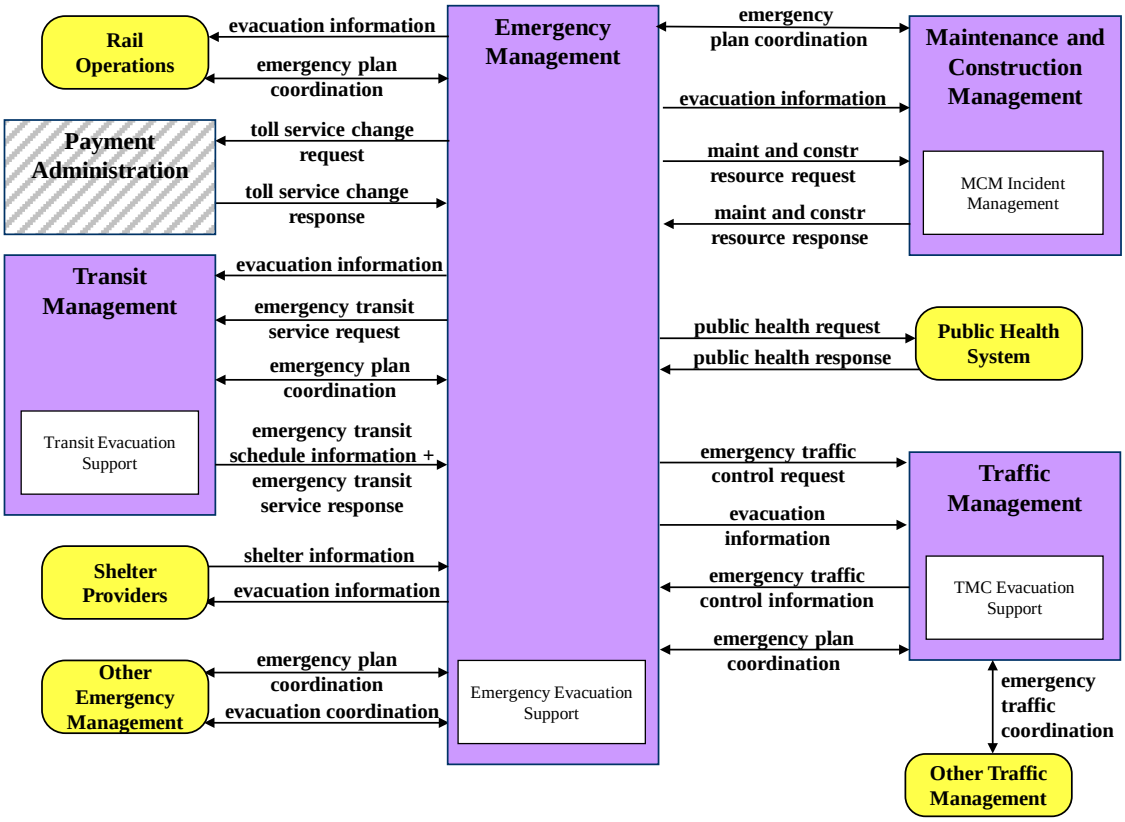
Table 2.2.6-26: EM09 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |
| Increase the security of the transportation system for motorized and nonmotorized users; | Improve the security of the transportation system |

Table 2.2.6-27: EM09 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Emergency/Incident Management: Evacuation Times | Reduce the per capita time to evacuate Z persons in the region by X percent over Y years. | Per capita time to evacuate. |

**EM09 - Evacuation and Reentry Management**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Disaster Traveler Information (EM10)

This service package uses ITS to provide disaster-related traveler information to the general public, including evacuation and reentry information and other information concerning the operation of the transportation system during a disaster. This service package collects information from multiple sources including traffic, transit, public safety, emergency management, shelter provider, and travel service provider organizations. The collected information is processed and the public is provided with real-time disaster and evacuation information using ITS traveler information systems.

A disaster will stress the surface transportation system since it may damage transportation facilities at the same time that it places unique demands on these facilities to support public evacuation and provide access for emergency responders. Similarly, a disaster may interrupt or degrade the operation of many traveler information systems at the same time that safety-critical information must be provided to the traveling public. This service package keeps the public informed in these scenarios, using all available means to provide information about the disaster area including damage to the transportation system, detours and closures in effect, special traffic restrictions and allowances, special transit schedules, and real-time information on traffic conditions and transit system performance in and around the disaster.

This service package also provides emergency information to assist the public with evacuations when necessary. Information on mandatory and voluntary evacuation zones, evacuation times, and instructions are provided. Available evacuation routes and destinations and current and anticipated travel conditions along those routes are provided so evacuees are prepared and know their destination and preferred evacuation route. Information on available transit services and traveler services (shelters, medical services, hotels, restaurants, gas stations, etc.) is also provided. In addition to general evacuation information, this service package provides specific evacuation trip planning information that is tailored for the evacuee based on origin, selected destination, and evacuee-specified evacuation requirements and route parameters.

This service package augments the ATIS service packages that provide traveler information on a day-to-day basis for the surface transportation system. This service package provides focus on the special requirements for traveler information dissemination in disaster situations.

Table 2.2.6-28: EM10 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Emergency Evacuation Support | Emergency Management |
| Emergency Response Management | Emergency Management |

| Equipment Package Name | Subsystem |
|---|---|
| ISP Emergency Traveler Information | Information Service Provider |
| ISP Traveler Data Collection | Information Service Provider |
| Traveler Telephone Information | Information Service Provider |
| Personal Basic Information Reception | Personal Information Access |
| Personal Interactive Information Reception | Personal Information Access |
| Remote Basic Information Reception | Remote Traveler Support |
| Remote Interactive Information Reception | Remote Traveler Support |
| Basic Vehicle Reception | Vehicle |
| Interactive Vehicle Reception | Vehicle |

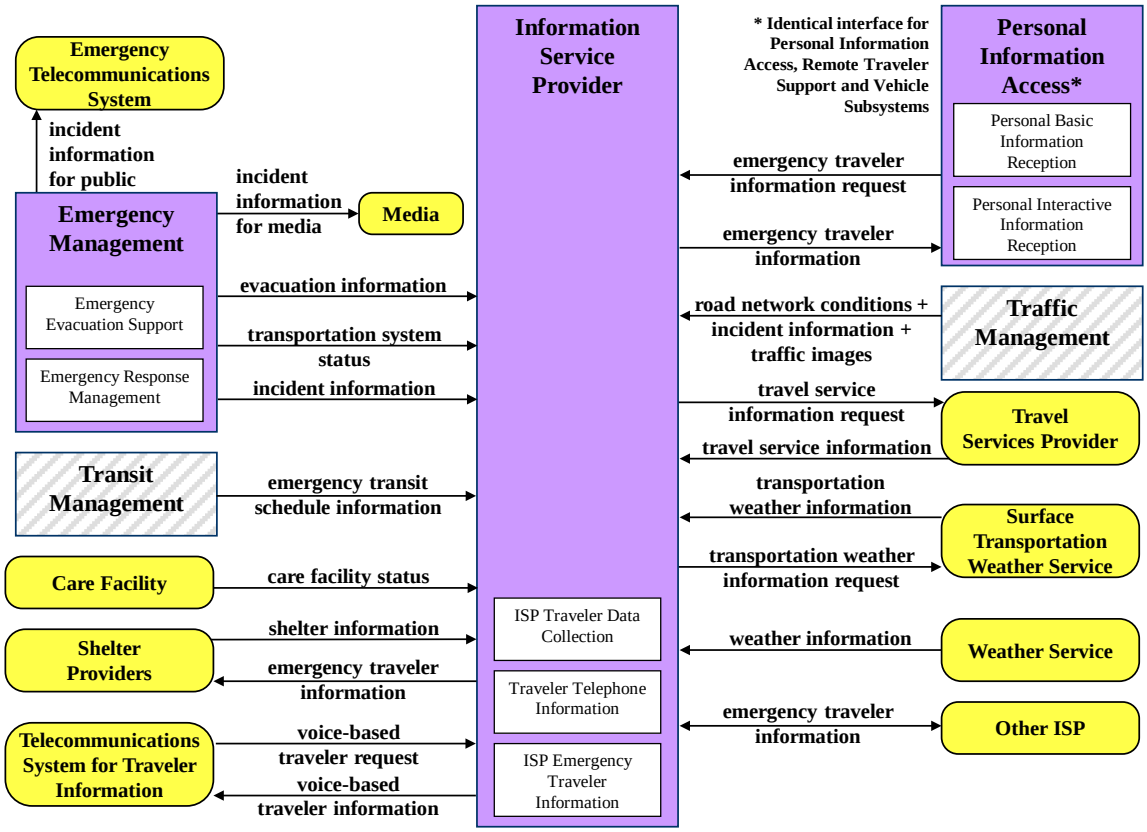
Table 2.2.6-29: EM10 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Increase the accessibility and mobility of people and for freight; | Enhance mobility, convenience, and comfort for transportation system users |
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |
| Increase the security of the transportation system for motorized and nonmotorized users; | Improve the security of the transportation system |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |

Table 2.2.6-30: EM10 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Emergency/Incident Management: Evacuation Times | Reduce the per capita time to evacuate Z persons in the region by X percent over Y years. | Per capita time to evacuate. |
| Traveler Information: Customer Satisfaction | Increase customer satisfaction rating of the timeliness, accuracy, and usefulness of traveler information in the region by W, X, and Z percent, respectively, over Y years. | Customer satisfaction ratings of timeliness, accuracy, and usefulness of traveler information. |

**EM10 – Disaster Traveler Information**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## 2.2.7 Archived Data Management Service Packages

### ITS Data Mart (AD1)

This service 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.

