ITS Physical Architecture

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Table of Contents

List of Tables

List of Figures

Executive Summary

The National ITS Architecture is a framework of physical elements on which ITS deployment, standards, and evaluation can be built. The framework consists of three layers: a transportation layer including functions required to implement ITS user services, a communication layer including identification of communication technologies and systems which will be used to exchange data required by the transportation layer, and an institutional layer which provides structure to the forces specifying requirements and deploying the architecture over time. The communications analysis is expanded in the *Communications Document.* The institutional layer is defined in the *Implementation Strategy*.

The transportation layer contains subsystems, terminators, and physical architecture flows between these entities. There are 21 subsystems representing groupings of functions defined in the logical architecture that may be operated by single entities. These 21 subsystems include Traffic Management, Transit Management, Maintenance and Construction Management, Commercial Vehicle Administration, Roadway, Toll Collection, Remote Traveler Support, Vehicles and others. The interfaces between these subsystems represent not only physical interfaces between equipment and computers but between operating agencies in the real world. Careful definition of these interfaces provides developers with an understanding of how to build components which will reliably integrate with other components in future ITS deployments. While specifying the groupings of functionality and the interfaces between entities, the architecture development team has been careful to not over specify an ITS design. It is impossible to foresee what technology will be forthcoming or what roles agencies wish to play in ITS. Therefore, the architecture remains flexible indicating top level types of data that is exchanged and basic functions which are performed. It leaves the specific system design up to implementers and the interface standards development up to standards development bodies and stakeholders with specific domain knowledge and vested interest in the outcome.

Similarly, the communication layer specifies general requirements to make ITS functions able to communicate with each other. Only 4 types of traditional communication are called for with the assumption that users will adopt existing and emerging technologies as they develop. Specific recommendations are that beacon technologies are ideally suited to several types of ITS communication requirements where it is desirable to communicate with a vehicle within the immediate proximity in a very short period of time. More general communication requirements between vehicles and the infrastructure are accommodated with existing deployed wide area wireless technology. Evaluation of the requirements of the architecture can find no justification for significant expenditures for development of additional infrastructure for wide area communication for ITS over and above that currently emerging. Other communications involve advanced vehicle-vehicle and traditional wireline communications. Specific requirements for each type of communication are identified in the physical architecture in support of data loading and communication performance analysis in other documents.

Deployment of ITS will be by the operating agencies currently in existence and by entrepreneurs who see a chance to better support travel needs with new technology. The User Service requirements are re-distributed into deployment elements called Market Packages. Each Market Package represents a service which the architecture team feels will be deployed as an integrated capability. Looking at the architecture structure, one can decompose each of these services into elements which will be performed by each of the defined subsystems. These elements called Equipment Packages are the basic functions which implementers will develop or buy. The architecture specifies the general capabilities of each of these functions and the interface of the function with other relevant functions.

All elements of the architecture presented in this document are maintained in a database providing a tool for easy retrieval of information, consistency checking, and ready documentation. The databases can be shared with other groups developing more detailed versions of special applications such as Commercial Vehicle Operations, Transit, Traffic Management, and Traveler Information. In this way, it is possible to maintain a coherent, integrated ITS database of functions, data flows, standards, and performance.

1. INTRODUCTION

The Physical Architecture identifies the physical subsystems and, architecture flows between subsystems that will implement the processes and support the data flows of the ITS Logical Architecture. The Physical Architecture further identifies the system terminator inputs (sources) and system terminator outputs (destinations) for architecture flows into and out of the system (see the Physical Architecture Context Diagram,).

1.1 System Overview

The Architecture is structured in 3 layers as shown in (Figure 1-1). A transportation layer performs transportation functions such as traffic management and traveler information provision. Functions (process specifications in the Logical Architecture) are assigned to subsystems such that the interfaces between subsystems represent candidate interfaces in the physical world. Subsystems were selected based on a limited set of criteria in order to:

- represent the functions of each major stakeholder group at a high level on in the physical architecture (e.g. Transit agencies, Emergency Services, Commercial Vehicle Operators all see both infrastructure and vehicle components)

- explicitly specify those functions that are performed in centers and those functions performed in vehicles (e.g. Route Planning could be performed either in the vehicle or by a service provider, route selection and turn-by-turn guidance is always done in the vehicle)

- collect functions currently performed by a single agency together (e.g. transit center functions are all performed in the Transit Management Subsystem, traffic management is performed in the Traffic Management Subsystem)

- separate functions that may in the future be split out to third party providers (e.g. provision of information in the Information Service Provider Subsystem, and data brokering in the Commercial Vehicle Administration Subsystem)

In order to provide for enough flexibility to stimulate market growth, the subsystems may be combined during system design within agencies, buildings, vehicles and so on. That means that a Traffic Management Center may include in addition to the Traffic Management Subsystem, an Information Service Provider Subsystem, and possibly an Emergency Management Subsystem.

The Communication layer represents the technology which will support the interfaces between transportation functions. Each data flow required by the transportation functions is evaluated with respect to the type of communication service which will be needed. The communication analysis document draws some conclusions regarding the current technical capabilities to support the requirements.

The Institutional layer represents the policy makers, planners and other users of the ITS services. These agencies and organizations are further addressed in Implementation Strategy Document.

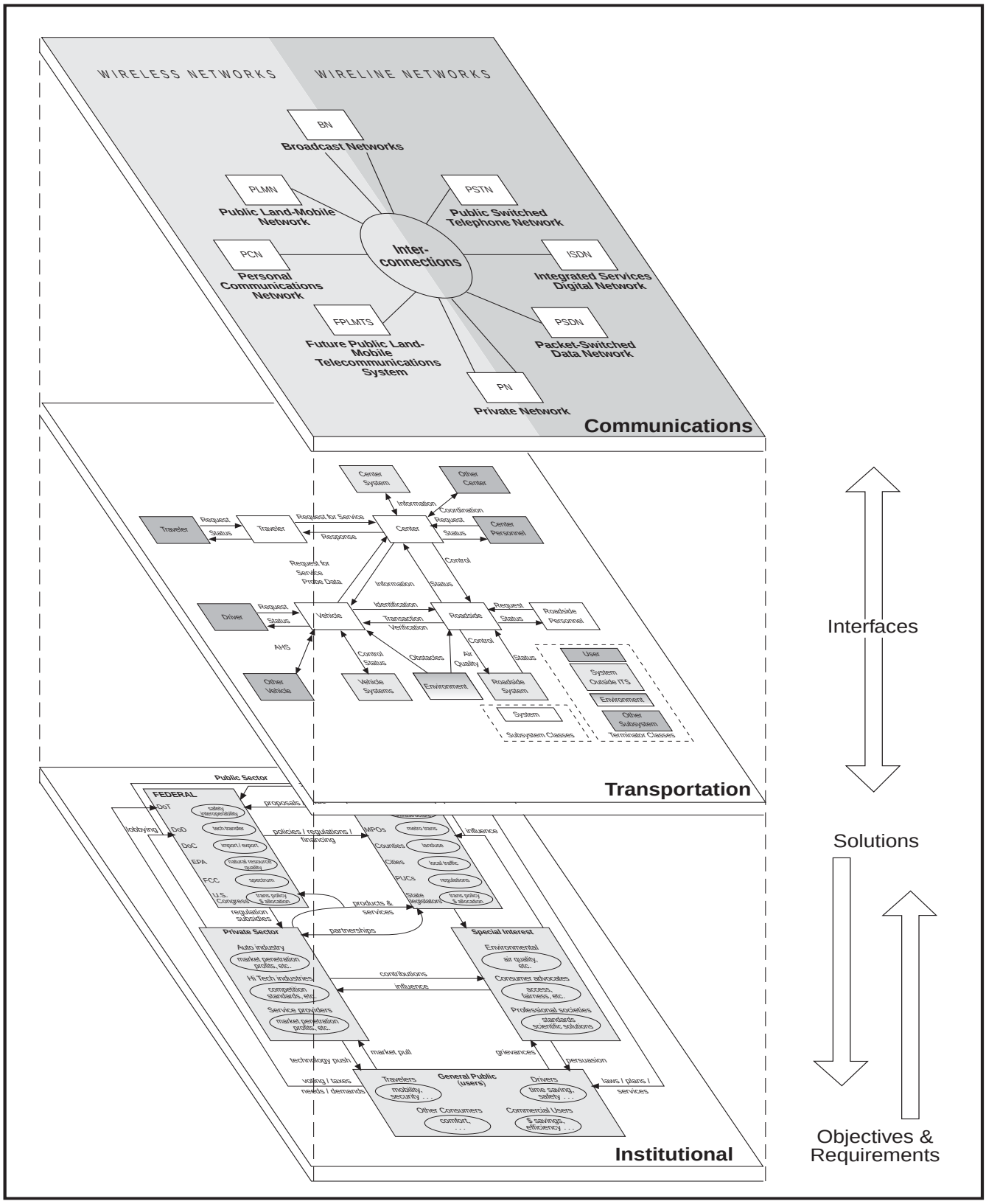


Figure 1-1 3 Layer Architecture

1.2 Strategies and Principles

The following are the strategies and principles that the Architecture team has followed in developing its ITS logical and physical architecture so as to best achieve the goals of ITS and the requirements of the User Services.

A summary of the strategies and principles is given below.

1. Low Entry Cost

Our architecture provides immediate service to all users, regardless of the degree of special instrumentation available to them. It does so by using all the information available from all terminators in order to devise the management strategy, and then disseminate the necessary information to the users through the information channels available to them. The fact that users having access to advanced channels can receive improved service will provide incentives for deployment of ITS instrumentation, but will not totally deny service to those users who do not own such channels. Basic service will be provided to the latter users through publicly available channels such as DMS, RDS and HAR.

The Architecture team is concerned that ITS benefits should be available to large numbers of commercial and private travelers at no cost or a small cost. Some examples of how we have designed this into the architecture are:

a. CVO with an ID tag. The architecture allows that a commercial vehicle have only an inexpensive electronic ID-tag in order to participate in the electronic clearance at roadside stations. The architecture further allows for enhanced tag technologies which may store detailed cargo and safety information for special purposes

b. Low/no cost traveler information services.
Travelers will benefit from better regional travel information broadcast by commercial AM/FM/Cable operators if these operators use the travel information that is available from local TMCs and ISPs via ITS media interfaces. Also, extensive Highway Advisory Radio (HAR) can be deployed for local advisory information based on real-time TMC surveillance. Information will also be available to travelers from publicly provided kiosks.

c. Traditional Toll-tag services- the Architecture support the current deployment of toll-tags.

2. Provide Choices (in price/ performance) for travelers to receive user services

The ITS architecture provides not just a single implementation of each user service, but in many cases supports a multiplicity of implementations with varying performance and associated costs to the user.

For example, in the area of route guidance the architecture supports three distinct modes of operation:

a. Traveler-based route selection, where all route selection processing equipment as well as the navigable database that route selection is based on is included in equipment located with the

traveler (either in their vehicle in their portable device).

b. Traveler-based route selection coupled to infrastructure-based and provided link/queue-times. In this method, the traveler-based route selection system is augmented by data from the infrastructure about current and possibly estimated future (predicted) link transit times and intersection queue delays. Using this type of data, the traveler will be able to use his equipment to compute better routes since his navigable road database will be augmented with information about current and future congestion conditions.

c. In-vehicle route guidance coupled to infrastructure based route selection. In this approach the infrastructure (in our architecture the ISP) selects the route based upon the traveler route request. Because of this approach the traveler equipment is simplified since it no longer requires a navigable map database, or the processing power to calculate a best route (only the processing power to display the route guidance).

3. Provide travelers with Privacy

In the area of privacy the ITS architecture takes into account that travelers have many distinct needs or desires with respect to privacy and the architecture provides the capability for these needs to be met: The route selection choices above offer a spectrum of options with respect to privacy for the ITS using traveler. The traveler can select routes totally independently of any infrastructure based entity, or they can choose a higher level of service that requires allowing the infrastructure to provide personalized service which requires sending personalized messages to their traveler based equipment.

4. Accommodate increasing levels of system integration

The ITS architecture is designed not only to support the introduction of new technologies, but has been designed in order to facility the ability of advances in technology to provide ever higher levels of system integration and hence ever higher levels of system performance. Such advanced concepts as Dynamic Traffic Assignment can be supported by the architecture. Through the coupling of Traffic Control and infrastructure based Route Selection the architecture can, when the technology permits approach optimum performance.

5. Assure equity

Providing an equitable division of benefits and costs is a key design strategy for the Architecture team. By splitting the key ITS infrastructure elements between private and public entities, the Architecture is able to assure equity in expenditures/payments. Public funds are used by public agencies (for example by running TMCs and Roadside facilities) to benefit all travelers equally, and private funds (and fees) are used to supply additional ”value added” services to those individuals willing to pay for those services.

6. Detailed, Open Standardization to maximize Interoperability reduces market entry risk.

One of the most important requirements on the ITS architecture is interoperability- the ability for the user to obtain the user services nationwide with a single set of equipment. To do this the architecture effort must choose limited areas of detailed national standardization to maximize interoperability and market breadth for travelers and manufacturers. In particular, the traveler to

infrastructure interface should be specified.

7. **Leverage the existing and emerging open, infrastructures.**

   Communications is key to providing ITS user services to the wide range of users. The Architecture strategy is to maximize use of the existing (and planned future) communications infrastructure. This approach has the following benefits:

   a. Minimize capital investment.

      A national communications infrastructure to support ITS would be costly to deploy if it were only to be used for ITS. The capital formation necessary for this hypothetical ITS only infrastructure could substantially limit or slow the deployment of ITS.

   b. Leverage existing infrastructure.

      The Architecture ITS architecture makes use of existing commercially available wired and wireless data communications services.

   c. Limit dependence on new spectrum allocations. New spectrum requirements which require FCC approval could delay and add considerable risk to the ITS evolutionary deployment.

8. **Facilitate profitability for Private Industry to speed early deployment.**

   New travel information technologies will require capital investments to deploy. The private sector is best prepared to rapidly form capital and efficiently deploy advanced technologies.

   Several subsystems in the architecture including the Commercial Vehicle Administration Subsystem and Information Service Provider Subsystem allow for a multiplicity of vendors to compete for the traveler and commercial vehicle business. Users will benefit from a competitive environment that will supply choices of service levels, privacy levels and cost levels.

9. **Architecture is open and not biased towards any particular products.**

   Use of open standards is a priority of the architecture. All subsystems in the architecture will support a range of existing or anticipated product offerings from an unlimited range of hardware or service providers.

10. **Encourage public-private infrastructure cooperation.**

    By carefully allocating processes to public and private subsystems, the Architecture has been designed to encourage mutually beneficial cooperation between public and private institutions through transportation surveillance and predictive model data exchange.

    Examples of this are TMCs providing surveillance data to ISPs which will allow the ISPs to compute better routes for their clients, and the ISPs providing (anonymous) probe data to the TMCs so that their surveillance of non-instrumented roadways is enhanced and thus their ability to manage traffic for all travelers is enhanced. Similarly, TMCs can access traffic data stored at neighboring TMCs over the data network.

11. Enhance traveler safety.

The Architecture team believes that enhancing traveler safety is a key requirement for the architecture. There are many ways in which the Architecture will enhance safety. Some of these are:

a. Reduce emergency response time.

Our early safety analysis leads us to believe that any reduction in time between the occurrence of an injury accident and the arrival of medical help has a substantial impact on survivability. In the high-end state architecture, emergency vehicles will have their routes selected by the infrastructure, and those routes will be communicated to the TMC Traffic Management service package for priority signal service for the emergency vehicles (with minimal disruption to the rest of the transportation network). In addition, rapid data based deployment of emergency response vehicles via the Emergency Management Subsystem will get help to incidents faster, and will enhance traveler safety as a direct consequence.

b. Reduce congestion.