Table 2.2.7-1: AD1 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Government Reporting Systems Support | Archived Data Management |
| ITS Data Repository | Archived Data Management |
| Traffic and Roadside Data Archival | Archived Data Management |
| CV Data Collection | Commercial Vehicle Administration |
| Emergency Data Collection | Emergency Management |
| Emissions Data Collection | Emissions Management |
| ISP Data Collection | Information Service Provider |
| MCM Data Collection | Maintenance and Construction Management |
| Parking Data Collection | Parking Management |
| Toll Data Collection | Payment Administration |
| Roadway Data Collection | Roadway |
| Roadway Probe Data Communications | Roadway |
| Traffic Data Collection | Traffic Management |
| Transit Data Collection | Transit Management |
| Vehicle Traffic Probe Support | Vehicle |

Table 2.2.7-2: AD1 Associated Planning Factors and Goals

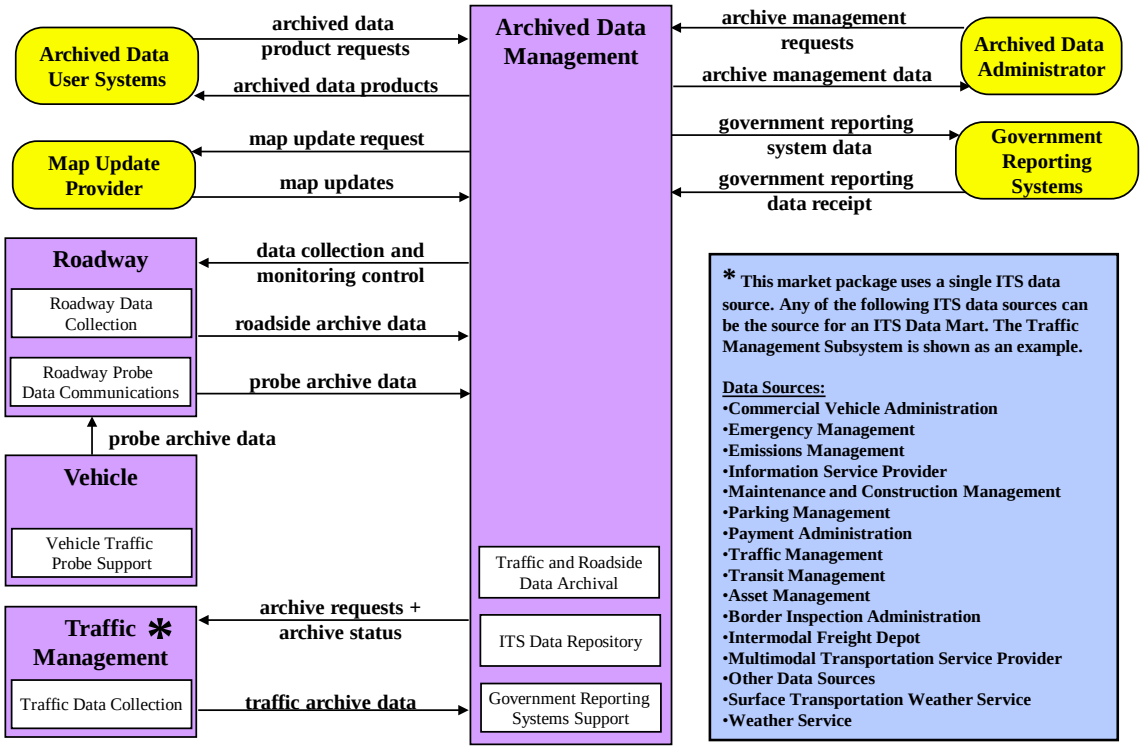
| MetroFactor | Goal |
|---|---|
| Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight; | Enhance the integration and connectivity of the transportation system |

Table 2.2.7-3: AD1 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Integration: Transportation Data Collection | Enhance planning with better data | Amount of data gathered from ITS enhancements used in infrastructure and operations planning |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Integration: Transportation Data Collection | Enhance planning with better data | Number of planning activities using data from ITS systems |
| Integration: Transportation Data Collection | Enhance planning with better data | Years of data in database that is easily searchable and extractable |

**AD1 - ITS Data Mart**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## ITS Data Warehouse (AD2)

This service 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 service package in addition to the basic query and reporting user access features offered by the ITS Data Mart.

Table 2.2.7-4: AD2 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Government Reporting Systems Support | Archived Data Management |
| ITS Data Repository | Archived Data Management |
| On-Line Analysis and Mining | Archived Data Management |
| Traffic and Roadside Data Archival | Archived Data Management |
| CV Data Collection | Commercial Vehicle Administration |
| Emergency Data Collection | Emergency Management |
| Emissions Data Collection | Emissions Management |
| ISP Data Collection | Information Service Provider |
| MCM Data Collection | Maintenance and Construction Management |
| Parking Data Collection | Parking Management |
| Toll Data Collection | Payment Administration |
| Roadway Data Collection | Roadway |
| Roadway Probe Data Communications | Roadway |
| Traffic Data Collection | Traffic Management |
| Transit Data Collection | Transit Management |
| Vehicle Traffic Probe Support | Vehicle |

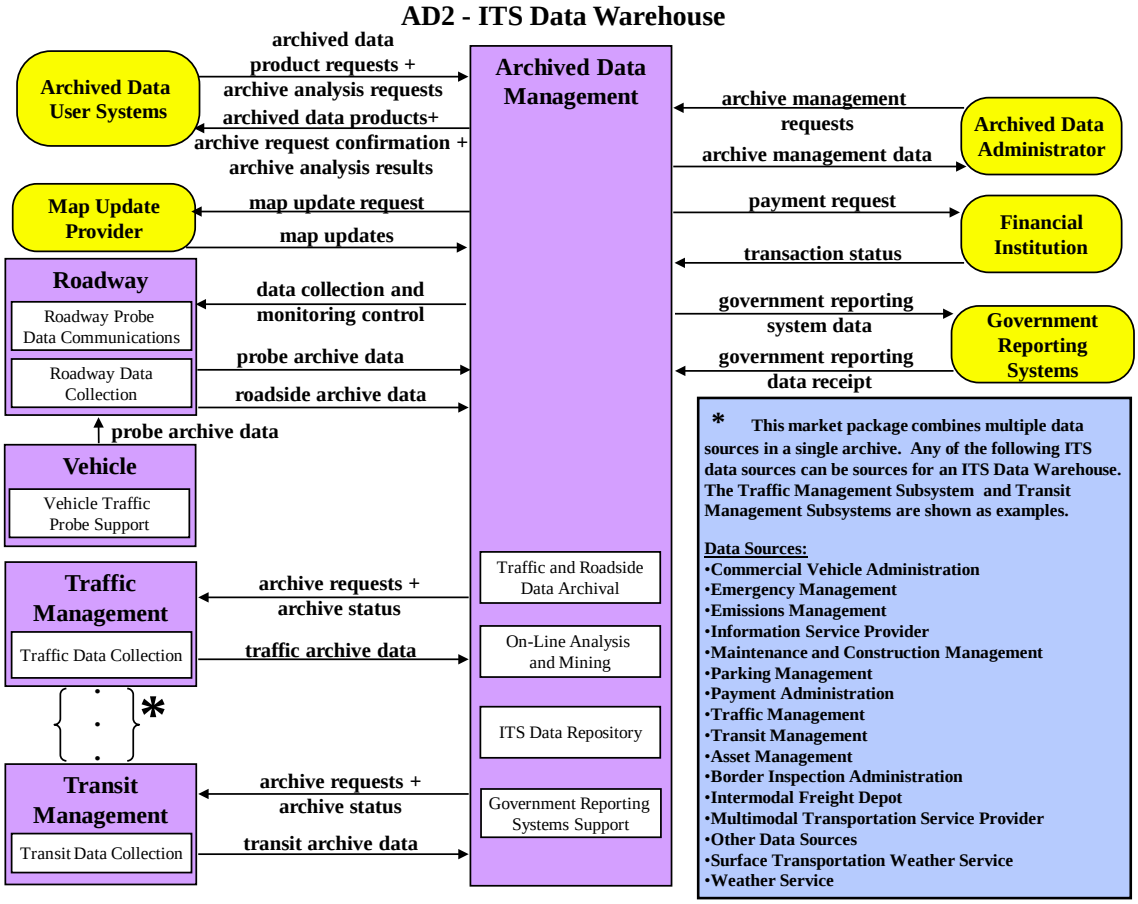
Table 2.2.7-5: AD2 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight; | Enhance the integration and connectivity of the transportation system |

Table 2.2.7-6: AD2 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Integration: Transportation Data Collection | Enhance planning with better data | Amount of data gathered from ITS enhancements used in infrastructure and operations planning |
| Integration: Transportation Data Collection | Enhance planning with better data | Number of planning activities using data from ITS systems |
| Integration: Transportation Data Collection | Enhance planning with better data | Years of data in database that is easily searchable and extractable |




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### ITS Virtual Data Warehouse (AD3)

This service package provides the same broad access to multimodal, multidimensional data from varied data sources as in the ITS Data Warehouse service 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 service package are parsed by the local archive and dynamically translated to requests to remote archives which relay the data necessary to satisfy the request.