By using standardized interfaces that the architecture identifies, demand management strategies and policies can be effectively implemented, congestion can be reduced, thus reducing the number of transitions from free-flow to stop-and-go traffic conditions. These transitions have been identified in our preliminary safety analysis as a cause of traffic accidents.

c. Fail-safe infrastructure architecture.

The Architecture has not allocated any new life threatening functions to the infrastructure. Vehicle control (for collision avoidance) remains entirely within the vehicle subsystem (and in the case of platooning and AHS related functions, is based on communication directly between adjacent vehicles). In the event of a total infrastructure failure, signals would fall back to local sensor based signal control or fixed time plans, exactly as they do today.

12. Provide Locally determined Management Capabilities

For ITS to be desirable in some areas and in some time frames it must be able to address demand management (in addition to supply management). The architecture gives local agencies (and ultimately elected officials) enormous latitude to decide how a limited transportation resources are to be allocated.

The Architecture team has designed the architecture so that any particular form of demand management is optional, and a local decision to deploy. Examples include congestion pricing, vehicle class preferences, and extensions of ramp metering, HOV management, lane management.

1.3 Development Methodology

The Physical architecture contains the elements on which the evaluations, standards, and deployment and implementation strategies are built. It defines the framework for the whole architecture.

Architecture Definition

- **Subsystems -** Subsystems are the primary structural components of the Physical Architecture. Focus group concerns, institutional issues, and technology constraints and capabilities are used to determine subsystems which can most likely be supported by single institution, which perform functions which "belong" together, and whose interfaces may require standards to promote interoperability and compatibility.

- **Physical Architecture Flows -** Processes from the logical architecture are assigned to each of the subsystems according to stakeholder inputs. Architecture flows between subsystems are determined based on the data exchange implied by the process specification assignments and the data flows in the logical architecture.

- **Physical Architecture Interconnections -** Each type of data flowing between subsystems requires a specific type of interconnect. The collection of interconnects which support all data flows are defined in the communications layer of the architecture. The data loading analysis compares the capabilities of these interconnects with expected requirements under various deployments. This information is reported in the communication analysis documentation.

Iterative Architecture Refinement

Our approach to iterative architecture refinement exploits a technical methodology that rapidly and easily enables changes to the logical and physical architectures and easily regenerates data loading and other analysis. We have demonstrated that we can use this methodology to rapidly adapt our architecture based on consensus feedback and other architecture design analysis. We accept feedback in a number of different ways:

Customer inputs are collected based on the following:

1. Formally documented customer requirements. E.g. the *User Services.* These inputs were used as a starting basis for designing the architecture (as well as our own initial analysis).

2. Written feedback from the customer on the Architecture.

3. Direct dialog at Program Reviews.

Stakeholder feedback is included as well from:

1. *Customer initiated interactions.* E.g. Stakeholder Consensus Forum meetings sponsored and facilitated by the customer.

2. *Team initiated informal interactions.* Our own team meetings with stakeholders and stakeholder groups and visits to ITS demonstration sites.

3. *Team initiated Stakeholder Focus Groups.* The Team held a number of formal focus groups with selected stakeholders at the University of Michigan. These focus groups gauged stakeholder perceptions and reactions to specific ITS benefits, costs, and solutions.

Other Team Analysis

We held periodic team review meetings where the current status of the architecture is reviewed with all team members. Discussion at these meetings often focused on identifying features and detractors of the architecture based on various analyses that are proceeding as well as identifying changes to the architecture that can enhance its overall value.

1.4 Document Organization

The Physical Architecture is made up of many real components.

Chapter 2 presents the Transportation Layer of the Physical Architecture. It includes definitions of all of the Physical Architecture entities and interfaces.

Chapter 3 presents the Communications Layer of the Physical Architecture by discussing the services and functions required for communications. This topic is explored further in the Communications Analysis Document.

A separate Implementation Strategy Document and the Market Package Document discuss the Institutional Layer of the architecture.

2. TRANSPORTATION LAYER

This layer of the architecture provides for the transportation related functions. Section 2.1 describes the architecture context, that is, what functions are defined in the architecture and what is considered outside the scope of the architecture. The functions defined in the architecture are contained within subsystems. The functions outside the scope of the architecture are represented by terminators. These two types of architectural elements (subsystems and terminators) are called entities. Classes bundle entities together into different categories such as humans, computers, and the physical world. Interfaces between these entities are sometimes very clearly data flows which can be carried by communication media. Some interfaces are fuzzier representing physical observation, contact, or human interaction.

Section 2.2 provides a Top Level representation of the architecture in terms of the entity classes. This representation indicates the different types of entities and the kinds of relations that the architecture includes.

Section 2.3 defines the principal Physical Architecture components Subsystem terminators, flows, and some top level architecture flow diagrams.

The sections following section 2.3 contain descriptions of each subsystem (functions in the scope of the architecture). They begin with a brief summary of how to deploy the subsystem with other subsystems. It describes how the subsystem may logically be combined with other subsystems within one jurisdiction. Alternative implementations of the subsystem itself within one operating agency are also described.

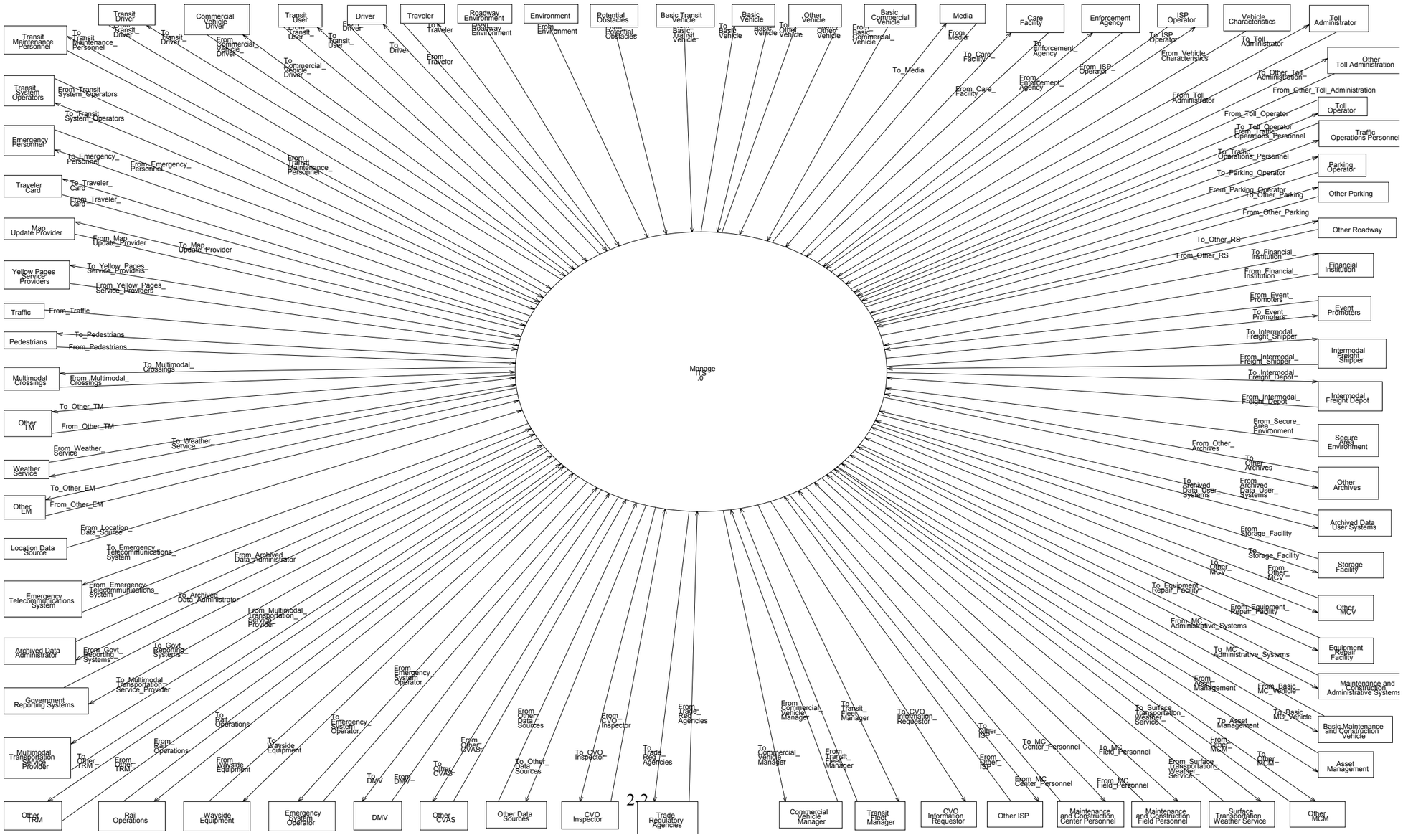
Next, the equipment packages assigned to each subsystem are described. Equipment packages are a functional capability that may be deployed at some specific time. Each equipment packages is composed of a collection of process specifications from the logical architecture. These assigned process specifications are listed with each equipment package. A brief overview of each process specification is included to provide the reader with one stop access to subsystem information.

Logical data flows between subsystems are assigned by identifying the connections between process specifications assigned to different subsystems. Assignment of logical data flows between subsystems leads to the description of physical interconnections between subsystems. For each architecture flow identified in the physical architecture, the list of associated logical architecture data flows is provided. The architecture flows indicate the type of information that is expected to be exchanged between subsystems. The logical data flows provide the type of data required executing the process specifications assigned to each subsystem.

2.1 Physical Architecture Context

The scope of “Context” of the physical architecture is identical to the scope of the logical architecture. The identical set of terminators establish exactly the same boundary. The physical architecture adds a broad structural overlay to the structured analysis model documented in the logical architecture. Figure 2-1 contains the physical architecture context diagram.

Figure 2-1 Architecture Context Diagram



2.2 Physical Architecture Decomposition

The architecture can be viewed at several levels of detail. The architecture team has defined collections of subsystems sufficient to express interfaces and processes that are essential to the development of interface standards that are necessary for nationwide interoperability. Multi-disciplinary considerations and the contributions of many different agencies all of whom have a stake in ITS have been incorporated. Efforts by other organizations (e.g., APL, ORNL Sandia) have further defined processes and interfaces within these subsystems or sets of subsystems to help support the detailed standards definition process within a particular discipline. Even though this National Architecture does not go into extreme detail for each User Service, the overall architecture is still very complex therefore it is presented in several levels of decomposition.

2.2.1 Top Level Architecture

Initial diagrams show the architecture at only the top level. Additional detail is added as it pertains to specific topics (e.g., stakeholders, technologies, Market Packages).

Figure 2-2. The box in the center represents the architecture subsystems while the outside boxes represent collections of terminators with which the subsystems interact. The lines between boxes represent at a high level the interfaces to the ITS system. Five classes of physical entities are defined:

- Subsystems - These perform transportation functions (e.g., collect data from the roadside, perform route planning, etc.). All of the functions are defined in the logical architecture as process specifications. Processes that are likely to be collected together under one physical agency, jurisdiction, physical unit are grouped together into a subsystem. This grouping is done to optimize the overall expected performance of the resulting ITS deployments taking into consideration anticipated communication technologies, performance, risk, deployment, etc. Significant detail is included for each of these subsystems and its interfaces.

- Users - These are people who interact with the architecture implementation. The people could either be travelers who use ITS to achieve travel goals, or operators of ITS who use features to streamline their operations, improve service, or make money. Each interface to a user involves human interaction with the system.

- Other Systems outside ITS - These are organizations or agencies that will likely interact with ITS through computer interfaces. These interfaces are similar to internal architecture interfaces.

- Environment - This is the physical world of pavement, air, obstacles and so on.

- Other Subsystems within the Architecture - There may be a multiplicity of instantiations of each of the Architecture subsystems. To adequately model the interaction between these multiple implementations, one representative of each subsystem is explicitly included in the diagrams while those which it communicates with are represented as Other Subsystems.

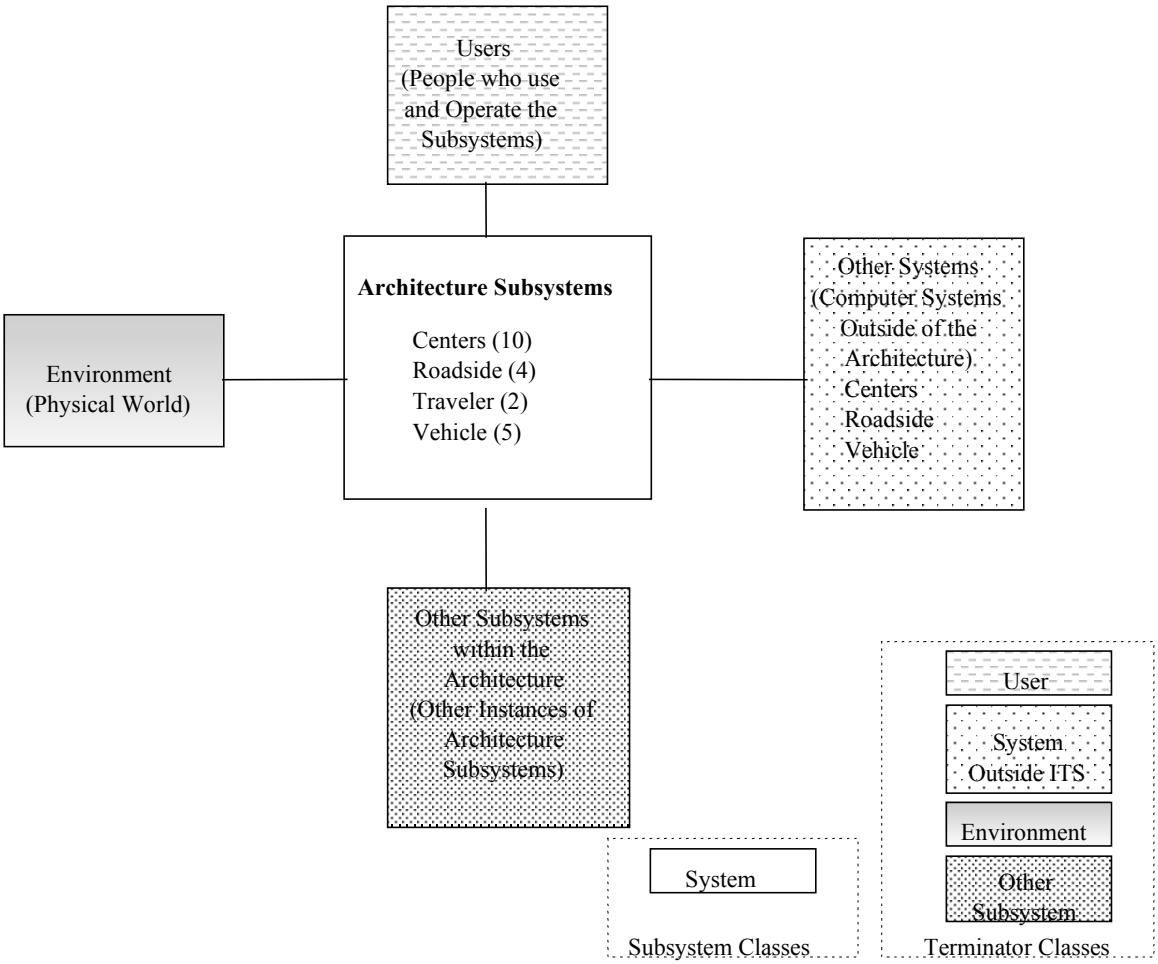


Figure 2-2 Simple View of ITS Architecture Structure

In ITS, there are four subclasses of subsystems, terminators, and users:

- Centers which collect and store information within the infrastructure
- Roadside which is deployed along the side of the road at many locations
- Vehicles
- Travelers representing ITS users with transportation needs

For example, other center systems may be weather reporting agency or a law enforcement agency. Other subsystems within the Architecture could be peer Emergency Management subsystems or TMC's that reside in an adjacent jurisdiction.

Figure 2-3 presents a top level Architecture Flow Diagram. The diagram represents the four classes of subsystems, the terminators associated with each of the classes and the type of information that is exchanged between the classes. A definition of each of the entity classes in the figure is provided in Table 2.2-1.

The information types indicated in Figure 2-3 are exchanged between entity classes using different types of communication media. A very simplified view of this communications interface is provided in the Top Level simplified Architecture Interconnect Diagram in Figure 2-4. The details of each of the interconnections are further explained in the communications layer of the architecture.

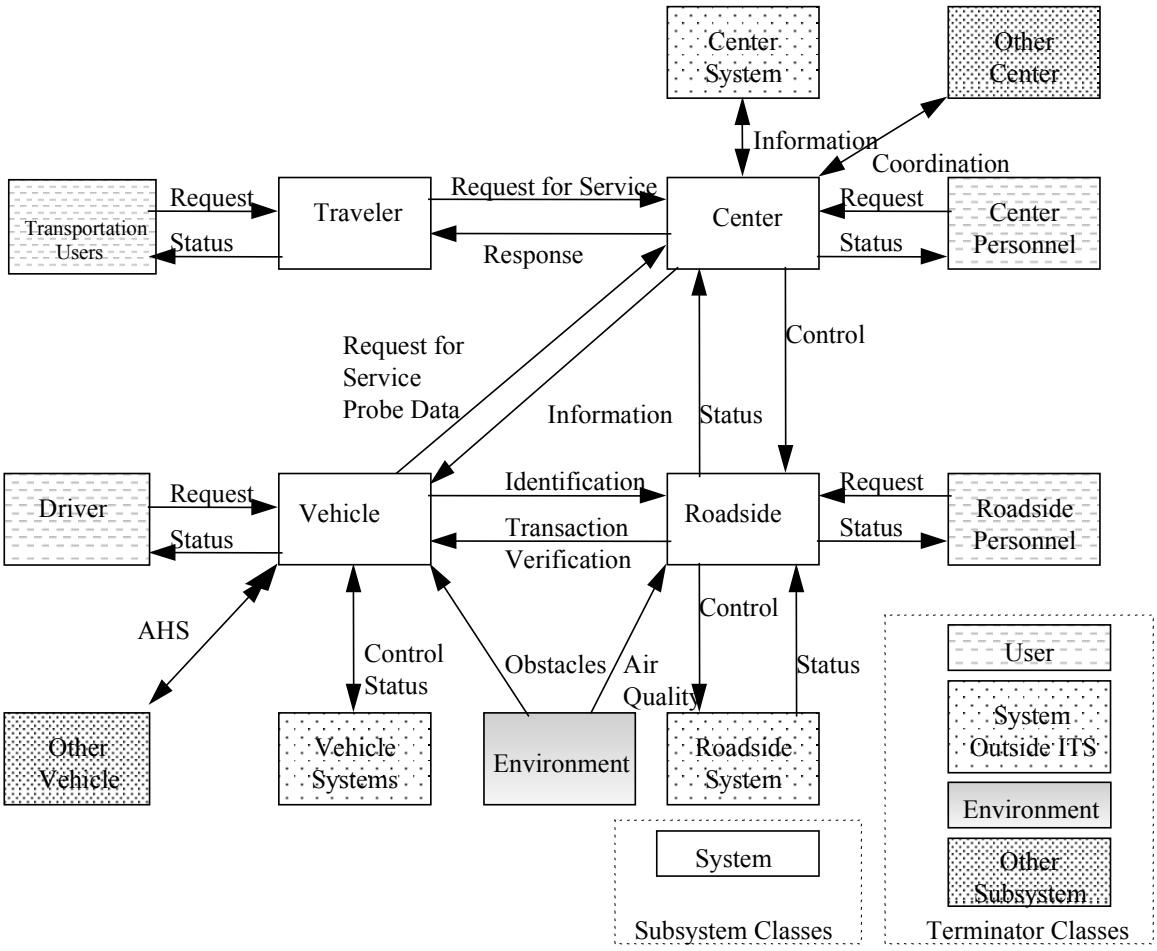


Figure 2-3 Top Level Architecture Flow Diagram

Table 2.2-1 Contents of Entity Classes

Entity	Entity Name	EntityKind	EntityClass	EntityType
ADMS	Archived Data Management Subsystem	Subsystem	Center	System
CVAS	Commercial Vehicle Administration	Subsystem	Center	System
CVCS	Commercial Vehicle Check	Subsystem	Roadside	System
CVS	Commercial Vehicle Subsystem	Subsystem	Vehicle	System
EM	Emergency Management	Subsystem	Center	System
EMMS	Emissions Management	Subsystem	Center	System
EVS	Emergency Vehicle Subsystem	Subsystem	Vehicle	System
FMS	Fleet and Freight Management	Subsystem	Center	System
ISP	Information Service Provider	Subsystem	Center	System
MCMS	Maintenance and Construction Management	Subsystem	Center	System
MCVS	Maintenance and Construction Vehicle	Subsystem	Vehicle	System
PIAS	Personal Information Access	Subsystem	Traveler	System
PMS	Parking Management	Subsystem	Roadside	System
RS	Roadway Subsystem	Subsystem	Roadside	System
RTS	Remote Traveler Support	Subsystem	Traveler	System
TAS	Toll Administration	Subsystem	Center	System
TCS	Toll Collection	Subsystem	Roadside	System
TMS	Traffic Management	Subsystem	Center	System
TRMS	Transit Management	Subsystem	Center	System
TRVS	Transit Vehicle Subsystem	Subsystem	Vehicle	System
VS	Vehicle	Subsystem	Vehicle	System
X01	Intermodal Freight Shipper	Terminator	Center	System
X02	Multimodal Transportation Service Provider	Terminator	Center	System
X03	Basic Vehicle	Terminator	Vehicle	System
X06	Commercial Vehicle Driver	Terminator	Vehicle	Human
X07	Commercial Vehicle Manager	Terminator	Center	Human
X08	Basic Commercial Vehicle	Terminator	Vehicle	System
X10	CVO Inspector	Terminator	Roadside	Human
X12	Driver	Terminator	Vehicle	Human
X13	Emergency Telecommunications System	Terminator	Center	System
X14	Emergency System Operator	Terminator	Center	Human
X15	Emergency Personnel	Terminator	Vehicle	Human
X18	Environment	Terminator	Roadside	Environment
X19	Event Promoters	Terminator	Center	System
X21	Financial Institution	Terminator	Center	System
X23	Map Update Provider	Terminator	Center	System
X24	Yellow Pages Service Providers	Terminator	Center	System
X26	Location Data Source	Terminator	Vehicle	System
X27	Media	Terminator	Center	System
X29	Multimodal Crossings	Terminator	Roadside	System
X30	Other EM	Terminator	Center	Other System
X31	Other ISP	Terminator	Center	Other System
X33	Other TRM	Terminator	Center	Other System

Entity	Entity Name	EntityKind	EntityClass	EntityType
X34	Other Vehicle	Terminator	Vehicle	Other System
X35	Other TM	Terminator	Center	Other System
X36	Parking Operator	Terminator	Roadside	Human
X38	Pedestrians	Terminator	Traveler	Human
X39	Potential Obstacles	Terminator	Roadside	Environment
X41	Roadway Environment	Terminator	Roadside	Environment
X42	Secure Area Environment	Terminator	Roadside	Environment
X43	Toll Operator	Terminator	Roadside	Human
X44	Toll Administrator	Terminator	Center	Human
X45	Traffic	Terminator	Roadside	Environment
X46	Traffic Operations Personnel	Terminator	Center	Human
X47	Transit Fleet Manager	Terminator	Center	Human
X49	Transit System Operators	Terminator	Center	Human
X50	Transit User	Terminator	Traveler	Human
X51	Basic Transit Vehicle	Terminator	Vehicle	System
X52	Transit Driver	Terminator	Vehicle	Human
X53	Transit Maintenance Personnel	Terminator	Center	Human
X56	Traveler	Terminator	Traveler	Human
X57	Vehicle Characteristics	Terminator	Roadside	Environment
X58	Weather Service	Terminator	Center	System
X59	Other CVAS	Terminator	Center	Other System
X60	Intermodal Freight Depot	Terminator	Center	System
X61	Traveler Card	Terminator	Traveler	System
X62	Enforcement Agency	Terminator	Center	System
X63	ISP Operator	Terminator	Center	Human
X64	DMV	Terminator	Center	System
X65	CVO Information Requestor	Terminator	Center	System
X66	Wayside Equipment	Terminator	Roadside	System
X67	Rail Operations	Terminator	Center	System
X68	Other Archives	Terminator	Center	Other System
X69	Archived Data User Systems	Terminator	Center	System
X70	Archived Data Administrator	Terminator	Center	Human
X71	Other Data Sources	Terminator	Center	System
X72	Government Reporting Systems	Terminator	Center	System
X73	Other Parking	Terminator	Roadside	Other System
X74	Other Roadway	Terminator	Roadside	Other System
X75	Maintenance and Construction Center Personnel	Terminator	Center	Human
X76	Maintenance and Construction Field Personnel	Terminator	Vehicle	Human
X77	Surface Transportation Weather Service	Terminator	Center	System
X78	Other MCM	Terminator	Center	Other System
X79	Asset Management	Terminator	Center	System
X87	Basic Maintenance and Construction Vehicle	Terminator	Vehicle	System
X88	Maintenance and Construction Administrative Systems	Terminator	Center	System
X89	Equipment Repair Facility	Terminator	Center	System
X90	Other MCV	Terminator	Vehicle	Other System

Entity	Entity Name	EntityKind	EntityClass	EntityType
X91	Storage Facility	Terminator	Center	System
X92	Trade Regulatory Agencies	Terminator	Center	System
X93	Care Facility	Terminator	Center	System
X94	Other Toll Administration	Terminator	Center	Other System

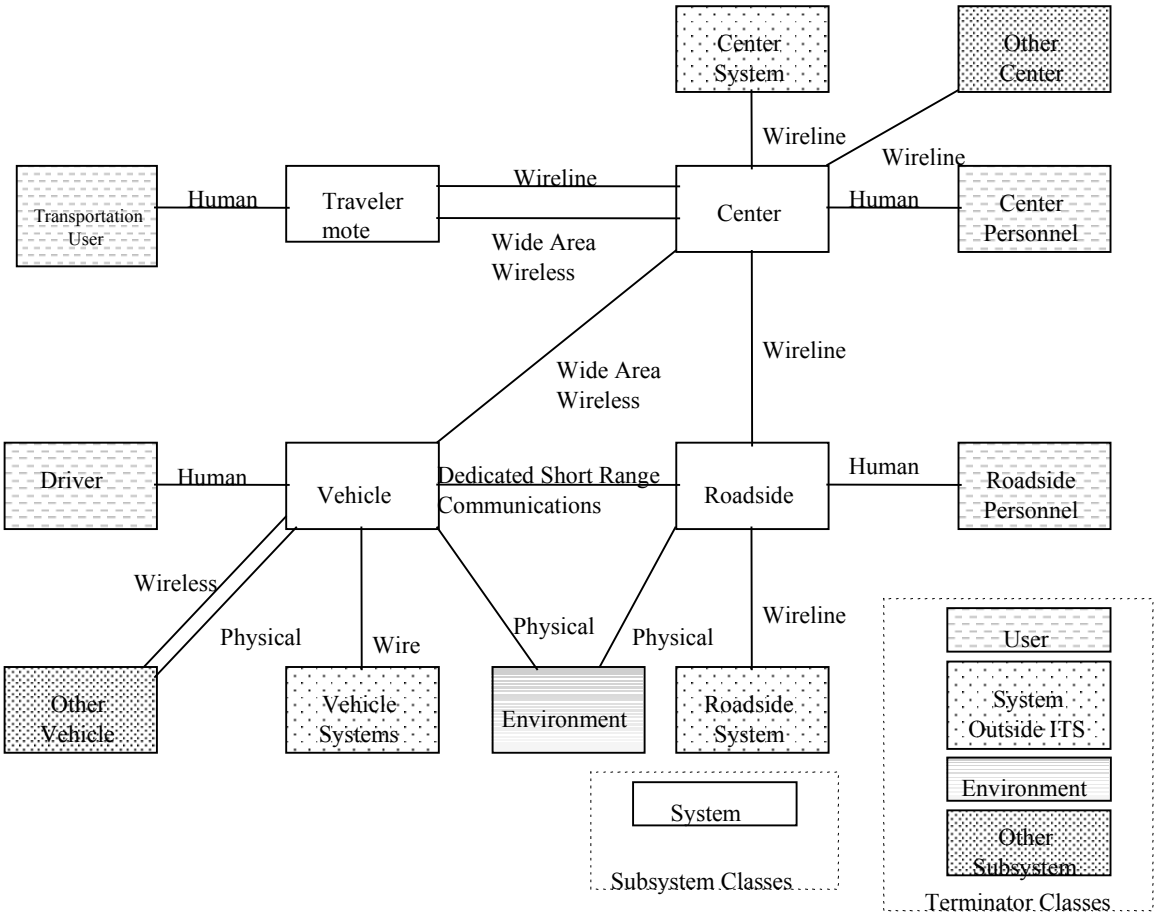


Figure 2-4 Top Level Architecture Interconnect Diagram

Expanding each of the entity classes represented in Table 2-1 results in a detailed level 0 Architecture Flow Diagram. Such a diagram is presented in Figures 3-x for each of the entities indicated in Table 2-1.

2.3 Physical Architecture Dictionary

2.3.1 Internal Entity Definitions

The ITS architecture subsystems may be grouped into four distinct subsystem classes that share basic functional, deployment, and institutional characteristics. These classes are used to frame top level descriptions for each of the subsystems in the following material.

Center Subsystems

These subsystems presented in Table 2.3-1 , provide management, administration, and support functions for the transportation system. The center subsystems each communicate with other centers to enable coordination between modes and across jurisdictions within a region. The center subsystems also communicate with roadside and vehicle subsystems to gather information and provide information and control that is coordinated by the center subsystems.

Table 2.3-1 Center Subsystem Descriptions

Entity Name	Entity Description
Archived Data Management Subsystem	The Archived Data Management Subsystem collects, archives, manages, and distributes data generated from ITS sources for use in transportation administration, policy evaluation, safety, planning, performance monitoring, program assessment, operations, and research applications. The data received is formatted, tagged with attributes that define the data source, conditions under which it was collected, data transformations, and other information (i.e. meta data) necessary to interpret the data. The subsystem can fuse ITS generated data with data from non-ITS sources and other archives to generate information products utilizing data from multiple functional areas, modes, and jurisdictions. The subsystem prepares data products that can serve as inputs to Federal, State, and local data reporting systems. This subsystem may be implemented in many different ways. It may reside within an operational center and provide focused access to a particular agency's data archives. Alternatively, it may operate as a distinct center that collects data from multiple agencies and sources and provides a general data warehouse service for a region.
Commercial Vehicle Administration	The Commercial Vehicle Administration Subsystem will operate at one or more fixed locations within a region. This subsystem performs administrative functions supporting credentials, tax, and safety regulations. It issues credentials, collects fees and taxes, and supports enforcement of credential requirements. This subsystem communicates with the Fleet Management Subsystems associated with the motor carriers to process credentials applications and collect fuel taxes, weight/distance taxes, and other taxes and fees associated with commercial vehicle operations. The subsystem also receives applications for, and issues special Oversize/Overweight and HAZMAT permits in coordination with other cognizant authorities. The subsystem coordinates with other Commercial Vehicle Administration Subsystems (in other states/regions) to support nationwide access to credentials and safety information for administration and enforcement functions. This subsystem supports communications with Commercial Vehicle Check Subsystems operating at the roadside to enable credential checking and safety information collection. The collected safety information is processed, stored, and made available to qualified stakeholders to identify carriers and drivers that operate unsafely.