Table 2.2.7-7: AD3 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| ITS Data Repository | Archived Data Management |
| Virtual Data Warehouse Services | Archived Data Management |

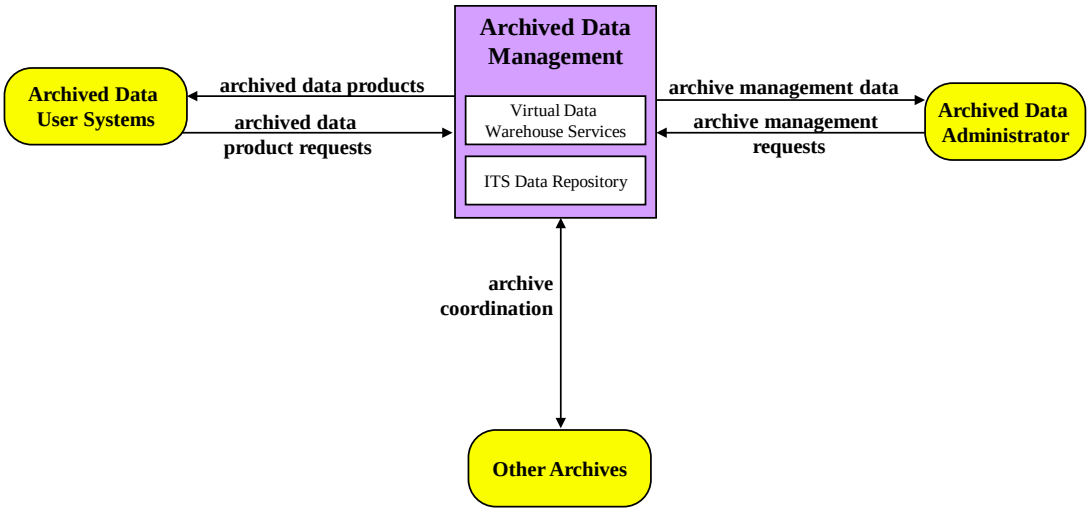
Table 2.2.7-8: AD3 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight; | Enhance the integration and connectivity of the transportation system |

Table 2.2.7-9: AD3 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Integration: Transportation Data Collection | Enhance planning with better data | Amount of data gathered from ITS enhancements used in infrastructure and operations planning |
| Integration: Transportation Data Collection | Enhance planning with better data | Number of planning activities using data from ITS systems |
| Integration: Transportation Data Collection | Enhance planning with better data | Years of data in database that is easily searchable and extractable |

**AD3 - ITS Virtual Data Warehouse**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## 2.2.8 Advanced Vehicle Safety Service Packages

### Vehicle Safety Monitoring (AVSS01)

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

Table 2.2.8-1: AVSS01 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Vehicle Safety Monitoring System | Vehicle |

Table 2.2.8-2: AVSS01 Associated Planning Factors and Goals

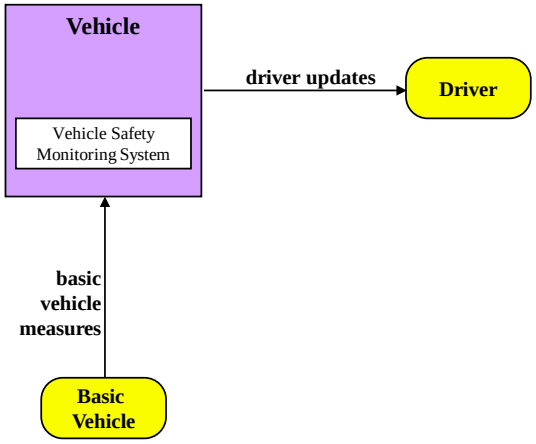
| MetroFactor | Goal |
|---|---|
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |

Table 2.2.8-3: AVSS01 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driver inattention and distraction |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driving while intoxicated |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to red-light running | Number of crashes and fatalities related to red-light running |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to unsafe drivers, vehicles and cargo on the transportation system | Number of crashes and fatalities due to commercial vehicle safety violations |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes in the region by X percent by year Y. | Total crashes per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes involving bicyclists and pedestrians in the region by X percent by year Y. | Total crashes involving bicycles. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes involving bicyclists and pedestrians in the region by X percent by year Y. | Total crashes involving pedestrians. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total fatalities per X VMT. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total severe injuries per X VMT. |

**AVSS01 - Vehicle Safety Monitoring**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## Driver Safety Monitoring (AVSS02)

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

Table 2.2.8-4: AVSS02 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Driver Safety Monitoring System | Vehicle |

Table 2.2.8-5: AVSS02 Associated Planning Factors and Goals

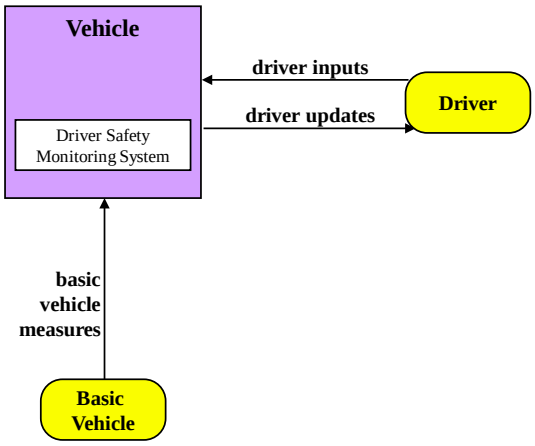
| MetroFactor | Goal |
|---|---|
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |

Table 2.2.8-6: AVSS02 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce crashes at intersections | Number of crashes and fatalities at signalized intersections |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes at intersections | Number of crashes and fatalities at unsignalized intersections |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes at intersections | Number of crashes and fatalities related to red-light running |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes at railroad crossings | Number of crashes and fatalities at railroad crossings |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driver inattention and distraction |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driving while intoxicated |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to unsafe drivers, vehicles and cargo on the transportation system | Number of crashes and fatalities due to commercial vehicle safety violations |
| Safety: Vehicle Crashes and Fatalities | Reduce lane departure crashes | Number of crashes and fatalities related to inappropriate lane departure, crossing or merging |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes in the region by X percent by year Y. | Total crashes per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total fatalities per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total severe injuries per X VMT. |

**AVSS02 - Driver Safety Monitoring**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## Longitudinal Safety Warning (AVSS03)

This service 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.

Table 2.2.8-7: AVSS03 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Vehicle Location Determination | Vehicle |
| Vehicle Longitudinal Warning System | Vehicle |

Table 2.2.8-8: AVSS03 Associated Planning Factors and Goals

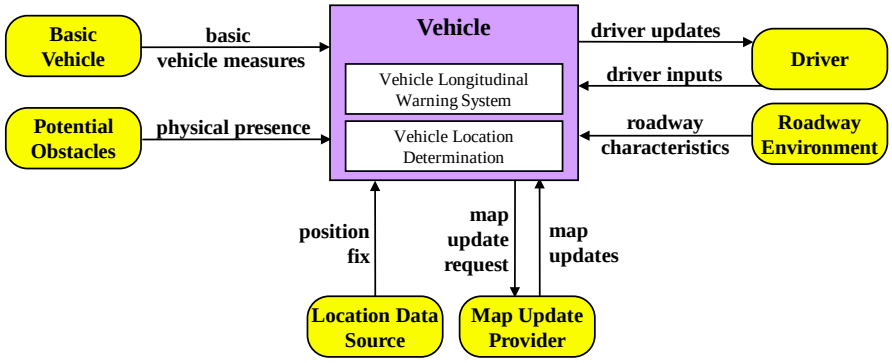
| MetroFactor | Goal |
|---|---|
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |

Table 2.2.8-9: AVSS03 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce crashes at intersections | Number of crashes and fatalities at signalized intersections |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes at intersections | Number of crashes and fatalities at unsignalized intersections |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes at intersections | Number of crashes and fatalities related to red-light running |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driver inattention and distraction |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driving while intoxicated |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to road weather conditions | Number of crashes and fatalities related to weather conditions |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to unexpected congestion | Number of crashes and fatalities related to unexpected congestion |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to unsafe drivers, vehicles and cargo on the transportation system | Number of crashes and fatalities due to commercial vehicle safety violations |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce secondary crashes | Number of secondary crashes |
| Safety: Vehicle Crashes and Fatalities | Reduce speed differential | Number of crashes and fatalities related to excessive speeding |
| Safety: Vehicle Crashes and Fatalities | Reduce speed differential | Number of speed violations |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes in the region by X percent by year Y. | Total crashes per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes involving bicyclists and pedestrians in the region by X percent by year Y. | Total crashes involving bicycles. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes involving bicyclists and pedestrians in the region by X percent by year Y. | Total crashes involving pedestrians. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total fatalities per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total severe injuries per X VMT. |

**AVSS03 - Longitudinal Safety Warning**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## Lateral Safety Warning (AVSS04)

This service 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.