Entity Name	Entity Description
Emergency Management	The Emergency Management Subsystem represents public safety and other allied agency systems that support coordinated traffic incident management and emergency response. The subsystem includes the functions associated with fixed and mobile public safety communications centers includes various public safety call taker and dispatch centers operated by police, fire, and emergency medical services. This subsystem also represents other allied systems including centers associated with towing and recovery, freeway service patrols, HAZMAT response teams, mayday service providers, and security/surveillance services that improve traveler security in public areas. This subsystem interfaces with other Emergency Management Subsystems to support coordinated emergency response involving multiple agencies. The subsystem creates, stores, and utilizes emergency response plans to facilitate coordinated response. The subsystem tracks and manages emergency vehicle fleets using automated vehicle location technology and two way communications with the vehicle fleet. Real-time traffic information received from the other center subsystems is used to further aide the emergency dispatcher in selecting the emergency vehicle(s) and routes that will provide the most timely response. Interface with the Traffic Management Subsystem allows strategic coordination in tailoring traffic control to support en-route emergency vehicles. Interface with the Transit Management Subsystem allows coordinated use of transit vehicles to facilitate response to major emergencies.
Emissions Management	This subsystem operates at a fixed location and may co-reside with the Traffic Management Subsystem or may operate in its own distinct location depending on regional preferences and priorities. This subsystem provides the capabilities for air quality managers to monitor and manage air quality. These capabilities include collecting emissions data from distributed emissions sensors within the roadway subsystem. These sensors monitor general air quality within each sector of the area and also monitor the emissions of individual vehicles on the roadway. The sector emissions measures are collected, processed, and used to identify sectors exceeding safe pollution levels. This information is provided to toll administration, traffic management, and transit management systems and used to implement strategies intended to reduce emissions in and around the problem areas. Emissions data associated with individual vehicles, supplied by the Roadway Subsystem, is also processed and monitored to identify vehicles that exceed standards. This subsystem provides any functions necessary to inform the violators and otherwise ensure timely compliance with the emissions standards.

Entity Name	Entity Description
Fleet and Freight Management	The Fleet and Freight Management Subsystem provides the capability for commercial drivers and dispatchers to receive real-time routing information and access databases containing vehicle and cargo locations as well as carrier, vehicle, cargo and driver information. In addition, the capability to purchase credentials electronically shall also be provided, with automated and efficient connections to financial institutions and regulatory agencies, along with post-trip automated mileage and fuel usage reporting. The Fleet Management Subsystem also provides the capability for fleet managers to monitor the safety of their commercial vehicle drivers and fleet. The subsystem also supports application for hazmat credentials and makes information about hazmat cargo available to agencies as required. Within this subsystem lies all the functionality associated with subsystems and components necessary to enroll and participate in international goods movement programs aimed at enhancing trade and transportation safety.
Information Service Provider	This subsystem collects, processes, stores, and disseminates transportation information to system operators and the traveling public. The subsystem can play several different roles in an integrated ITS. In one role, the ISP provides a general data warehousing function, collecting information from transportation system operators and redistributing this information to other system operators in the region and other ISPs. In this information redistribution role, the ISP provides a bridge between the various transportation systems that produce the information and the other ISPs and their subscribers that use the information. The second role of an ISP is focused on delivery of traveler information to subscribers and the public at large. Information provided includes basic advisories, traffic and road conditions, transit schedule information, yellow pages information, ridematching information, and parking information. The subsystem also provides the capability to provide specific directions to travelers by receiving origin and destination requests from travelers, generating route plans, and returning the calculated plans to the users. In addition to general route planning for travelers, the ISP also supports specialized route planning for vehicle fleets. In this third role, the ISP function may be dedicated to, or even embedded within, the dispatch system. Reservation services are also provided in advanced implementations. The information is provided to the traveler through the Personal Information Access Subsystem, Remote Traveler Support Subsystem, and various Vehicle Subsystems through available communications links. Both basic one-way (broadcast) and personalized two-way information provision is supported. The subsystem provides the capability for an informational infrastructure to connect providers and consumers, and gather that market information needed to assist in the planning of service improvements and in maintenance of operations.

Entity Name	Entity Description
Maintenance and Construction Management	The Maintenance and Construction Management Subsystem monitors and manages roadway infrastructure construction and maintenance activities. Representing both public agencies and private contractors that provide these functions, this subsystem manages fleets of maintenance, construction, or special service vehicles (e.g., snow and ice control equipment). The subsystem receives a wide range of status information from these vehicles and performs vehicle dispatch, routing, and resource management for the vehicle fleets and associated equipment. The subsystem participates in incident response by deploying maintenance and construction resources to an incident scene, in coordination with other center subsystems. The subsystem manages equipment at the roadside, including environmental sensors and automated systems that monitor and mitigate adverse road and surface weather conditions. The subsystem manages the repair and maintenance of both non-ITS and ITS equipment including the traffic controllers, detectors, dynamic message signs, signals, and other equipment associated with the roadway infrastructure. Additional interfaces to weather information providers (the weather service and surface transportation weather service providers) provide current and forecast weather information that can be fused with other data sources and used to support advanced decision support systems that increase the efficiency and effectiveness of maintenance and construction operations. The subsystem remotely monitors and manages ITS capabilities in work zones, gathering, storing, and disseminating work zone information to other systems. It manages traffic in the vicinity of the work zone and advises drivers of work zone status (either directly at the roadside or through an interface with the Information Service Provider or Traffic Management subsystems.) It schedules and manages the location and usage of maintenance assets (such as portable dynamic message signs). Construction and maintenance activities are tracked and coordinated with other systems, improving the quality and accuracy of information available regarding closures and other roadway construction and maintenance activities.

Entity Name	Entity Description
Toll Administration	The Toll Administration Subsystem provides general payment administration capabilities and supports the electronic transfer of authenticated funds from the customer to the transportation system operator. This subsystem supports traveler enrollment and collection of both pre-payment and post-payment transportation fees in coordination with the existing, and evolving financial infrastructure supporting electronic payment transactions. The system may establish and administer escrow accounts depending on the clearinghouse scheme and the type of payments involved. This subsystem posts a transaction to the customer account and generates a bill (for post-payment accounts), debits an escrow account, or interfaces to the financial infrastructure to debit a customer designated account. It supports communications with the Toll Collection Subsystem to support fee collection operations. The subsystem also sets and administers the pricing structures and includes the capability to implement road pricing policies in coordination with the Traffic Management Subsystem. The electronic financial transactions in which this subsystem is an intermediary between the customer and the financial infrastructure shall be cryptographically protected and authenticated to preserve privacy and ensure authenticity and auditability.
Traffic Management	The Traffic Management Subsystem operates within a traffic management center or other fixed location. This subsystem communicates with the Roadway Subsystem to monitor and manage traffic flow. Incidents are detected and verified and incident information is provided to the Emergency Management Subsystem, travelers (through Roadway Subsystem Highway Advisory Radio and Dynamic Message Signs), and to third party providers. The subsystem supports HOV lane management and coordination, road pricing, and other demand management policies that can alleviate congestion and influence mode selection. The subsystem monitors and manages maintenance work and disseminates maintenance work schedules and road closures. The subsystem also manages reversible lane facilities, and processes probe vehicle information. The subsystem communicates with other Traffic Management Subsystems to coordinate traffic information and control strategies in neighboring jurisdictions. It also coordinates with rail operations to support safer and more efficient highway traffic management at highway-rail intersections. Finally, the Traffic Management Subsystem provides the capabilities to exercise control over those devices utilized for AHS traffic and vehicle control.

Entity Name	Entity Description
Transit Management	The transit management subsystem manages transit vehicle fleets and coordinates with other modes and transportation services. It provides operations, maintenance, customer information, planning and management functions for the transit property. It spans distinct central dispatch and garage management systems and supports the spectrum of fixed route, flexible route, paratransit services, and bus rapid transit (BRT) service. The subsystem's interfaces allow for communication between transit departments and with other operating entities such as emergency response services and traffic management systems. This subsystem receives special event and real-time incident data from the traffic management subsystem. It provides current transit operations data to other center subsystems. The Transit Management Subsystem collects and stores accurate ridership levels and implements corresponding fare structures. It collects operational and maintenance data from transit vehicles, manages vehicle service histories, and assigns drivers and maintenance personnel to vehicles and routes. The Transit Management Subsystem also provides the capability for automated planning and scheduling of public transit operations. It furnishes travelers with real-tim e travel information, continuously updated schedules, schedule adherence information, transfer options, and transit routes and fares. In addition, the monitoring of key transit locations with both video and audio systems is provided with automatic alerting of operators and police of potential incidents including support for traveler activated alarms.

Roadside Subsystems

These infrastructure subsystems presented in Table 2.3-2 provides the direct interface to the roadway network, vehicles traveling on the roadway network, and travelers in transit. Each of the roadway subsystems includes functions that require distribution to the roadside to support direct surveillance, information provision, and control plan execution. All roadside subsystems interface to one or more of the center subsystems that govern overall operation of the roadside subsystems. The roadside subsystems also generally include direct user interfaces to drivers and transit users and short-range interfaces to the Vehicle Subsystems to support operations.

Table 2.3-2 Roadside Subsystem Descriptions

Entity Name	Entity Description
Commercial Vehicle Check	The Commercial Vehicle Check Subsystem supports automated vehicle identification at mainline speeds for credential checking, roadside safety inspections, and weigh-in-motion using two-way data exchange. These capabilities include providing warnings to the commercial vehicle drivers, their fleet managers, and proper authorities of any safety problems that have been identified, accessing and examining historical safety data, and automatically deciding whether to allow the vehicle to pass or require it to stop with operator manual override. The Commercial Vehicle Check Subsystem also provides supplemental inspection services to current capabilities by supporting expedited brake inspections, the use of operator hand-held devices, on-board safety database access, and the enrollment of vehicles and carriers in the electronic clearance program.

Entity Name	Entity Description
Parking Management	The Parking Management Subsystem provides electronic monitoring and management of parking facilities. It supports a DSRC communications link to the Vehicle Subsystem that allows electronic collection of parking fees. It also includes the instrumentation, signs, and other infrastructure that monitors parking lot usage and provides local information about parking availability and other general parking information. This portion of the subsystem functionality must be located in the parking facility where it can monitor, classify, and share information with customers and their vehicles. The subsystem also interfaces with the financial infrastructure and broadly disseminates parking information to other operational centers in the region. Note that the latter functionality may be located in a back office, remote from the parking facility.
Roadway Subsystem	This subsystem includes the equipment distributed on and along the roadway which monitors and controls traffic and monitors and manages the roadway itself. Equipment includes traffic detectors, environmental sensors, traffic signals, highway advisory radios, dynamic message signs, CCTV cameras and video image processing systems, grade crossing warning systems, and freeway ramp metering systems. HOV lane management and reversible lane management functions are also available. This subsystem also provides the capability for environmental monitoring including sensors that measure road conditions, surface weather, and vehicle emissions. In adverse conditions, automated systems can be used to apply anti-icing materials, disperse fog, etc. Work zone systems including work zone surveillance, traffic control, driver warning, and work crew safety systems are also included. In advanced implementations, this subsystem supports automated vehicle safety systems by safely controlling access to and egress from an Automated Highway System through monitoring of, and communications with, AHS vehicles. Intersection collision avoidance functions are provided by determining the probability of a collision in the intersection and sending appropriate warnings and/or control actions to the approaching vehicles.
Toll Collection	The Toll Collection Subsystem provides the capability for vehicle operators to pay tolls without stopping their vehicles using locally determined pricing structures and including the capability to implement various variable road pricing policies. Each transaction is accompanied by feedback to the customer which indicates the general status of the customer account. A record of the transactions is provided to the Toll Administration subsystem for reconciliation and so that the customer can periodically receive a detailed record of the transactions.

Vehicle Subsystems

These subsystems presented in Table 2.3-3 are all vehicle-based and share many general driver information, vehicle navigation, and advanced safety systems functions. The vehicle subsystems communicate with the roadside subsystems and center subsystems for provision of information to the driver. In the following descriptions, the Personal Vehicle Subsystem description includes general traveler information and vehicle safety functions that are also applicable to the three fleet vehicle subsystems (Commercial Vehicle Subsystem, Emergency Vehicle Subsystem, Maintenace and Construction Vehicle, and Transit Vehicle Subsystem). The fleet vehicle subsystems all include vehicle location and two-way communications functions that support efficient fleet operations. Each of the three fleet vehicle subsystems also include functions that support their specific service area.

Table 2.3-3 Vehicle Subsystem Descriptions

Entity Name	Entity Description
Commercial Vehicle Subsystem	This subsystem resides in a commercial vehicle and provides the sensory, processing, storage, and communications functions necessary to support safe and efficient commercial vehicle operations. The Commercial Vehicle Subsystem provides two-way communications between the commercial vehicle drivers, their fleet managers, and roadside officials, and provides HAZMAT response teams with timely and accurate cargo contents information after a vehicle incident. This subsystem provides the capability to collect and process vehicle, cargo, and driver safety data and status and alert the driver whenever there is a potential safety problem. Basic identification and safety status data are supplied to inspection facilities at mainline speeds. In addition, the subsystem will automatically collect and record mileage, fuel usage, and border crossings.
Emergency Vehicle Subsystem	This subsystem resides in an emergency vehicle and provides the sensory, processing, storage, and communications functions necessary to support safe and efficient incident response. The subsystem represents a range of vehicles including those operated by police, fire, and emergency medical services. In addition, this subsystem represents other incident response vehicles including towing and recovery vehicles and freeway service patrols. The Emergency Vehicle Subsystem includes two-way communications to support coordinated response to emergencies in accordance with an associated Emergency Management Subsystem. Emergency vehicles are equipped with automated vehicle location capability for monitoring by vehicle tracking and fleet management functions in the Emergency Management Subsystem. Using these capabilities, the appropriate emergency vehicle to respond to each emergency is determined. Route guidance capabilities within the vehicle enable safe and efficient routing to the emergency. In addition, the emergency vehicle may be equipped to support signal preemption through communications with the Roadway Subsystem.
Maintenance and Construction Vehicle	This subsystem resides in a maintenance, construction, or other specialized service vehicles or equipment and provides the sensory, processing, storage, and communications functions necessary to support highway maintenance and construction. All types of maintenance and construction vehicles are covered, including heavy equipment and supervisory vehicles. The subsystem provides two-way communications between drivers/operators and dispatchers and maintains and communicates current location and status information. A wide range of operational status is monitored, measured, and made available, depending on the specific type of vehicle or equipment. For example, for a snow plow, the information would include whether the plow is up or down and material usage information. The subsystem may also contain capabilities to monitor vehicle systems to support maintenance of the vehicle itself and other sensors that monitor environmental conditions including the road condition and surface weather information. This subsystem can represent a diverse set of mobile environmental sensing platforms, including wheeled vehicles and any other vehicle that collects and reports environmental information.

Entity Name	Entity Description
Transit Vehicle Subsystem	This subsystem resides in a transit vehicle and provides the sensory, processing, storage, and communications functions necessary to support safe and efficient movement of passengers. The Transit Vehicle Subsystem collects accurate ridership levels and supports electronic fare collection. An optional traffic signal prioritization function communicates with the roadside subsystem to improve on-schedule performance. Automated vehicle location functions enhance the information available to the Transit Management Subsystem enabling more efficient operations. On-board sensors support transit vehicle maintenance. The Transit Vehicle Subsystem also furnishes travelers with real-time travel information, continuously updated schedules, transfer options, routes, and fares.
Vehicle	This subsystem provides the sensory, processing, storage, and communications functions necessary to support efficient, safe, and convenient travel. These functions reside in general vehicles including personal automobiles, commercial vehicles, emergency vehicles, transit vehicles, or other vehicle types. Information services provide the driver with current travel conditions and the availability of services along the route and at the destination. Both one-way and two-way communications options support a spectrum of information services from low-cost broadcast services to advanced, pay for use personalized information services. Route guidance capabilities assist in formulation of an optimal route and step by step guidance along the travel route. Advanced sensors, processors, enhanced driver interfaces, and actuators complement the driver information services so that, in addition to making informed mode and route selections, the driver travels these routes in a safer and more consistent manner. Initial collision avoidance functions provide “vigilant co-pilot” driver warning capabilities. More advanced functions assume limited control of the vehicle to maintain safe headway. Ultimately, this subsystem supports completely automated vehicle operation through advanced communications with other vehicles in the vicinity and in coordination with supporting infrastructure subsystems. Pre-crash safety systems are deployed and emergency notification messages are issued when unavoidable collisions do occur.

Traveler Subsystem

Table 2.3-4includes the equipment that is typically owned and operated by the traveler. Though this equipment is often general purpose in nature and used for a variety of tasks, this equipment is specifically used for gaining access to traveler information within the scope of the ITS architecture. These subsystems interface to the information provider (one of the center subsystems, most commonly the Information Service Provider Subsystem) to access the traveler information. A range of service options and levels of equipment sophistication are considered and supported. Specific equipment included in this subsystem class include personal computers, telephones, personal digital assistants (PDAs), televisions, and any other communications-capable consumer products that can be used to supply information to the traveler.

Table 2.3-4 Traveler Subsystem Descriptions

Entity Name	Entity Description
Personal Information Access	This subsystem provides the capability for travelers to receive formatted traffic advisories from their homes, place of work, major trip generation sites, personal portable devices, and over multiple types of electronic media. These capabilities shall also provide basic routing information and allow users to select those transportation modes that allow them to avoid congestion, or more advanced capabilities to allow users to specify those transportation parameters that are unique to their individual needs and receive travel information. This subsystem shall provide capabilities to receive route planning from the infrastructure at fixed locations such as in their homes, their place of work, and at mobile locations such as from personal portable devices and in the vehicle or perform the route planning process at a mobile information access location. In addition to end user devices, this subsystem may also represent a device that is used by a merchant or other service provider to receive traveler information and relay important information to their customers. This subsystem shall also provide the capability to initiate a distress signal and cancel a prior issued manual request for help.
Remote Traveler Support	This subsystem provides access to traveler information at transit stations, transit stops, other fixed sites along travel routes (e.g., rest stops, merchant locations), and at major trip generation locations such as special event centers, hotels, office complexes, amusement parks, and theaters. Traveler information access points include kiosks and informational displays supporting varied levels of interaction and information access. At transit stops, simple displays providing schedule information and imminent arrival signals can be provided. This basic information may be extended to include multi-modal information including traffic conditions and transit schedules along with yellow pages information to support mode and route selection at major trip generation sites. Personalized route planning and route guidance information can also be provided based on criteria supplied by the traveler. In addition to traveler information provision, this subsystem also supports public safety monitoring using CCTV cameras or other surveillance equipment and emergency notification within these public areas. Fare card maintenance, and other features which enhance traveler convenience may also be provided at the discretion of the deploying agency.

2.3.2 Terminator Descriptions

Entities that establish the boundary of the architecture are defined in the Physical Architecture as terminators. These terminators are replicated here in Table 2.3-5.

Table 2.3-5 Terminator Descriptions

Entity Name	Entity Description
Archived Data Administrator	This terminator represents the human operator who provides overall data management, administration, and monitoring duties for the ITS data archive. Unlike the manager of the operational databases, the archive data administrator's role is focused on the archive and covers areas such as establishing user authentication controls, monitoring data quality, and initiating data import requests.
Archived Data User Systems	This terminator represents the systems users employ to access archived data. The general interface provided from this terminator allows a broad range of users (e.g. planners, researchers, analysts, operators) and their systems (e.g. databases, models, analytical tools, user interface devices) to acquire data and analyses results from the archive.
Asset Management	This terminator represents the systems that support decision-making for maintenance, upgrade, and operation of physical transportation assets. Asset management integrates and includes the pavement management systems, bridge management systems, and other systems that inventory and manage the highway infrastructure and other transportation-related assets. The types of assets that are inventoried and managed will vary, and may include the maintenance and construction vehicles and equipment as well as "soft" assets such as human resources and software. Asset management systems monitor the condition, performance, and availability of the infrastructure and evaluate and prioritize alternative reconstruction, rehabilitation, and maintenance strategies.
Basic Commercial Vehicle	This terminator represents the commercial vehicle platform that interfaces with and hosts ITS electronics. This terminator represents a vehicle that is used to transport goods or services which are operated by professional drivers, typically administered as part of a larger fleet, and regulated by a Commercial Vehicle Manager. This classification applies to all such vehicles ranging from small panel vans used in local pick-up and delivery services to large, multi-axle tractor trailer rigs operating on long haul routes.
Basic Maintenance and Construction Vehicle	This terminator represents a specialized form of the Basic Vehicle used by maintenance fleets. It supports the on-board equipment that control the non-ITS systems such as the actual operation of the snow plow, as well as any non-ITS sensor equipment that monitors the amount of materials (e.g., sand or salt) on-board. The monitoring of the Basic Maintenance and Construction Vehicle mechanical condition and mileage provides the major inputs for maintenance vehicle activity scheduling.

Entity Name	Entity Description
Basic Transit Vehicle	This terminator represents a specialized form of the Basic Vehicle used by transit service providers. It supports equipment to collect fares, monitor activities, request priority at signals, and provide information to travelers. It may be a bus, LRT vehicle, or other vehicle specially designed for the carriage of passengers, such as those used by demand responsive transit operators. The monitoring of the Transit Vehicle mechanical condition and mileage provides the major inputs for transit vehicle maintenance scheduling.
Basic Vehicle	This terminator represents the basic vehicle platform that interfaces with and hosts ITS electronics. The Basic Vehicle terminator provides an interface to drive train, driver convenience and entertainment systems, and other non-ITS electronics on-board the vehicle. This interface allows general vehicle systems (e.g., the stereo speaker system) to be shared by ITS and non-ITS systems. It also allows monitoring and control of the vehicle platform for advanced vehicle control system applications.
Care Facility	This terminator represents a hospital or another emergency care facility. It may also represent a third party quality of care information provider.
Commercial Vehicle Driver	This terminator represents the human entity that operates vehicles transporting goods including both long haul trucks and local pick up and delivery vans. This terminator is complementary to the Driver terminator in that it represents those interactions which are unique to Commercial Vehicle Operations. Data flowing from the Commercial Vehicle Driver terminator will include those system inputs specific to Commercial Vehicle Operations, such as information back to the Commercial Vehicle Manager. Data flowing to the Commercial Vehicle Driver may include system outputs such as commands to pull into a roadside safety inspection facility. Showing the Driver as a terminator includes the user interface devices within the ITS architecture boundary. The CVO Driver will be expected to interact with the ITS with interface devices designed to provide support for their usage.
Commercial Vehicle Manager	This terminator represents the human entities that are responsible for the dispatching and management of Commercial Vehicle fleets (e.g. traditional Fleet Managers). It may be many people in a large tracking organization but it can also be a single person (owner driver) in the case of single vehicle fleets. The Commercial Vehicle Manager provides instructions and coordination for Commercial Vehicles, including electronic clearance and tax filing, and receives the status of the Vehicles in the fleet that they manage. The Commercial Vehicle Manager is expected to interface with ITS on a regular basis to enhance productivity. Many interfaces with the system are also provided through normal user interfaces This interface is specific to CVO and is intended to complement these other interfaces.
CVO Information Requestor	This terminator represents any organization requesting information from the CVO Information Exchange network. It typically represents insurance companies requesting safety information on carriers etc.

Entity Name	Entity Description
CVO Inspector	This terminator represents the human entities who perform regulatory inspection of Commercial Vehicles in the field. CVO Inspectors support the roadside inspection, weighing, and checking of credentials either through automated preclearance or manual methods. The CVO Inspector is an inspection and enforcement arm of the regulatory agencies with frequent direct interface with the Commercial Vehicles and their Drivers.
DMV	This terminator represents a specific (state) public organization responsible for registering vehicles, e.g., the Department of Motor Vehicles.
Driver	This terminator represents the human entity that operates a licensed vehicle on the roadway. Included are operators of private, Transit, Commercial, and Emergency vehicles where the data being sent or received is not particular to the type of vehicle. Thus this terminator originates driver requests and receives driver information that reflects the interactions which might be useful to all drivers, regardless of vehicle classification. The Driver terminator is the operator of the Basic Vehicle terminator. Information and interactions which are unique to drivers of a specific vehicle type (e.g., fleet interactions with transit, commercial, or emergency vehicle drivers) are covered separately.
Emergency Personnel	This terminator represents personnel that are responsible for police, fire, emergency medical services, towing, service patrols, and other special response team (e.g., hazardous material clean-up) activities at an incident site. These personnel are associated with the Emergency Vehicle Subsystem during dispatch to the incident site, but often work independently of the Emergency Vehicle Subsystem while providing their incident response services. Emergency personnel may include an Officer in Charge (OIC) and a crew. When managing an incident following standard Incident Command System practices, the on-site emergency personnel form an organizational structure under the auspices of an Incident Commander.
Emergency System Operator	This terminator represents the human entity that monitors all ITS emergency requests, (including those from the E911 Operator) and sets up pre-defined responses to be executed by an emergency management system. The operator may also override predefined responses where it is observed that they are not achieving the desired result. This terminator includes dispatchers who manage an emergency fleet (police, fire, ambulance, HAZMAT, etc.) or higher order emergency managers who provide response coordination during emergencies.
Emergency Telecommunications System	This terminator represents the telecommunications systems that connect a caller with a Public Safety Answering Point (PSAP). These systems transparently support priority wireline and wireless caller access to the PSAP through 9-1-1 and other access mechanisms like 7 digit local access numbers, and motorist aid call boxes. The calls are routed to the appropriate PSAP, based on caller location when this information is available. When available, the caller's location and call-back number are also provided to the PSAP by this interface.

Entity Name	Entity Description
Enforcement Agency	This terminator represents the systems that receive reports of violations detected by various ITS facilities including individual vehicle emissions, toll violations, CVO violations, excessive speed in work zones, etc.
Environment	This terminator represents the natural surroundings in which the ITS operates. These surroundings include conditions such as snow, rain, fog, pollution, dust, temperature, humidity, solar radiation, and man made electromagnetic (RF) effects. Environmental conditions must be monitored by the ITS Architecture so that Travelers may be informed and control strategies can reflect adverse environmental conditions in a timely fashion.
Equipment Repair Facility	This terminator represents the facilities that configure, service, and repair vehicles and other support equipment used in roadway infrastructure construction and maintenance. The equipment repair facility receives preventative and corrective maintenance schedules and vehicle configuration requirements, performs the necessary configuration and maintenance work on the vehicles and equipment, and provides vehicle and equipment status back to the architecture.
Event Promoters	This terminator represents Special Event Sponsors that have knowledge of events that may impact travel on roadways or other modal means. Examples of special event sponsors include sporting events, conventions, motorcades/parades, and public/political events. These promoters interface to the ITS to provide event information such as date, time, estimated duration, location, and any other information pertinent to traffic movement in the surrounding area.
Financial Institution	This terminator represents the organization that handles all electronic fund transfer requests to enable the transfer of funds from the user of the service to the provider of the service. The functions and activities of financial clearinghouses are subsumed by this entity.
Government Reporting Systems	This terminator represents the system and associated personnel that prepare the inputs to support the various local, state, and federal government transportation data reporting requirements (e.g. Highway Performance Monitoring System, Fatal Analysis Reporting System) using data collected by ITS systems. This terminator represents a system interface that would provide access to the archived data that is relevant to these reports. In most cases, this terminator would manually combine data collected from the ITS archives with data from non ITS sources to assemble and submit the required information.
Intermodal Freight Depot	A Depot operated either by an ITS Freight manager or an alternate mode freight shipper which is capable of tracking cargo as it is moved from one mode to another.

Entity Name	Entity Description
Intermodal Freight Shipper	This terminator represents organizations that engage in the shipment of freight by multiple means, in addition to road-going trucks. They enable ITS to move goods on routes that require the use of other modes of transportation such as heavy rail, air, sea, etc. An example is a third party logistics provider that interfaces with Fleet and Freight Managers to transfer cargo from one mode to another. This definition includes those responsible for the movement of freight across international borders. These entities are responsible for filing required declarations, and have an acute interest in the status of international shipments.
ISP Operator	This terminator is the human entity that may be physically present at the ISP to monitor the operational status of the facility and provide human interface capabilities to travelers and other ISP subsystems.
Location Data Source	This terminator provides accurate position information. Systems which use GPS, terrestrial trilateration, or driver inputs are all potential examples of Location Data Sources. This terminator contains sensors such as radio position receivers (e.g. GPS) and/or dead reckoning sensors (e.g. odometer, differential odometer, magnetic compass, gyro, etc.). This terminator implies that some additional functionality associated with developing an absolute position is outside the system and will not be directly modeled by the logical or physical architecture representations of the system.
Maintenance and Construction Administrative Systems	This terminator represents the various administrative systems that support the operation of ITS systems for maintenance and construction operations. The interfaces to this terminator support general administrative data interchanges between ITS and non-ITS systems. This includes: interfaces to purchasing for equipment and consumables resupply, interfaces to human resources that manage training and special certification for field crews and other personnel, and interfaces to contract administration functions that administer and monitor the work performance for maintenance and construction contracts.
Maintenance and Construction Center Personnel	This terminator represents the people that directly interface with the systems in the Maintenance and Construction Management subsystem. These personnel interact with fleet dispatch and management systems, road maintenance systems, incident management systems, work plan scheduling systems, and work zone management systems. They provide operator data and command inputs to direct system operations to varying degrees depending on the type of system and the deployment scenario. All functionality associated with these services that might be automated in the course of ITS deployment is modeled as internal to the architecture.

Entity Name	Entity Description
Maintenance and Construction Field Personnel	This terminator represents the people that perform maintenance and construction field activities including vehicle and equipment operators, field supervisory personnel, field crews, and work zone safety personnel. Information flowing from the Maintenance and Construction Field Personnel terminator will include those system inputs specific to maintenance and construction operations, such as information regarding work zone status, or the status of maintenance actions. The field personnel are also monitored within the work zone to enhance work zone safety. Information provided to Maintenance and Construction Field Personnel includes system outputs such as dispatch requests, maintenance and construction actions to be performed, and work zone safety warnings.
Map Update Provider	This terminator represents a third-party developer and provider of digitized map databases used to support ITS services. It supports the provision of the databases that are required exclusively for route guidance (navigable maps) as well as those that are used exclusively for display by operators and at traveler information points, e.g. kiosks (display maps).
Media	This terminator represents the information systems that provide traffic reports, travel conditions, and other transportation-related news services to the traveling public through radio, TV, and other media. Traffic and travel advisory information that are collected by ITS are provided to this terminator. It is also a source for traffic flow information, incident and special event information, and other events which may have implications for the transportation system.
Multimodal Crossings	This terminator represents the control equipment that interfaces to a non-road based transportation system at an interference crossing with the roadway. The majority of these crossings are railroad grade crossings that are more specifically addressed by the "Wayside Equipment" terminator. This multimodal crossing terminator addresses similar interface requirements, but for other specialized intersections like draw bridges at rivers and canals. These crossings carry traffic that may take priority over the road traffic at the intersection. The data provided will in its basic form be a simple "stop road traffic" indication. However more complex data flows may be provided that give the time at which right-of-way will be required and the duration of that right-of-way requirement.
Multimodal Transportation Service Provider	This terminator provides the interface through which Transportation Service Providers can exchange data with ITS. They are the operators of non-roadway transportation systems (e.g. airlines, ferry services, passenger carrying heavy rail) and providers of non-motorized transportation facilities. This two-way interface enables coordination for efficient movement of people across multiple transportation modes. It also enables the traveler to efficiently plan itineraries which include segments using modes not directly included in the ITS User Services.