Table 2.2.8-10: AVSS04 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Vehicle Lateral Warning System | Vehicle |

Table 2.2.8-11: AVSS04 Associated Planning Factors and Goals

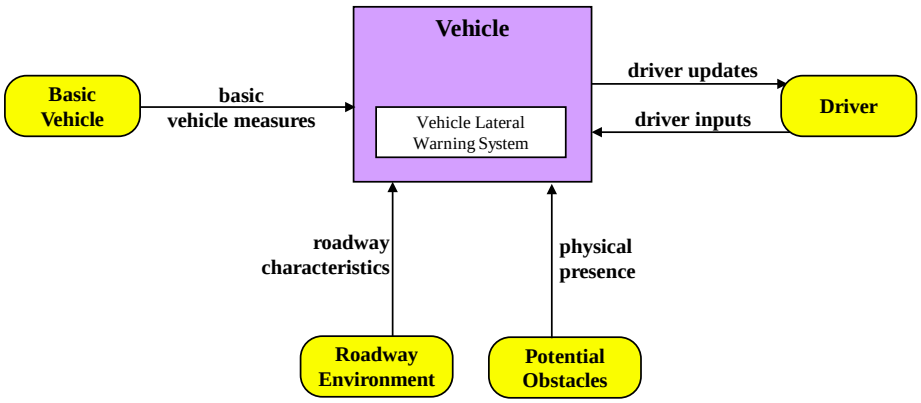
| MetroFactor | Goal |
|---|---|
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |

Table 2.2.8-12: AVSS04 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driver inattention and distraction |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driving while intoxicated |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to road weather conditions | Number of crashes and fatalities related to weather conditions |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to unsafe drivers, vehicles and cargo on the transportation system | Number of crashes and fatalities due to commercial vehicle safety violations |
| Safety: Vehicle Crashes and Fatalities | Reduce lane departure crashes | Number of crashes and fatalities related to inappropriate lane departure, crossing or merging |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes in the region by X percent by year Y. | Total crashes per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes involving bicyclists and pedestrians in the region by X percent by year Y. | Total crashes involving bicycles. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes involving bicyclists and pedestrians in the region by X percent by year Y. | Total crashes involving pedestrians. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total fatalities per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total severe injuries per X VMT. |

**AVSS04 - Lateral Safety Warning**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Intersection Safety Warning (AVSS05)

This service package monitors vehicles approaching an intersection and warns drivers when hazardous conditions are detected. The service package detects impending violations (e.g., red-light violations) and potential conflicts between vehicles occupying or approaching the intersection (e.g., situations where a left turn would be unsafe because of approaching traffic). When a potentially hazardous condition is detected, a warning is communicated to the involved vehicles using short range communications and/or signs/signals in the intersection.

Table 2.2.8-13: AVSS05 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Roadway Equipment Coordination | Roadway |
| Roadway Intersection Safety Warning | Roadway |
| Vehicle Intersection Safety Warning | Vehicle |
| Vehicle Location Determination | Vehicle |

Table 2.2.8-14: AVSS05 Associated Planning Factors and Goals

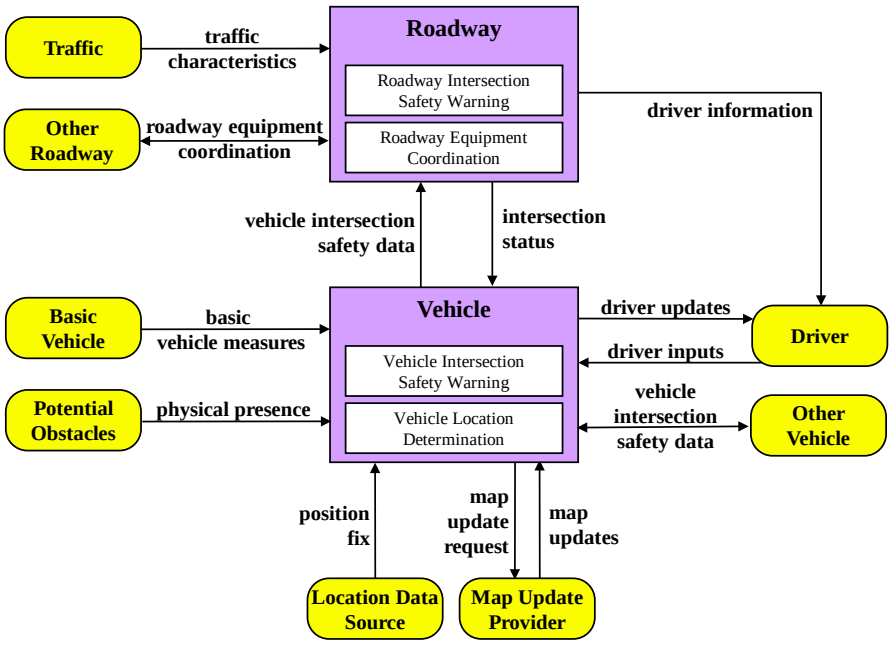
| MetroFactor | Goal |
|---|---|
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |

Table 2.2.8-15: AVSS05 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce crashes at intersections | Number of crashes and fatalities at signalized intersections |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes at intersections | Number of crashes and fatalities at unsignalized intersections |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes at intersections | Number of crashes and fatalities related to red-light running |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes at railroad crossings | Number of crashes and fatalities at railroad crossings |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driver inattention and distraction |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driving while intoxicated |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to red-light running | Number of crashes and fatalities related to red-light running |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to road weather conditions | Number of crashes and fatalities related to weather conditions |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to unsafe drivers, vehicles and cargo on the transportation system | Number of crashes and fatalities due to commercial vehicle safety violations |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes in the region by X percent by year Y. | Total crashes per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes involving bicyclists and pedestrians in the region by X percent by year Y. | Total crashes involving bicycles. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes involving bicyclists and pedestrians in the region by X percent by year Y. | Total crashes involving pedestrians. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total fatalities per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total severe injuries per X VMT. |

**AVSS05 - Intersection Safety Warning**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## Pre-Crash Restraint Deployment (AVSS06)

This service package provides in-vehicle sensors and on-board communications 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 exchange messages with other equipped vehicles to determine the precise location of surrounding vehicles. It will deploy a pre-crash safety system when a crash is imminent.

Table 2.2.8-16: AVSS06 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Vehicle Pre-Crash Safety Systems | Vehicle |
| Vehicle Warning System | Vehicle |

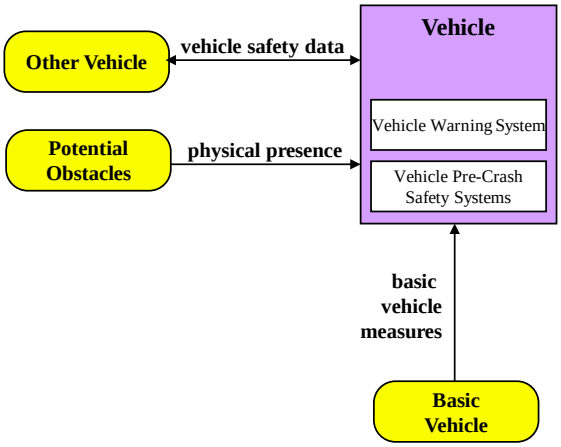
Table 2.2.8-17: AVSS06 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |

Table 2.2.8-18: AVSS06 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total fatalities per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total severe injuries per X VMT. |

**AVSS06 - Pre-Crash Restraint Deployment**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## Driver Visibility Improvement (AVSS07)

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

Table 2.2.8-19: AVSS07 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Driver Visibility Improvement System | Vehicle |

Table 2.2.8-20: AVSS07 Associated Planning Factors and Goals

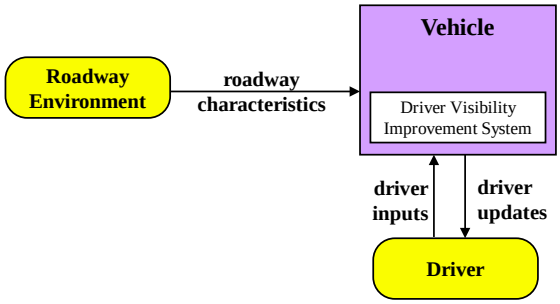
| MetroFactor | Goal |
|---|---|
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |

Table 2.2.8-21: AVSS07 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driver inattention and distraction |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driving while intoxicated |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to road weather conditions | Number of crashes and fatalities related to weather conditions |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to unexpected congestion | Number of crashes and fatalities related to unexpected congestion |
| Safety: Vehicle Crashes and Fatalities | Reduce lane departure crashes | Number of crashes and fatalities related to inappropriate lane departure, crossing or merging |
| Safety: Vehicle Crashes and Fatalities | Reduce secondary crashes | Number of secondary crashes |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes in the region by X percent by year Y. | Total crashes per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes involving bicyclists and pedestrians in the region by X percent by year Y. | Total crashes involving bicycles. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes involving bicyclists and pedestrians in the region by X percent by year Y. | Total crashes involving pedestrians. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total fatalities per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total severe injuries per X VMT. |

**AVSS07 - Driver Visibility Improvement**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## Advanced Vehicle Longitudinal Control (AVSS08)

This service 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.