Entity Name	Entity Description
Other Archives	This terminator represents distributed archived data systems or centers whose data can be accessed and shared with a local archive. The interface between the Other Archives Terminator and the Archived Data Management Subsystem allows data from multiple archives to be accessed on demand or imported and consolidated into a single repository.
Other CVAS	This terminator is intended to provide a source and destination for ITS data flows between peer (e.g. inter-regional) commercial vehicle administration functions. It enables commercial vehicle administration activities to be coordinated across different jurisdictional areas. In the Physical Architecture, this terminator is a reciprocal Commercial Vehicle Administration Subsystem (CVAS). This terminator encompasses all functions associated with commercial vehicle safety, registration, and operating authority for non-U.S. based commercial motor vehicle carriers. The agencies represented herein may include Federal, state, provincial, and local regulatory entities outside the U.S.
Other Data Sources	This terminator represents the myriad systems and databases containing data not generated from subsystems and terminators represented in the National ITS Architecture that can provide predefined data sets to the ITS archive. The terminator can provide economic, cost, demographic, land use, law enforcement, and other data that is not collected by ITS systems and would otherwise be unavailable within an ITS data archive.
Other EM	Representing other Emergency Management centers, systems or subsystems, this terminator provides a source and destination for ITS data flows between various communications centers operated by public safety agencies as well as centers operated by other allied agencies and private companies that participate in coordinated management of highway-related incidents. The interface represented by this terminator enables emergency management activities to be coordinated across jurisdictional boundaries and between functional areas. In the Physical Architecture this terminator is a reciprocal Emergency Management Subsystem (EM) implying the requirements for general networks connecting many allied agencies. The interface between this terminator and the EM supports coordination of incident management information between many different centers providing Public Safety Answering Point (both public or private sector implementations), Public Safety Dispatch, Emergency Operations, and other functions that participate in the detection, verification, response, and clearance of highway incidents. This terminator also supports interface to other allied agencies like utility companies that also participate in the coordinated response to selected highway-related incidents.
Other ISP	Representing other distinct Information Service Providers, this terminator is intended to provide a source and destination for ITS data flows between peer information and service provider functions. It enables cooperative information sharing between providers as conditions warrant. In the Physical Architecture this terminator is a reciprocal Information Service Provider (ISP) Subsystem.

Entity Name	Entity Description
Other MCM	Representing another Maintenance and Construction Management center or subsystem, this terminator is intended to provide a source and destination for ITS information flows between maintenance and construction management functions. It enables maintenance and construction operations to be coordinated across jurisdictions or between public and private sectors. In the Physical Architecture, this terminator is a reciprocal Maintenance and Construction Management Subsystem (MCMS).
Other MCV	This terminator represents another ITS Maintenance and Construction Vehicle Subsystem. It provides a source and destination for ITS information transfers between maintenance and construction vehicles. These information transfers allow vehicle operational status, environmental information, and work zone intrusion warnings or alarms to be shared between vehicles.
Other Parking	Representing another parking facility, system or subsystem, this terminator provides a source and destination for information that may be exchanged between peer parking systems. This terminator enables parking management activities to be coordinated between different parking operators or systems in a region. In the Physical Architecture this terminator is a reciprocal Parking Management Subsystem.
Other Roadway	Representing another roadway system or subsystem, this terminator provides a source and destination for information that may be exchanged between peer roadway subsystems. The interface to this terminator enables direct coordination between field equipment. Examples include the direct interface between sensors and other roadway devices (e.g., Dynamic Message Signs) and the direct interface between roadway devices (e.g., adjacent traffic control equipment).
Other TM	Representing another Traffic Management center, system or subsystem, this terminator is intended to provide a source and destination for ITS data flows between peer (e.g. inter-regional) traffic management functions. It enables traffic management activities to be coordinated across different jurisdictional areas. In the Physical Architecture this terminator is a reciprocal Traffic Management Subsystem (TMS).
Other Toll Administration	Representing another Toll Administration center or subsystem, this terminator is intended to provide a source and destination for ITS information flows between toll administration functions. This interface allows reconciliation of toll charges across different agencies by allowing the exchange of information about clients who have incurred charges in jurisdictions of toll collection agencies other than their home (billing) customer service center. This interface enables "reciprocity" between participating customer service centers. In the Physical Architecture, this terminator is a reciprocal Toll Administration Subsystem (TAS).

Entity Name	Entity Description
Other TRM	Representing another Transit Management center, system or subsystem, this terminator is intended to provide a source and destination for ITS data flows between peer (e.g. inter-regional) transit management functions. It enables traffic management activities to be coordinated across geographic boundaries or different jurisdictional areas. In the Physical Architecture this terminator represents a reciprocal Transit Management Subsystem (TRMS).
Other Vehicle	This terminator represents another ITS vehicle system or subsystem and provides a source and destination for ITS information transfers between peer vehicle systems to support vehicle-to-vehicle communication and coordination. These features are associated with advanced vehicle safety systems and services that require communications between vehicles.
Parking Operator	This terminator is the human entity that may be physically present at the parking lot facility to monitor the operational status of the facility.
Pedestrians	This terminator provides input (e.g. a request for right of way at an intersection) from a specialized form of the Traveler who is not using any type of vehicle (including bicycles) as a form of transport. Pedestrians may comprise those on foot and those in wheelchairs.
Potential Obstacles	Any object that possesses the potential of being sensed and struck and thus also possesses physical attributes. Potential Obstacles include roadside obstructions, other vehicles, pedestrians, infrastructure elements or any other element which is in a potential path of the vehicle. This terminator represents the physical obstacles which possess properties which enable detection using sensory functions included as part of the ITS architecture. These physical attributes are represented as a data input to the system.
Rail Operations	This is roughly the railroad equivalent to a highway Traffic Management Center. It is (usually) a centralized control point for a substantial segment of a railroad's operations and maintenance activities. It is the source and destination of information that can be used to coordinate rail and highway traffic management and maintenance operations. This terminator would also represent a railroad's management information system, if that system is the source or destination for this information. The use of a single terminator for multiple sources and destination for information exchange with the railroad entity is meant to imply the need for a single, consistent interface between a given railroad's operations and maintenance activities and ITS. In any given implementation, there may be multiple instantiations of this interface. For example, a city like Chicago may have interfaces to 5 or more Rail Operations Centers (e.g. BNSF, CSX, NS, UP. CR, etc.)

Entity Name	Entity Description
Roadway Environment	This terminator represents the physical condition and geometry of the road surface and the conditions surrounding the roadway. The geometry of the roadway and the road surface characteristics must be sensed and interpreted to support automated vehicle control services. Surrounding conditions may include fog, ice, snow, rain, wind, etc. which will influence the way in which a vehicle can be safely operated on the roadway. The condition of the roadway must be monitored by the architecture to enable corrective action and information dissemination regarding roadway conditions which may adversely affect travel. This physical interface carries these physical condition and geometry attributes which must be sensed, interpreted, and processed by functions internal to the system to achieve ITS User Service functionality.
Secure Area Environment	This terminator comprises public access areas that transit users frequent during trips. Areas include bus stops, park and ride (PAR) facilities, at kiosks, and other transit transfer locations. These environments are monitored as part of the ITS Architecture functions to promote transit safety.
Storage Facility	This terminator represents the facilities that provide storage and forward staging for equipment and materials used in maintenance and construction operations. It provides status information on the types and quantities of materials and equipment that are available at the facility.
Surface Transportation Weather Service	This terminator represents the providers of value-added sector specific meteorological services. These providers utilize National Weather Service data and predictions, road condition information and local environmental data provided by the traffic management or maintenance organizations, and their own models to provide surface transportation related weather observations and forecasts including pavement temperature and conditions.
Toll Administrator	The Toll Administrator is the human entity that manages the back office payment administration systems for a electronic toll system. This terminator monitors the systems that support the electronic transfer of authenticated funds from the customer to the system operator. The terminator monitors customer enrollment and supports the establishment of escrow accounts depending on the clearinghouse scheme and the type of payments involved. The terminator also establishes and administers the pricing structures and policies.
Toll Operator	The Toll Operator is the human entity that may be physically present at the toll plaza to monitor the operational status of the plaza.
Trade Regulatory Agencies	These agencies include U.S. domestic and foreign governmental agencies responsible for the regulation of trade, and the enforcement of customs and immigration laws. These agencies include U.S. Customs, the U.S. Immigration and Naturalization Service (INS), and their counterparts in Canada and Mexico. They may also include secondary trade agencies (e.g., U.S. Food and Drug Administration, U.S. Department of Agriculture, other USDOT departments, etc.), and agencies from other trading nations.

Entity Name	Entity Description
Traffic	The Traffic terminator represents the collective body of vehicles that travel on surface streets, arterials, highways, expressways, tollways, freeways, or any other vehicle travel surface. Traffic depicts the vehicle population from which traffic flow surveillance information is collected (average occupancy, average speed, total volume, average delay, etc.), and to which traffic control indicators are applied (intersection signals, stop signs, ramp meters, lane control barriers, variable speed limit indicators, etc.). All sensory and control elements that interface to this vehicle population are internal to ITS.
Traffic Operations Personnel	This terminator represents the human entity that directly interfaces with vehicle traffic operations. These personnel interact with traffic control systems, traffic surveillance systems, incident management systems, work zone management systems, and travel demand management systems to accomplish ITS services. They provide operator data and command inputs to direct systems' operations to varying degrees depending on the type of system and the deployment scenario. All functionality associated with these services that might be automated in the course of ITS deployment is modeled as internal to the architecture.
Transit Driver	This terminator represents the human entity that is a special form of the Driver terminator that receives and provides additional information that is specific to Transit (including demand responsive transit) operations. This information will not be received by other types of Driver. The Transit Driver terminator operates the Transit Vehicle terminator and represents random route drivers, flexible fixed route drivers and fixed route drivers. The fixed route drivers require minimal information such as run times and passenger loading. The flex fixed and random route drivers require additional information such as dynamically changing routes.
Transit Fleet Manager	This terminator represents the human entity that is responsible for planning the operation of transit fleets, including monitoring and controlling the transit fleet route schedules and the transit fleet maintenance schedules. This comprises planning routes and schedules for either daily use or for special occasions as distinct from making day to day variations to schedules and routes.
Transit Maintenance Personnel	The terminator represents the human entity that is actively responsible for monitoring, controlling, and planning the schedules for the maintenance of transit fleets.
Transit System Operators	This terminator represents the human entities that are responsible for all aspects of the Transit subsystem operation including planning and management. They actively monitor, control, and modify the transit fleet routes and schedules on a day to day basis. The modifications will be to take account of abnormal situations such as vehicle breakdown, vehicle delay, etc. These personnel may also be responsible for demand responsive transit operation and for managing emergency situations within the transit network.

Entity Name	Entity Description
Transit User	This terminator represents the human entities using Public Transit vehicles. They may be in the act of embarking or debarking the vehicles and are thus sensed for the purpose of determining passenger loading and fares, or on the vehicles and able to request and receive information.
Traveler	This terminator represents any individual (human) who uses transportation services. At the time that data is passed to or from the terminator the individual is neither a driver, pedestrian, or transit user. This means that the data provided is that for pre-trip planning or multi-modal personal guidance and includes their requests for assistance in an emergency. Subsequent to receipt of pre-trip information, a Traveler may become a vehicle driver, passenger, transit user, or pedestrian.
Traveler Card	This terminator represents the entity that enables the actual transfer of electronic information from the user of a service (I.e. a traveler) to the provider of the service. This may include the transfer of funds through means of an electronic payment instrument. The device, like a smart card, may also hold and update the traveler's information such as personal profiles or trip histories.
Vehicle Characteristics	This terminator represents the external view of an individual vehicle. It includes vehicle characteristics such as height, width, length, weight, and other properties (e.g., magnetic properties, number of axles) that allow an individual vehicle to be detected and measured or classified. This external view of an individual vehicle is also used as a source of visible data that supports individual vehicle imaging requirements in the architecture. ITS subsystems at the roadside sense these characteristics and generate ITS data flows. These individual vehicle characteristics are important for toll collection, parking management, and other applications that identify and measure individual vehicles. See also the related "Traffic" terminator which represents physical characteristics of many vehicles in the aggregate that is measured for general traffic applications.
Wayside Equipment	This terminator represents train interface equipment (usually) maintained and operated by the railroad and (usually) physically located at or near a grade crossing. This terminator is the source and destination for HRI information for, or about, approaching trains and their crews (e.g. the time at which the train will arrive and the time it will take to clear a crossing, crossing status or warnings, etc.). Generally one wayside equipment interface would be associated with one highway rail intersection. However, multiple crossings may be controlled using information based on data from one wayside equipment interface.

Entity Name	Entity Description
Weather Service	This terminator provides weather, hydrologic, and climate information and warnings of hazardous weather including thunderstorms, flooding, hurricanes, tornadoes, winter weather, tsunamis, and climate events. It provides atmospheric weather observations and forecasts that are collected and derived by the National Weather Service, private sector providers, and various research organizations. The interface provides formatted weather data products suitable for on-line processing and integration with other ITS data products as well as Doppler radar images, satellite images, severe storm warnings, and other products that are formatted for presentation to various ITS users.
Yellow Pages Service Providers	This terminator represents the individual organizations that provide any service oriented towards the Traveler. Example services that could be included are gas, food, lodging, vehicle repair, points of interest, and recreation areas. Also included are services specifically directed toward bicyclists and pedestrians such as bicycle shops and parking locations and bicycle and pedestrian rest areas. The Service Providers may pay a fee to have their services advertised to travelers. The interface with the Service Provider is necessary so that accurate, up-to-date service information can be provided to the traveler and to support electronic reservation capabilities included in the ITS User Services.

Architecture flows are connected in the physical architecture flow diagram with data flows. Table 2.3-6 contains the descriptions of all physical architecture flows. More detailed definition of the message sizes and contents can be obtained from the appropriate logical data dictionary entries. Detailed timing information is implementation dependent and is provided in the evaluatory design.

Also included are architecture flow diagrams containing the subsystems associated with each set of stakeholder areas. Each of these diagrams is further broken down in subsequent sections.

Table 2.3-6 Architecture Flow Descriptions

Architecture Flow	Flow Description
accident report	Report of commercial vehicle safety accident. The information may be provided as a response to a real-time query or proactively by the source. The query flow is not explicitly shown.
AHS control data	Information required for vehicles to operate on AHS lanes.
AHS control information	Control data to AHS roadway equipment.
AHS status	Status of AHS equipment, lane controls etc.
AHS vehicle data	AHS route and vehicle condition data.
air quality information	Aggregated region-wide measured air quality data and possible pollution incident information.
alerts	Specific alerts and messages related to commercial vehicles (e.g. trucks not advised, trucks over 10 tons not allowed on bridge, route details). This also includes warning indications detected by on-board sensors (cargo, safety).
archive analysis requests	A user request that initiates data mining, analytical processing, aggregation or summarization, report formulation, or other advanced processing and analysis of archived data. The request also includes information that is used to identify and authenticate the user and support electronic payment requirements, if any.
archive analysis results	Processed information products, supporting meta data, and any associated transaction information resulting from data mining, analytical processing, aggregation or summarization, report formulation, or other on-line processing and analysis of archived data.
archive coordination	Catalog data, meta data, published data, and other information exchanged between archives to support data synchronization and satisfy user data requests.
archive management data	Information used to support the management of an ITS archive including database reports on the condition and quality of the archived data, status of the import and collection process, reports that monitor archive usage, and any special requests that require direct action by the administrator (e.g., requests for access to new data sources).
archive management requests	Commands, requests, and queries that support the administration and management of an ITS data archive.
archive request confirmation	Confirmation that an archive request has been received and processed with information on the disposition of the request.
archive requests	A request to a data source for information on available data (i.e. "catalog") or a request that defines the data to be archived. The request can be a general subscription intended to initiate a continuous or regular data stream or a specific request intended to initiate a one-time response from the recipient.
archive status	Notification that data provided to an archive contains erroneous, missing, or suspicious data or verification that the data provided appears valid. If an error has been detected, the offending data and the nature of the potential problem are identified.
archived data product requests	A user-specified request for archived data products (i.e. data, meta data, or data catalogs). The request also includes information that is used to identify and authenticate the user and support electronic payment requirements, if any.

Architecture Flow	Flow Description
archived data products	Raw or processed data, meta data, data catalogs and other data products provided to a user system upon request. The response may also include any associated transaction information.
arriving train information	Information for a train approaching a highway-rail intersection that may include direction and allow calculation of approximate arrival time and closure duration.
asset archive data	Information describing transportation assets including pavements, bridges, and all other infrastructure included in the transportation network. In addition, information can cover support assets (support equipment and systems, software, etc.). Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.
asset inventory	Information on pavement, bridges, signs and other assets. This includes asset location, installation information, materials information, vendor/contractor information, current maintenance status, and a variety of other information (e.g., video logs) that define the transportation infrastructure.
asset restrictions	Restrictions levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard height, width, and weight restrictions by facility as well as special restrictions such as spring weight restrictions and temporary bridge weight restrictions.
asset status update	Changes to status of pavement, bridges, signs and other assets resulting from maintenance or construction activities or infrastructure monitoring. The updates may include changes in installation information, materials information, vendor/contractor information, condition, and current maintenance status. In addition to infrastructure asset updates, the information provided may also include status of the maintenance and construction support assets, including vehicle and equipment utilization and repair records.
audit data	Information to support a tax audit.
bad tag list	List of invalid transit user tags which may have previously failed a fare payment transaction.
basic vehicle measures	Information provided to on-board ITS equipment from the vehicle platform indicating current vehicle status.
border agency clearance results	Notification regarding the granting of permission for commercial freight shipment to enter the U.S.
border clearance data	Trip specific data regarding the movement of goods across international borders. Includes trip identification number. May also include results from recent border crossing screening events.
border clearance data request	Request for trip specific data regarding the movement of goods across international borders. Includes trip identification number. May also include results from recent border crossing screening events.
border clearance event	Reports clearance event data regarding action taken at border, including acceptance or override of system decision, and date/time stamp
border clearance status	Notification regarding the crossing status of commercial freight shipment scheduled to enter the U.S. Includes portions of border agency and transportation agency clearance results, as they become available. Recipients may include trade regulatory agencies that do not receive status information directly from U.S. Customs (e.g., other transportation agencies with trade related responsibilities, such as NHTSA, MARAD, etc.)

Architecture Flow	Flow Description
broadcast advisories	General broadcast advisories that are provided over wide-area wireless communications direct to the vehicle radio. These analog advisory messages may provide similar content to ITS broadcast information flows, but include no digital data component. Existing Highway-Advisory Radio (HAR) advisory messages are a prime example of this flow.
broadcast information	General broadcast information that contains link travel times, incidents, advisories, transit services and a myriad of other traveler information.
care facility status	Information regarding facility type and capabilities, facility status, and its ability to admit new patients.
care facility status request	Request for information regarding care facility availability and status.
citation	Report of commercial vehicle citation. The citation includes references to the statute(s) that was (were) violated. It includes information on the violator and the officer issuing the citation. A citation differs from a violation because it is adjudicated by the courts. The information may be provided as a response to a real-time query or proactively by the source. The query flow is not explicitly shown.
commercial vehicle archive data	Information describing commercial vehicle travel and commodity flow characteristics. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.
commercial vehicle data	Information about the commercial vehicles cargo, credentials, and payments.
commercial vehicle data request	Requests from the vehicle for information about the commercial vehicle's cargo, credentials, and payments.
commercial vehicle measures	Commercial vehicle, driver, and cargo safety status measured by on-board ITS equipment.
compliance review report	Report containing results of carrier compliance review, including concomitant out-of-service notifications, carrier warnings/notifications. The information may be provided as a response to a real-time query of proactively by the source. The query flow is not explicitly shown.
credential application	Application for commercial vehicle credentials. Authorization for payment is included.
credential fee coordination	Jurisdiction's rates for various credentials (IRP, IFTA, etc.) that are exchanged between agencies.
credentials information	Response containing full credentials information. "Response" may be provided in reaction to a real-time query or a standing request for updated information. The query flow is not explicitly shown.
credentials status information	Credentials information such as registration, licensing, insurance, check flags, and electronic screening enrollment data. A unique identifier is included. Corresponds to the credentials portion of CVISN "snapshots." The status information may be provided as a response to a real-time query or as a result of a standing request for updated information (subscription). This may also include information about non-U.S. fleets for use by U.S. authorities, and information regarding U.S. fleets made available to Mexican and Canadian authorities. The query flow is not explicitly shown.
crew movements	Field crew location within a work zone that is monitored to enhance work zone safety.

Architecture Flow	Flow Description
crossing call	Request for pedestrian crossing.
crossing permission	Signal to pedestrians indicating permission to cross roadway.
current asset restrictions	Restrictions levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.
CVC override mode	Manual override of automated pass/pull-in decisions generated by the Commercial Vehicle Check station.
CVO driver initialization	Commercial vehicle driver and vehicle information and requests to the commercial vehicle managing system.
CVO inspector information	Credential, safety, and preclearance information and instructions to the commercial vehicle inspector.
CVO inspector input	Requests from the commercial vehicle inspector to operate the commercial vehicle inspection station.
CVO pass/pull-in message	Message sent to commercial vehicle driver indicating whether to bypass or requesting pull in to inspection/verification stop along with inspection results (e. g., LED indicator on transponder or variable message sign).
CVO weight and presence	Physical attribute of commercial vehicle that can be measured (for example, weight, number of axels, axel spacing, etc.).
daily site activity data	Record of daily activities at commercial vehicle check stations including summaries of screening events and inspections.
data collection and monitoring control	Information used to configure and control data collection and monitoring systems.
declaration information	Notification containing information regarding pending commercial freight shipment into the U.S.
demand responsive transit plan	Plan regarding overall demand responsive transit schedules and deployment.
demand responsive transit request	Request for paratransit support.
dispatch information	Dispatch information and command to emergency personnel.
domestic transportation information	Real-time or near real-time data regarding trade transportation activity. Potentially categorized by shipper classification, carrier, commodity, etc. Intended for use as a transportation decision tool.
driver information	General advisory and traffic control information provided to the driver while en route.
driver inputs	Driver commands to the vehicle.
driver instructions	Transit service instructions, traffic information, road conditions, and other information for both transit and paratransit drivers.
driver log	A daily log showing hours in service for the current driver.
driver log request	Request for driver log data.
driver to fleet request	Requests from the driver and vehicle for routing, payment, and enrollment information.
driver updates	Information displayed or otherwise conveyed by the vehicle to the driver.
electronic lock data	Notification to roadside (via transponder) of the presence and status of electronic cargo locks.

Architecture Flow	Flow Description
electronic lock data request	Request from roadside for data regarding presence and status of electronic cargo locks.
electronic screening request	Request for identification data to support electronic screening.
emergency acknowledge	Acknowledge request for emergency assistance and provide additional details regarding actions and verification requirements.
emergency archive data	Logged incident information that characterizes the identified incidents and provides a record of the corresponding incident response. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.
emergency data request	A request for additional information or a control command issued by the emergency response agency in response to an emergency request for assistance from a traveler.
emergency dispatch requests	Emergency vehicle dispatch instructions including incident location and available information concerning the incident.
emergency dispatch response	Request for additional emergency dispatch information (e.g., a suggested route) and provision of en route status.
emergency notification	An emergency request for assistance originated by a traveler using an in-vehicle, public access, or personal device.
emergency operations request	Emergency operator inputs supporting call taking, dispatch, and other operations and communications center operator functions.
emergency operations status	Emergency operations data supporting a range of emergency operating positions including call taker, dispatch, and various other operations and communications center operator positions.
emergency personnel inputs	Current incident status information and requests from emergency personnel in the field for information and/or resources.
emergency request	An emergency assistance request originated by a transit traveler using an in-vehicle, public access, or personal device.
emergency traffic control request	Special request to preempt the current traffic control strategy in effect at one or more signalized intersections or highway segments. For example, this flow can request all signals to red-flash, request a progression of traffic control preemptions along an emergency vehicle route, or request another special traffic control plan.
emergency traffic control response	Status of the special traffic signal control strategy implemented in response to the emergency traffic control request.
emergency vehicle tracking data	The current location and operating status of the emergency vehicle.
emissions archive data	Air quality and vehicle emissions information that is collected by sensors or derived from models. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.
emissions data	Emissions data and associated imagery collected by roadside equipment.
environmental conditions	Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) that are measured by environmental sensors.

Architecture Flow	Flow Description
environmental conditions data	Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) as measured and reported by environmental sensors.
environmental probe data	Current environmental conditions (e.g., air temperature, wind speed, surface temperature) as measured by vehicle-based environmental sensors. In addition to environmental sensor inputs, this flow may also include vehicle control system information that may indicate adverse road surface conditions (e.g., traction control system activations).
environmental sensors control	Data used to configure and control environmental sensors.
equipment availability	An inventory of the maintenance and construction equipment available at the storage facility. This flow includes the type of equipment, enough descriptive information to indicate its suitability for use, and its current status. This flow may contain information for a specific type of equipment or include all equipment available at the facility.
equipment maintenance status	Current status of field equipment maintenance actions.
event confirmation	Confirmation that special event details have been received and processed.
event information	Special event information for travelers. This would include a broader array of information than the similar "event plans" that conveys only information necessary to support traffic management for the event.
event information request	Request for special event information.
event plans	Plans for major events possibly impacting traffic.
external reports	Traffic and incident information that is collected by the media through a variety of mechanisms (e.g., radio station call-in programs, air surveillance).
fare and payment status	Current fare collection information including the operational status of the fare collection equipment and financial payment transaction data.
fare and price information	Current transit, parking, and toll fee schedule information.
fare management information	Transit fare information and transaction data used to manage transit fare processing on the transit vehicle.
field device status	Reports from field equipment (sensors, signals, signs, controllers, etc.) which indicate current operational status.
field equipment status	Identification of field equipment requiring repair and known information about the associated faults.
fleet manager inquiry	Inquiry from fleet manager requesting data from commercial vehicle management system.
fleet status	Fleet status information including enrollment status, routing information, current vehicle information, and emergency information.
fleet to driver update	Updated instructions to the driver including dispatch, routing, and special instructions.
freeway control data	Control commands and operating parameters for ramp meters, mainline metering/lane controls and other systems associated with freeway operations.

Architecture Flow	Flow Description
freeway control status	Current operational status and operating parameters for ramp meters, mainline metering/lane controls and other control equipment associated with freeway operations.
government reporting data receipt	The acknowledgement of satisfactory receipt of information used as input to government data systems or a report identifying problems or issues with the data submittal.
government reporting system data	Information provided by an ITS archive, formatted as appropriate, that can be used as input to government data reporting systems.
hazmat information	Information about a particular hazmat load including nature of the load and unloading instructions. May also include hazmat vehicle route and route update information.
hazmat information request	Request for information about a particular hazmat load.
hazmat spill notification	This data flow is used by the on-board cargo monitoring equipment package to contact emergency response organizations when the cargo sensors detect a release of hazardous material. This information will include the vehicle location discussed above as well as identifying the carrier. The information may be provided as a response to a real-time query or proactively by the source. The query flow is not explicitly shown.
highway control status	Current traffic control equipment status that indicates operational status and right-of-way availability to the non-highway transportation mode at a multimodal crossing.
hov data	Current HOV lane information including both standard traffic flow measures and information regarding vehicle occupancy in HOV lanes.
hri advisories	Notification of Highway-Rail Intersection equipment failure, intersection blockage, or other condition requiring attention, and maintenance activities at or near highway rail intersections.
hri control data	Data required for HRI information transmitted at railroad grade crossings and within railroad operations.
hri operational status	Status of the highway-rail grade crossing equipment including both the current state or mode of operation and the current equipment condition.
hri request	A request for highway-rail intersection status or a specific control request intended to modify HRI operation.
hri status	Status of the highway-rail intersection equipment including both the current state or mode of operation and the current equipment condition.
identification information	Vehicle identification information such as license plate number, US DOT number, ICC number, bar code, etc.
incident command information	Information that supports local management of an incident. It includes resource deployment status, hazardous material information, traffic, road, and weather conditions, evacuation advice, and other information that enables emergency or maintenance personnel in the field to implement an effective, safe incident response.
incident command information presentation	Presentation of information to emergency personnel in the field that supports local tactical decision-making within an incident command system structure.

Architecture Flow	Flow Description
incident command request	Request for resources, commands for relay to other allied response agencies, and other requests that reflect local command of an evolving incident response.
incident information	Notification of existence of incident and expected severity, location, time and nature of incident.
incident information for media	Report of current desensitized incident information prepared for public dissemination through the media.
incident information request	Request for incident information, clearing time, severity. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.
incident notification	The notification of an incident including its nature, severity, and location.
incident notification response	Interactive acknowledgement and verification of the incident information received, requests for additional information, and general information on incident response status.
incident report	Report of an identified incident including incident location, type, severity and other information necessary to initiate an appropriate incident response.
incident response coordination	Incident response procedures, resource coordination, and current incident response status that are shared between allied response agencies to support a coordinated response to incidents. This flow also coordinates a positive hand off of responsibility for all or part of an incident response between agencies.
incident response status	Status of the current incident response including traffic management strategies implemented at the site (e.g., closures, diversions, traffic signal control overrides).
incident status	Information gathered at the incident site that more completely characterizes the incident and provides current incident response status.
information on violators	Response from law enforcement agency to request for information on violators. May include information about commercial vehicle violations or other kinds of violations associated with the particular entity.
infrastructure conditions data	Current condition of pavement, bridges, culverts, signs, and other roadway infrastructure as measured by on-board sensors or read from infrastructure-based sensors. The data may include raw data or images (e.g., photo logs) that indicate the current status of the infrastructure.
infrastructure monitoring sensor control	Data used to configure and control infrastructure monitoring sensors.
infrastructure monitoring sensor data	Data read from infrastructure-based sensors that monitor the condition of pavement, bridges, culverts, signs, and other roadway infrastructure.
intermod CVO coord	Cargo movement logs, routing information, and cargo ID's.
intermodal freight archive data	Information describing demand at intermodal freight terminals including loading/unloading activities of trailers and containers. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.
intersection blockage notification	Notification that a highway-rail intersection is obstructed and supporting information.
intersection status	Status of intersection congestion, approaching vehicles, etc.
in-vehicle transaction status	The status of an electronic payment transaction presented to the driver by in-vehicle equipment.