Table 2.2.8-22: AVSS08 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Vehicle Location Determination | Vehicle |
| Vehicle Longitudinal Control | Vehicle |

Table 2.2.8-23: AVSS08 Associated Planning Factors and Goals

| MetroFactor | Goal |
|---|---|
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns; | Reduce environmental impacts |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

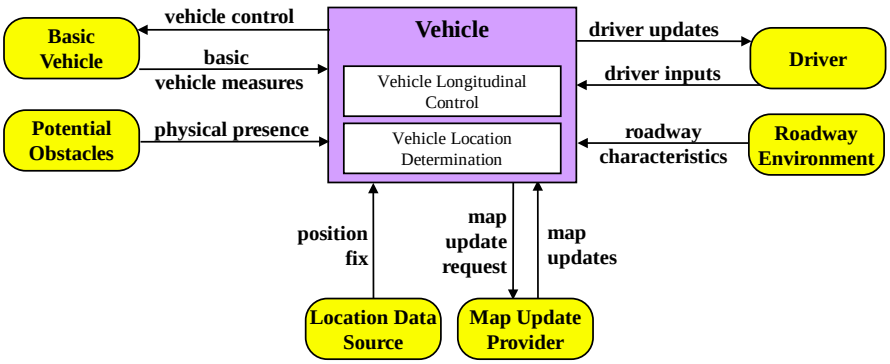
Table 2.2.8-24: AVSS08 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce crashes at intersections | Number of crashes and fatalities at signalized intersections |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes at intersections | Number of crashes and fatalities at unsignalized intersections |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes at intersections | Number of crashes and fatalities related to red-light running |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driver inattention and distraction |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driving while intoxicated |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to road weather conditions | Number of crashes and fatalities related to weather conditions |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to unexpected congestion | Number of crashes and fatalities related to unexpected congestion |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to unsafe drivers, vehicles and cargo on the transportation system | Number of crashes and fatalities due to commercial vehicle safety violations |
| Safety: Vehicle Crashes and Fatalities | Reduce secondary crashes | Number of secondary crashes |
| Safety: Vehicle Crashes and Fatalities | Reduce speed differential | Number of crashes and fatalities related to excessive speeding |
| Safety: Vehicle Crashes and Fatalities | Reduce speed differential | Number of speed violations |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes in the region by X percent by year Y. | Total crashes per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes involving bicyclists and pedestrians in the region by X percent by year Y. | Total crashes involving bicycles. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes involving bicyclists and pedestrians in the region by X percent by year Y. | Total crashes involving pedestrians. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total fatalities per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total severe injuries per X VMT. |
| System Efficiency: Cost of Congestion | Reduce the annual monetary cost of congestion per capita for the next X years. | Cost (in dollars) of congestion or delay per capita. |
| System Efficiency: Duration of Congestion | Reduce the daily hours of recurring congestion on major freeways from X to Y by year Z. | Hours per day at LOS F or V/C > 1.0 (or other threshold). |
| System Efficiency: Duration of Congestion | Reduce the number of hours per day that the top 20 most congested roadways experience recurring congestion by X percent by year Y. | Hours per day at LOS F or V/C > 1.0 (or other threshold). |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Extent of Congestion | Maintain the rate of growth in facility miles experiencing recurring congestion as less than the population growth rate (or employment growth rate). | Percent of lane-miles (or rail) operating at LOS F or V/C > 1.0 |
| System Efficiency: Extent of Congestion | Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period by X percent by year Y. | Percent of lane-miles (or rail) operating at LOS F or V/C > 1.0 |
| System Efficiency: Extent of Congestion | Reduce the share of major intersections operating at LOS Z by X percent by year Y. | Percent of intersections operating at LOS F or V/C > 1.0 |

**AVSS08 - Advanced Vehicle Longitudinal Control**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## Advanced Vehicle Lateral Control (AVSS09)

This service 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.

Table 2.2.8-25: AVSS09 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Vehicle Lateral Control | Vehicle |

Table 2.2.8-26: AVSS09 Associated Planning Factors and Goals

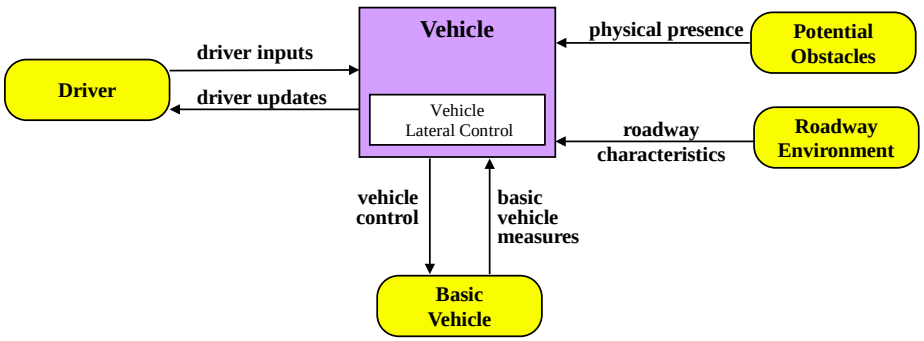
| MetroFactor | Goal |
|---|---|
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |

Table 2.2.8-27: AVSS09 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce crashes at intersections | Number of crashes and fatalities at signalized intersections |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes at intersections | Number of crashes and fatalities at unsignalized intersections |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes at intersections | Number of crashes and fatalities related to red-light running |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driver inattention and distraction |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driving while intoxicated |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to road weather conditions | Number of crashes and fatalities related to weather conditions |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to unsafe drivers, vehicles and cargo on the transportation system | Number of crashes and fatalities due to commercial vehicle safety violations |
| Safety: Vehicle Crashes and Fatalities | Reduce lane departure crashes | Number of crashes and fatalities related to inappropriate lane departure, crossing or merging |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes in the region by X percent by year Y. | Total crashes per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes involving bicyclists and pedestrians in the region by X percent by year Y. | Total crashes involving bicycles. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes involving bicyclists and pedestrians in the region by X percent by year Y. | Total crashes involving pedestrians. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total fatalities per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total severe injuries per X VMT. |

**AVSS09 - Advanced Vehicle Lateral Control**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Intersection Collision Avoidance (AVSS10)

This service package will determine the probability of an intersection collision and provide timely warnings to approaching vehicles so that avoidance actions can be taken. This service package builds on the Intersection Safety Warning field and in-vehicle equipment and adds equipment in the vehicle that can take control of the vehicle to avoid intersection violations and potential collisions. The same sensors and communications equipment in the roadway infrastructure are used 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.

Table 2.2.8-28: AVSS10 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Roadway Equipment Coordination | Roadway |
| Roadway Intersection Safety Warning | Roadway |
| Vehicle Intersection Control | Vehicle |
| Vehicle Location Determination | Vehicle |

Table 2.2.8-29: AVSS10 Associated Planning Factors and Goals

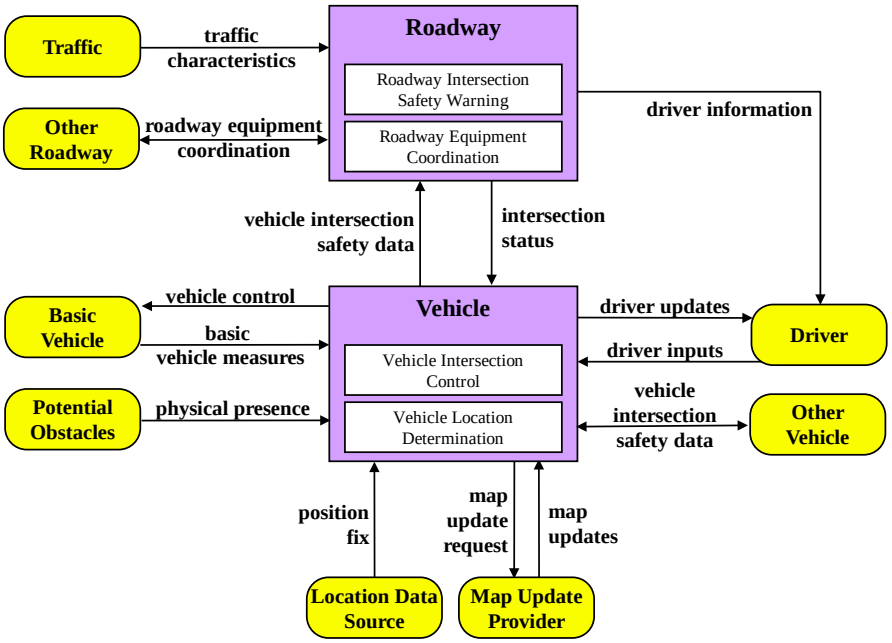
| MetroFactor | Goal |
|---|---|
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |

Table 2.2.8-30: AVSS10 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce crashes at intersections | Number of crashes and fatalities at signalized intersections |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes at intersections | Number of crashes and fatalities at unsignalized intersections |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes at intersections | Number of crashes and fatalities related to red-light running |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driver inattention and distraction |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driving while intoxicated |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to red-light running | Number of crashes and fatalities related to red-light running |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to road weather conditions | Number of crashes and fatalities related to weather conditions |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to unsafe drivers, vehicles and cargo on the transportation system | Number of crashes and fatalities due to commercial vehicle safety violations |
| Safety: Vehicle Crashes and Fatalities | Reduce speed differential | Number of crashes and fatalities related to excessive speeding |
| Safety: Vehicle Crashes and Fatalities | Reduce speed differential | Number of speed violations |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes in the region by X percent by year Y. | Total crashes per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes involving bicyclists and pedestrians in the region by X percent by year Y. | Total crashes involving bicycles. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes involving bicyclists and pedestrians in the region by X percent by year Y. | Total crashes involving pedestrians. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total fatalities per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total severe injuries per X VMT. |

**AVSS10 - Intersection Collision Avoidance**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

## Automated Vehicle Operations (AVSS11)

This service package enables "hands-off" operation of the vehicle on automated portions of the highway system. Implementation requires lateral lane holding, vehicle speed and steering control. Communications between vehicles and between the vehicles and supporting infrastructure equipment supports cooperative check-in to the automated portion of the system and transition to automated mode, coordination of maneuvers between vehicles in automated mode, and checkout from the automated system as the driver resumes control of the vehicle.

Table 2.2.8-31: AVSS11 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Roadway Automated Vehicle Operations | Roadway |
| TMC Automated Vehicle Operations | Traffic Management |
| Vehicle Automated Operations | Vehicle |

Table 2.2.8-32: AVSS11 Associated Planning Factors and Goals

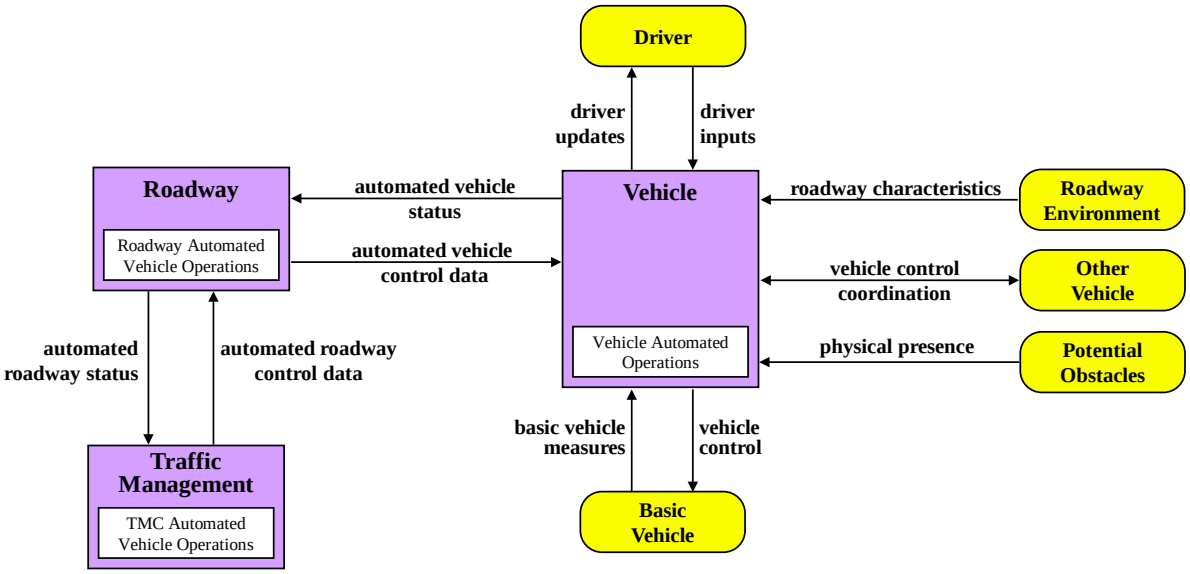
| MetroFactor | Goal |
|---|---|
| Promote efficient system management and operation; | Increase operational efficiency and reliability of the transportation system |
| Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns; | Reduce environmental impacts |
| Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency; | Support regional economic productivity and development |

Table 2.2.8-33: AVSS11 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Cost of Congestion | Reduce the annual monetary cost of congestion per capita for the next X years. | Cost (in dollars) of congestion or delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per capita by X percent by year Y. | Hours of delay per capita. |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay (person-hours). |
| System Efficiency: Delay | Reduce hours of delay per driver by X percent by year Y. | Hours of delay per driver. |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| System Efficiency: Duration of Congestion | Reduce the daily hours of recurring congestion on major freeways from X to Y by year Z. | Hours per day at LOS F or V/C > 1.0 (or other threshold). |
| System Efficiency: Duration of Congestion | Reduce the number of hours per day that the top 20 most congested roadways experience recurring congestion by X percent by year Y. | Hours per day at LOS F or V/C > 1.0 (or other threshold). |
| System Efficiency: Energy Consumption | Reduce excess fuel consumed due to congestion by X percent by year Y. | Excess fuel consumed (total or per capita). |
| System Efficiency: Energy Consumption | Reduce total energy consumption per capita for transportation by X percent by year Y. | Total energy consumed per capita for transportation. |
| System Efficiency: Energy Consumption | Reduce total fuel consumption per capita for transportation by X percent by year Y. | Total fuel consumed per capita for transportation. |
| System Efficiency: Extent of Congestion | Maintain the rate of growth in facility miles experiencing recurring congestion as less than the population growth rate (or employment growth rate). | Percent of lane-miles (or rail) operating at LOS F or V/C > 1.0 |
| System Efficiency: Extent of Congestion | Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period by X percent by year Y. | Percent of lane-miles (or rail) operating at LOS F or V/C > 1.0 |
| System Efficiency: Extent of Congestion | Reduce the share of major intersections operating at LOS Z by X percent by year Y. | Percent of intersections operating at LOS F or V/C > 1.0 |
| System Efficiency: Intensity of Congestion (Travel Time Index) | Reduce the regional average travel time index by X percent per year. | Travel time index (the average travel time during the peak period, using congested speeds, divided by the off-peak period travel time, using posted or free-flow speeds). |
| System Efficiency: Travel Time | Annual rate of change in regional average commute travel time will not exceed regional rate of population growth through the year Y. | Average commute trip travel time (minutes). |
| System Efficiency: Travel Time | Improve average travel time during peak periods by X percent by year Y. | Average travel time during peak periods (minutes). |

**AVSS11 - Automated Vehicle Operations**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

### Cooperative Vehicle Safety Systems (AVSS12)

This service package enhances the on-board longitudinal and lateral warning stand-alone systems by exchanging messages with other surrounding vehicles and roadside equipment. Vehicles send out information concerning their location, speed, and direction to surrounding vehicles. The roadside equipment provides information about potential safety hazards in the vehicle path such as stalled (unequipped) vehicles, wrong-way drivers, debris, or water hazards. The on-board systems can then process this information and present warnings to the driver including headway warnings, merge warnings, unsafe passing warnings, and warnings about hazards detected in the vehicle path. Special messages from approaching emergency vehicles may also be received and processed.

Table 2.2.8-34: AVSS12 Included Equipment Packages and Subsystems

| Equipment Package Name | Subsystem |
|---|---|
| | |
| Roadway Equipment Coordination | Roadway |
| Roadway Safety Warning System | Roadway |
| Vehicle Warning System | Vehicle |

Table 2.2.8-35: AVSS12 Associated Planning Factors and Goals

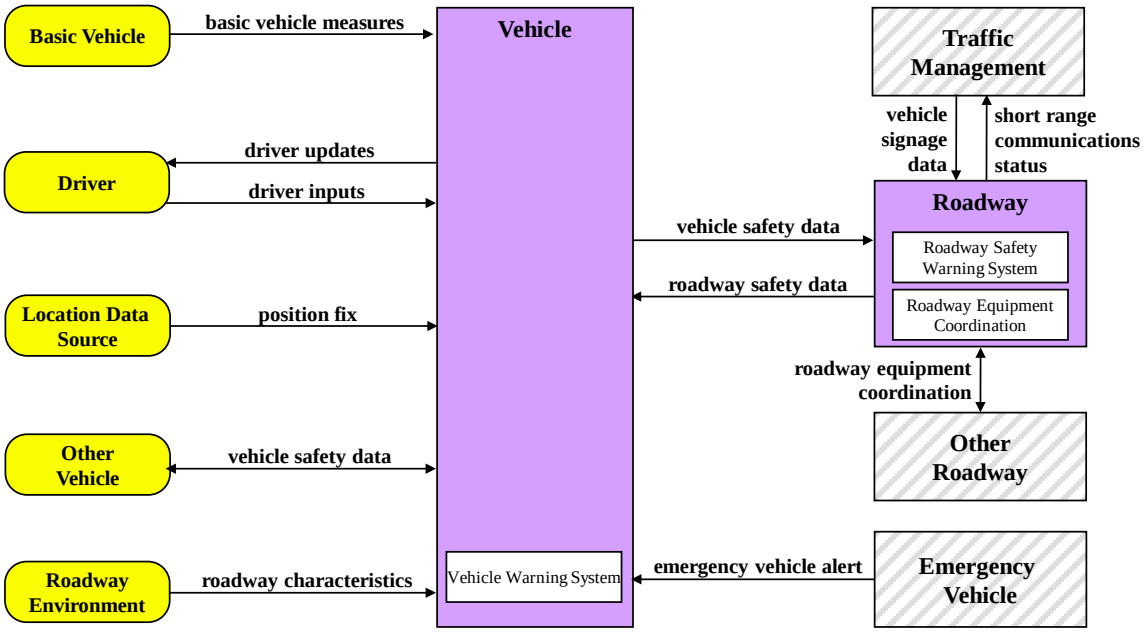
| MetroFactor | Goal |
|---|---|
| Increase the safety of the transportation system for motorized and nonmotorized users; | Improve the safety of the transportation system |

Table 2.2.8-36: AVSS12 Associated Objectives and Performance Measures

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce crashes at intersections | Number of crashes and fatalities at signalized intersections |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes at intersections | Number of crashes and fatalities at unsignalized intersections |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes at intersections | Number of crashes and fatalities related to red-light running |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes at railroad crossings | Number of crashes and fatalities at railroad crossings |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driver inattention and distraction |

| Objective Category | Objective | Performance Measure |
|---|---|---|
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to driver errors and limitations | Number of crashes and fatalities related to driving while intoxicated |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to red-light running | Number of crashes and fatalities related to red-light running |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to road weather conditions | Number of crashes and fatalities related to weather conditions |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to unexpected congestion | Number of crashes and fatalities related to unexpected congestion |
| Safety: Vehicle Crashes and Fatalities | Reduce crashes due to unsafe drivers, vehicles and cargo on the transportation system | Number of crashes and fatalities due to commercial vehicle safety violations |
| Safety: Vehicle Crashes and Fatalities | Reduce lane departure crashes | Number of crashes and fatalities related to inappropriate lane departure, crossing or merging |
| Safety: Vehicle Crashes and Fatalities | Reduce secondary crashes | Number of secondary crashes |
| Safety: Vehicle Crashes and Fatalities | Reduce speed differential | Number of crashes and fatalities related to excessive speeding |
| Safety: Vehicle Crashes and Fatalities | Reduce speed differential | Number of speed violations |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes in the region by X percent by year Y. | Total crashes per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes involving bicyclists and pedestrians in the region by X percent by year Y. | Total crashes involving bicycles. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of crashes involving bicyclists and pedestrians in the region by X percent by year Y. | Total crashes involving pedestrians. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total fatalities per X VMT. |
| Safety: Vehicle Crashes and Fatalities | Reduce the total number of fatalities and severe injuries in the region by X percent by year Y. | Total severe injuries per X VMT. |

**AVSS12 – Cooperative Vehicle Safety Systems**




*Note: Graphic shows key service package elements. Some elements are omitted for clarity.

# 3 Service Packages and User Services

The Service Packages are directly traceable to the User Services and often include capabilities that span more than one user service. Conversely, a single User Service sometimes includes a range of incremental capabilities that are segregated into separate Service Packages so that they may be considered separately from a deployment perspective. As a result, there is often a many-to-many relationship between the Service Packages and the User Services.

To illustrate these relationships, consider the following examples:

- The Traffic Control user service requires distinct surveillance, freeway and surface street traffic control, integrated area-wide traffic control, HOV lane control, and traffic information dissemination capabilities. Since each of these capabilities may be deployed individually by a local jurisdiction, they are allocated to distinct Service Packages. The Service Packages also distinguish between different traffic surveillance approaches. Roadside instrumentation (i.e., the Network Surveillance Service Package) and vehicle probes (i.e. the Traffic Probe Surveillance Service Package) are separated due to fundamentally different technical and institutional issues for the two approaches. In total, sixteen separate Service Packages provide different mechanisms and levels of support for satisfying the Traffic Control User Service Requirements.

- The HOV Lane Management Service Package supports both the Traffic Control and Travel Demand Management User Services since both services could include HOV lane management capabilities. This single deployable package satisfies portions of the requirements associated with both of these user services.

The relationship between User Services and Service Packages is presented in Table 3-1. As shown in the table, the identified Service Packages support all required User Services.

***Table 3-1: Service Package to User Service Relationships***

| Service Package | 1_1 - Pre-trip Travel Information | 1_2 - En-route Driver Information | 1_3 - Route Guidance | 1_4 - Ride Matching And Reservation | 1_5 - Traveler Services Information | 1_6 - Traffic Control | 1_7 - Incident Management | 1_8 - Travel Demand Management | 1_9 - Emissions Testing And Mitigation | 1_10 - Highway Rail Intersection | 2_1 - Public Transportation Management | 2_2 - En-route Transit Information | 2_3 - Personalized Public Transit | 2_4 - Public Travel Security | 3_1 - Electronic Payment Services | 4_1 - Commercial Vehicle Electronic Clearance | 4_2 - Automated Roadside Safety Inspection | 4_3 - On-board Safety And Security Monitoring | 4_4 - Commercial Vehicle Administrative Processes | 4_5 - Hazmat Security and Incident Response | 4_6 - Freight Mobility | 5_1 - Emergency Notification and Personal Security | 5_2 - Emergency Vehicle Management | 5_3 - Disaster Response And Evacuation | 6_1 - Longitudinal Collision Avoidance | 6_2 - Lateral Collision Avoidance | 6_3 - Intersection Collision Avoidance | 6_4 - Vision Enhancement For Crash Avoidance | 6_5 - Safety Readiness | 6_6 - Pre-crash Restraint Deployment | 6_7 - Automated Vehicle Operation | 7_1 - Archived Data | 8_1 - Maintenance and Construction Operations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AD1: ITS Data Mart | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | |
| AD2: ITS Data Warehouse | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | |
| AD3: ITS Virtual Data Warehouse | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | |
| APTS01: Transit Vehicle Tracking | | | | | | | | | | | ● | | | ● | | | | | | | | | | | | | | | | | | | |
| APTS02: Transit Fixed-Route Operations | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | |
| APTS03: Demand Response Transit Operations | | | | | | | | | | | ● | | ● | | | | | | | | | | | | | | | | | | | | |
| APTS04: Transit Fare Collection Management | | | | | | | | ● | | | ● | | | | ● | | | | | | | | | | | | | | | | | | |
| APTS05: Transit Security | | | | | | | | | | | ● | | | ● | | | | | | | | | ● | | | | | | | | | | |
| APTS06: Transit Fleet Management | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | |
| APTS07: Multi-modal Coordination | | | | | | ● | | | | | ● | | | | | | | | | | | | | | | | | | | | | | |
| APTS08: Transit Traveler Information | | | | | | | | | | | ● | ● | ● | | ● | | | | | | | | | | | | | | | | | | |
| APTS09: Transit Signal Priority | | | | | | ● | | | | | ● | | | | | | | | | | | | | | | | | | | | | | |
| APTS10: Transit Passenger Counting | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | |
| APTS11: Multimodal Connection Protection | | | | | | | | | | | ● | ● | | | | | | | | | | | | | | | | | | | | | |
| ATIS01: Broadcast Traveler Information | ● | ● | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | | | | |
| ATIS02: Interactive Traveler Information | ● | ● | | ● | ● | | ● | | | | | ● | | | ● | | | | | | | | | | | | | | | | | | |
| ATIS03: Autonomous Route Guidance | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ATIS04: Dynamic Route Guidance | | | ● | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Service Package | 1_1 - Pre-trip Travel Information | 1_2 - En-route Driver Information | 1_3 - Route Guidance | 1_4 - Ride Matching And Reservation | 1_5 - Traveler Services Information | 1_6 - Traffic Control | 1_7 - Incident Management | 1_8 - Travel Demand Management | 1_9 - Emissions Testing And Mitigation | 1_10 - Highway Rail Intersection | 2_1 - Public Transportation Management | 2_2 - En-route Transit Information | 2_3 - Personalized Public Transit | 2_4 - Public Travel Security | 3_1 - Electronic Payment Services | 4_1 - Commercial Vehicle Electronic Clearance | 4_2 - Automated Roadside Safety Inspection | 4_3 - On-board Safety And Security Monitoring | 4_4 - Commercial Vehicle Administrative Processes | 4_5 - Hazmat Security and Incident Response | 4_6 - Freight Mobility | 5_1 - Emergency Notification and Personal Security | 5_2 - Emergency Vehicle Management | 5_3 - Disaster Response And Evacuation | 6_1 - Longitudinal Collision Avoidance | 6_2 - Lateral Collision Avoidance | 6_3 - Intersection Collision Avoidance | 6_4 - Vision Enhancement For Crash Avoidance | 6_5 - Safety Readiness | 6_6 - Pre-crash Restraint Deployment | 6_7 - Automated Vehicle Operation | 7_1 - Archived Data | 8_1 - Maintenance and Construction Operations |
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| ATIS05: ISP Based Trip Planning and Route Guidance | ● | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ATIS06: Transportation Operations Data Sharing | | | | | | ● | ● | | | | ● | | | | ● | | | | | | ● | | | ● | | | | | | | | ● |
| ATIS07: Travel Services Information and Reservation | ● | | | | ● | | | | | | | | | | ● | | | | | | | | | | | | | | | | | |
| ATIS08: Dynamic Ridesharing | | | | ● | | | | ● | | | | | ● | | | | | | | | | | | | | | | | | | | |
| ATIS09: In Vehicle Signing | | ● | | | | | | | | | ● | | | | | | | | | | | | | ● | | | | | | | | |
| ATIS10: Short Range Communications Traveler Information | | ● | | | ● | ● | | | | | | | | | | | | | | | | | | | ● | | | | | | | ● |
| ATMS01: Network Surveillance | | | | | | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | |
| ATMS02: Traffic Probe Surveillance | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ATMS03: Traffic Signal Control | | | | | | ● | ● | | | ● | | | | | | | | | | | | | | | | | | | | | | |
| ATMS04: Traffic Metering | | | | | | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | |
| ATMS05: HOV Lane Management | | | | | | ● | | ● | | | | | | | | | | | | | | | | | | | | | | | | |
| ATMS06: Traffic Information Dissemination | | ● | | | | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | |
| ATMS07: Regional Traffic Management | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ATMS08: Traffic Incident Management System | | | | | | | ● | | | | | | | | | | | | | | | | | ● | ● | | | | | | | |
| ATMS09: Transportation Decision Support and Demand Management | | | | | | ● | | ● | | | | | | | | | | | | | | | | | | | | | | | | |
| ATMS10: Electronic Toll Collection | | | | | | | | ● | | | | | | | ● | | | | | | | | | | | | | | | | | |
| ATMS11: Emissions | | | | | | | | ● | ● | | | | | | | | | | | | | | | | | | | | | | | |

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| Monitoring and Management | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ATMS12: Roadside Lighting System Control | | | | | | ● | | | | | | | | | | | | | | | | ● | | | | | | | | | | | |
| 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 Warning and Enforcement | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | ● |
| ATMS20: Drawbridge Management | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ATMS21: Roadway Closure Management | | | | | | ● | ● | | | ● | | | | | | | | | | | ● | | ● | ● | ● | | | | | | | | |
| ATMS22: Variable Speed Limits | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ATMS23: Dynamic Lane Management and Shoulder Use | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ATMS24: Dynamic Roadway Warning | | | | | | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ATMS25: VMT Road User Payment | | | | | | | | ● | | | | | | | ● | | | | | | | | | | | | | | | | | | |
| ATMS26: Mixed Use Warning Systems | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| AVSS01: Vehicle Safety Monitoring | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | | | |
| AVSS02: Driver Safety Monitoring | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | | | |

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| 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 Vehicle Operations | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | | |
| AVSS12: Cooperative Vehicle Safety Systems | | | | | | | | | | | | | | | | | | | | | | | | | ● | ● | | | | | | | |
| CVO01: Carrier Operations and Fleet Management | | | | | | | | | | | | | | | | | | | | | | ● | | | | | | | | | | | |
| CVO02: Freight Administration | | | | | | | | | | | | | | | | | | | | | | ● | | | | | | | | | | | |
| CVO03: Electronic Clearance | | | | | | | | | | | | | | | | ● | | | ● | | | | | | | | | | | | | | |
| CVO04: CV Administrative Processes | | | | | | | | | | | | | | | | ● | | | ● | | | ● | | | | | | | | | | | |
| CVO05: International Border Electronic Clearance | | | | | | | | | | | | | | | | ● | | | ● | | | ● | | | | | | | | | | | |
| CVO06: Weigh-In-Motion | | | | | | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | |
| CVO07: Roadside CVO Safety | | | | | | | | | | | | | | | | ● | ● | | | | | ● | | | | | | | | | | | |

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| CVO08: On-board CVO Safety | | | | | | | | | | | | | | | | | | ● | | | | | | | | | | | | | | | |
| CVO09: CVO Fleet Maintenance | | | | | | | | | | | | | | | | | ● | ● | | | ● | | | | | | | | | | | | |
| CVO10: HAZMAT Management | | | | | | | | | | | | | | | | | | | ● | ● | ● | ● | ● | | | | | | | | | | |
| CVO11: Roadside HAZMAT Security Detection and Mitigation | | | | | | | | | | | | | | | | | | | | ● | ● | | | | | | | | | | | | |
| CVO12: CV Driver Security Authentication | | | | | | | | | | | | | | | | | | ● | | ● | | | | | | | | | | | | | |
| CVO13: Freight Assignment Tracking | | | | | | | | | | | | | | | | | | ● | | ● | ● | | | | | | | | | | | | |
| EM01: Emergency Call-Taking and Dispatch | | | | | | | | | | | | | | | | | | | | ● | | | ● | | | | | | | | | | |
| EM02: Emergency Routing | | | ● | | | ● | | | | | | | | | | | | | | | | | ● | | | | | | | | | | |
| EM03: Mayday and Alarms Support | | | | | | | | | | | | | | | | | | | | | | ● | | | | | | | | | | | |
| EM04: Roadway Service Patrols | | | | | | | | | | | | | | | | | | | | | | | ● | | | | | | | | | | |
| EM05: Transportation Infrastructure Protection | | | | | | | | | | | | | | | | | | | | | | ● | | ● | | | | | | | | | |
| EM06: Wide-Area Alert | | | | | | | | | | | | ● | | | | | | | | | | ● | | | | | | | | | | | |
| EM07: Early Warning System | | | | | | | | | | | | | | | | | | | | | | | | ● | | | | | | | | | |
| EM08: Disaster Response and Recovery | | | | | | | | | | | | | | | | | | | | | | | | ● | | | | | | | | | |
| EM09: Evacuation and Reentry Management | | | | | | | | | | | | | | | | | | | | | | | | ● | | | | | | | | | |
| EM10: Disaster Traveler Information | | | | | | | | | | | | | | | | | | | | | | | | ● | | | | | | | | | |
| MC01: Maintenance and Construction Vehicle and Equipment Tracking | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● |
| MC02: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● |

| Service Package | 1_1 - Pre-trip Travel Information | 1_2 - En-route Driver Information | 1_3 - Route Guidance | 1_4 - Ride Matching And Reservation | 1_5 - Traveler Services Information | 1_6 - Traffic Control | 1_7 - Incident Management | 1_8 - Travel Demand Management | 1_9 - Emissions Testing And Mitigation | 1_10 - Highway Rail Intersection | 2_1 - Public Transportation Management | 2_2 - En-route Transit Information | 2_3 - Personalized Public Transit | 2_4 - Public Travel Security | 3_1 - Electronic Payment Services | 4_1 - Commercial Vehicle Electronic Clearance | 4_2 - Automated Roadside Safety Inspection | 4_3 - On-board Safety And Security Monitoring | 4_4 - Commercial Vehicle Administrative Processes | 4_5 - Hazmat Security and Incident Response | 4_6 - Freight Mobility | 5_1 - Emergency Notification and Personal Security | 5_2 - Emergency Vehicle Management | 5_3 - Disaster Response And Evacuation | 6_1 - Longitudinal Collision Avoidance | 6_2 - Lateral Collision Avoidance | 6_3 - Intersection Collision Avoidance | 6_4 - Vision Enhancement For Crash Avoidance | 6_5 - Safety Readiness | 6_6 - Pre-crash Restraint Deployment | 6_7 - Automated Vehicle Operation | 7_1 - Archived Data | 8_1 - Maintenance and Construction Operations |
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| Maintenance and Construction Vehicle Maintenance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MC03: Road Weather Data Collection | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● |
| MC04: Weather Information Processing and Distribution | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● |
| MC05: Roadway Automated Treatment | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● |
| MC06: Winter Maintenance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● |