Architecture Flow	Flow Description
ISP coordination	Coordination and exchange of transportation information between centers. This flow allows a broad range of transportation information collected by one ISP to be redistributed to many other ISPs and their clients.
ISP operating parameter updates	Tuning and performance enhancement parameters to ISP algorithms.
ISP operating parameters	Parameters provided to the ISP Operator by the ISP including broadcast information settings, route selection controls, and travel optimization algorithms.
license request	Request supporting registration data based on license plate read during violation.
local signal preemption request	Direct control signal or message to a signalized intersection that results in preemption of the current control plan and grants right-of-way to the requesting vehicle.
local signal priority request	Request from a vehicle to a signalized intersection for priority at that intersection.
logged special vehicle route	Anticipated route information for special vehicles (e.g., oversize vehicles) or groups of vehicles (e.g., governor's motorcade) that may require changes in traffic control strategy.
maint and constr administrative information	Administrative information that is provided to support maintenance and construction operations. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.
maint and constr administrative request	Requests for maintenance and construction administrative information or services. Requests include: requests to purchasing for equipment and consumables resupply and requests to human resources that manage training and special certification for field crews and other personnel.
maint and constr archive data	Information describing road construction and maintenance activities identifying the type of activity, the work performed, and work zone information including work zone configuration and safety (e.g., a record of intrusions and vehicle speeds) information.. For construction activities, this information also includes a description of the completed infrastructure, including as-built plans as applicable. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.
maint and constr center personnel inputs	Maintenance and construction related information (e.g., routing information, scheduling data, dispatch instructions, resource allocations, incident coordination) entered by maintenance and construction center personnel.
maint and constr dispatch information	Information used to dispatch maintenance and construction vehicles, equipment, and crews. This information includes routing information, traffic information, road restrictions, incident information, environmental information, decision support information, maintenance schedule data, dispatch instructions, personnel assignments, and corrective actions.
maint and constr dispatch status	Current maintenance and construction status including work data, operator status, crew status, and equipment status.
maint and constr equipment repair status	Current maintenance and repair status of the maintenance and construction vehicle fleet and other support equipment. This information includes a record of all maintenance and repair activities performed.

Architecture Flow	Flow Description
maint and constr field personnel information presentation	Information presented to maintenance and construction field personnel including vehicle routing and traffic information, road restrictions, environmental information, decision support information, maintenance schedules, dispatch instructions, maintenance personnel assignments, vehicle maintenance information, work zone status information, and corrective actions.
maint and constr field personnel inputs	Current maintenance and construction status information provided by field personnel including work data, operator status, crew status, vehicle status, and equipment status.
maint and constr fleet information	Information supporting maintenance of the maintenance and construction vehicle fleet and other support equipment. This information includes vehicle status and diagnostic information, vehicle utilization, and coordination of when vehicles will be available for preventative and corrective maintenance.
maint and constr material information	Information on materials stored on the vehicle including quantity and current application rate.
maint and constr operations information presentation	Presentation of maintenance and construction operations information to center personnel. This information includes maintenance resource status (vehicles, equipment, and personnel), work schedule information, work status, road and weather conditions, traffic information, incident information and associated resource requests, and a range of other information that supports efficient maintenance and construction operations and planning.
maint and constr resource coordination	Request for road maintenance and construction resources that can be used in the diversion of traffic (cones, portable signs), clearance of a road hazard, repair of ancillary damage, or any other incident response.
maint and constr resource request	Request for road maintenance and construction resources that can be used in the diversion of traffic (cones, portable signs), clearance of a road hazard, repair of ancillary damage, or any other incident response.
maint and constr resource response	Current status of maintenance and construction resources including availability and deployment status.
maint and constr vehicle condition presentation	Presentation of vehicle diagnostics and operating status including speed, engine temperature, mileage, tire wear, brake wear, belt wear, maintenance and construction system status, environmental sensor information, and other measures associated with the operation of a maintenance vehicle.
maint and constr vehicle conditions	Vehicle diagnostics information that is collected, filtered, and selectively reported by a maintenance and construction vehicle. The information includes engine temperature, mileage, tire wear, brake wear, belt wear, and any warnings or alarms concerning the operational condition of the vehicle and ancillary equipment.
maint and constr vehicle control	Control data sent from on-board ITS systems to control maintenance and construction vehicle equipment, including control of materials dispersion rate and other control functions that will vary with vehicle type and application.
maint and constr vehicle location data	The current location and related status (e.g., direction and speed) of the maintenance/construction vehicle.
maint and constr vehicle measures	Raw vehicle diagnostics and operating status data reported by the maintenance vehicle platform including engine temperature, mileage, tire wear, brake wear, belt wear, and other operational status measures. In addition to this general vehicle status, this flow also includes the status of maintenance and construction-specific systems on the vehicle.

Architecture Flow	Flow Description
maint and constr vehicle operational data	Data that describes the maintenance and construction activity performed by the vehicle. Operational data includes materials usage (amount stored and current application rate), operational state of the maintenance equipment (e.g., blade up/down, spreader pattern), vehicle safety status, and other measures associated with the operation of a maintenance, construction, or other special purpose vehicle. Operational data may include basic operational status of the vehicle equipment or a more precise record of the work performed (e.g., application of crack sealant with precise locations and application characteristics).
maint and constr vehicle status coordination	Maintenance and construction vehicle status information that is shared between vehicles. This includes environmental conditions and the operational status of the vehicles.
maint and constr vehicle system control	Configure and control data that supports remote control of on-board maintenance and construction vehicle systems and field equipment that is remotely controlled by the vehicle. For example, the data can be used to adjust material application rates and spread patterns.
maint and constr work performance	Overall project status and work performance information provided to support contract administration.
maint and constr work plans	Future construction and maintenance work schedules and activities including anticipated closures with anticipated impact to the roadway, alternate routes, anticipated delays, closure times, and durations.
maintenance and repair needs	Recommended strategies and schedules for maintenance of the transportation infrastructure.
maintenance materials storage status	The amount and availability of maintenance materials in storage facilities.
maintenance status	Current maintenance status of vehicle.
map update request	Request for a map update which could include a new underlying map or map layer updates.
map updates	Map update which could include a new underlying static or real-time map or map layer(s) update.
media information request	Request from the media for current transportation information.
multimodal archive data	Operational information from alternate passenger transportation modes including air, rail transit, taxis, and ferries. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.
multimodal crossing status	Indication of operational status and pending requests for right-of-way from equipment supporting the non-highway mode at multimodal crossings.
multimodal information	Schedule information for alternate mode transportation providers such as train, ferry, air and bus.
multimodal information request	Information request for alternate mode transportation providers such as train, ferry, air and bus.
multimodal service data	Multimodal transportation schedules and other service information.
on-board safety data	Safety data measured by on-board sensors. Includes information about the vehicle, vehicle components, cargo, and driver.

Architecture Flow	Flow Description
on-board safety request	Request for on-board vehicle safety data by the roadside equipment.
on-board vehicle data	Information about the commercial vehicle stored on-board (for maintenance purposes, gate access, cargo status, lock status, etc.).
on-board vehicle request	Request for on-board vehicle data.
other data source archive data	Data extracted from other data sources. A wide range of ITS and non-ITS data and associated meta data may be provided.
parking archive data	Data used to analyze and monitor trends in parking demand, pricing, and operational actions. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.
parking availability	Current parking lot occupancy, parking availability, and cost information.
parking coordination	Information that enables parking management activities to be coordinated between different parking operators or systems in a region.
parking demand management request	Request to change the demand for parking facility use through pricing or other mechanisms.
parking demand management response	Response to parking demand management change requests indicating level of compliance with request.
parking information	General parking information and current parking availability.
parking instructions	Information that allows local parking facilities to be managed to support regional traffic management objectives.
parking lot data request	Request for parking lot occupancy, fares, and availability. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.
parking lot reservation confirmation	Confirmation for parking lot reservation.
parking operator inputs	Local parking operator inputs that query current status and control the operation of the parking management system.
parking reservations request	Reservation request for parking lot.
parking status	Parking lot operational status.
pass/pull-in	Command to commercial vehicle to pull into or bypass inspection station.
patient status	Information that supports assessment of the patient's condition. Information could include general categorization of patient status, patient vital signs, pertinent medical history, and emergency care information.
payment	Payment of some kind (e.g., toll, parking, fare) by traveler which, in most cases, can be related to a credit account.
payment request	Request for payment from financial institution.
payment violation notification	Notification to enforcement agency of a toll, parking, or transit fare payment violation.
personal transit information	General and personalized transit information for a particular fixed route, flexible route, or paratransit system.

Architecture Flow	Flow Description
physical presence	Detection of an obstacle by a vehicle. Obstacle could include animals, other vehicles, pedestrians, rocks in roadway etc.
pollutant levels	Atmospheric pollutant levels as monitored by air quality sensors.
pollution data	Measured emissions data comprised of various atmospheric pollutants.
pollution data display	Both reference and current pollution status details for a given geographic area.
pollution data parameters	Nominal pollution data compliance (reference) levels for each sector of an urban area.
pollution state data request	Aggregated emissions data information request.
position fix	Information which provides a traveler's or vehicle's geographical position.
probe data	Aggregate data from probe vehicles including location, speed for a given link or collection of links.
provider profile confirm	Confirmation of profile information received by a service provider (e.g. for a hotel or restaurant).
provider profile data	Information supplied by a service provider (e.g., a hotel or restaurant) that identifies the service provider and provides details of the service offering. This flow covers initial registration of a service provider and subsequent submittal of new information and status updates so that data currency is maintained.
railroad advisories	Real-time notification of railway-related incident or advisory.
railroad schedules	Train schedules, maintenance schedules, and other information from the railroad that supports forecast of HRI closures.
registration	Registered owner of vehicle and associated vehicle information.
remote surveillance control	The control commands used to remotely operate another center's sensors or surveillance equipment so that roadside surveillance assets can be shared by more than one agency.
request fare and price information	Requests for current fare and price information from a service provider that can be used to augment the traffic manager's overall view of current transportation network status.
request for bad tag list	Request for list of bad vehicle tag IDs.
request for enforcement	Request for traffic enforcement to address safety issues in a work zone or other special situations.
request for payment	Request to deduct cost of service from user's payment account.
request for performance data	Request issued by a service provider for current parking service performance data.
request for right-of-way	Forwarded request from signal prioritization, signal preemption, pedestrian call, multi-modal crossing activation, or other source for right-of-way.
request for road network conditions	Request for traffic information, road conditions, surface weather conditions, incident information, and other road network status. The request specifies the region/route of interest, the desired effective time period, and other parameters that allow preparation of a tailored response. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.
request for service	A traveler service request initiated by a driver or traveler. The request may result in a financial transaction, summon an emergency response, or initiate another service at the behest of the driver.

Architecture Flow	Flow Description
request for vehicle measures	Request for vehicle performance and maintenance data collected by onboard sensors.
request tag data	Request for tag information including credit identity, stored value card cash, etc.
request transit information	Request for transit service information and current transit status.
resource deployment status	Status of traffic management center resource deployment identifying the resources available and their current deployment status.
resource request	A request for traffic management resources to implement special traffic control measures, assist in clean up, verify an incident, etc.
reversible lane status	Current reversible lane status including traffic sensor and surveillance data and the operational status and mode of the reversible lane control equipment.
road data	Basic road facility and treatment information that supports road conditions forecasts.
road network conditions	Current and forecasted traffic information, road and weather conditions, incident information, and other road network status. Either raw data, processed data, or some combination of both may be provided by this architecture flow.
road network probe information	Aggregated route usage, travel times, environmental conditions, and other aggregated data collected from probe vehicles.
road weather information	Road conditions and weather information that are made available by road maintenance operations to other transportation system operators.
roadside archive data	A broad set of data derived from roadside sensors that includes current traffic conditions, environmental conditions, and any other data that can be directly collected by roadside sensors. This data also indicates the status of the sensors and reports of any identified sensor faults.
roadside transaction status	The status of an electronic payment transaction provided directly to the driver via sign or other roadside infrastructure.
roadway characteristics	Detectable or measurable road characteristics such as friction coefficient and general surface conditions, road geometry and markings, etc. These characteristics are monitored or measured by ITS sensors and used to support advanced vehicle safety and control and road maintenance capabilities.
roadway equipment coordination	The direct flow of information between field equipment. This includes transfer of information between sensors and driver information systems or control devices (traffic signals, ramp meters, etc.), direct coordination between adjacent control devices, interfaces between detection and warning or alarm systems, and any other direct communications between field equipment. Both peer-to-peer and master-slave communications between field devices are covered by this flow.
roadway information system data	Information used to initialize, configure, and control roadside systems that provide driver information (e.g., dynamic message signs, highway advisory radio, beacon systems). This flow can provide message content and delivery attributes, local message store maintenance requests, control mode commands, status queries, and all other commands and associated parameters that support remote management of these systems.
roadway information system status	Current operating status of dynamic message signs, highway advisory radios, beacon systems, or other configurable field equipment that provides dynamic information to the driver.

Architecture Flow	Flow Description
roadway maintenance status	Summary of maintenance fleet operations affecting the road network. This includes the status of winter maintenance (snow plow schedule and current status).
roadway treatment system control	Control data for remotely located, automated devices, that affect the roadway surface (e.g. de-icing applications).
roadway treatment system status	Current operational status of automated roadway treatment devices (e.g., anti-icing systems).
route assignment	Route assignment information for transit driver.
route plan	Tailored route provided by ISP in response to a specific request.
route request	Request for a tailored route based on given constraints.
safety inspection record	Record containing results of commercial vehicle safety inspection.
safety inspection report	Report containing results of commercial vehicle safety inspection. The information may be provided as a response to a real-time query or proactively by the source. The query flow is not explicitly shown.
safety inspection request	Request for safety inspection record.
safety status information	Safety information such as safety ratings, inspection summaries, and violation summaries. A unique identifier is included. Corresponds to the safety portion of CVISN "snapshots." The status information may be provided as a response to a real-time query or as a result of a standing request for updated information (subscription). This may also include information about non-U.S. fleets for use by U.S. authorities, and information regarding U.S. fleets made available to Mexican and Canadian authorities. The query flow is not explicitly shown.
safety system status	Current vehicle safety system status indicating the operating condition of these systems and the safety status of the vehicle and driver.
screening event record	Results of CVO electronic screening activity.
secure area characteristics	Characteristics (visual, audible, other) that are monitored by surveillance security systems via sensors.
secure area monitoring support	Commands that control surveillance equipment and security sensors that monitor secure public transportation areas. Also includes information for general advisories and alerts intended for general dissemination in these same public areas.
secure area surveillance data	Data collected from surveillance systems used to monitor secure areas. Includes video, audio, and other security sensor outputs.
selected routes	Routes selected based on route request criteria.
signal control data	Information used to configure and control traffic signal systems.
signal control status	Status of surface street signal controls.
speed monitoring control	Information used to configure and control automated speed monitoring, speed warning, and speed enforcement systems.
speed monitoring information	System status including current operational state and logged information including measured speeds, warning messages displayed, and violation records.
storage facility request	Request for information about the equipment and/or materials available at a maintenance storage facility.

Architecture Flow	Flow Description
suggested route	Suggested route for a dispatched emergency or maintenance vehicle that may reflect current network conditions and the additional routing options available to en route emergency or maintenance vehicles that are not available to the general public.
tag data	Unique tag ID and related vehicle information.
tag update	Update data held in tag which can be read by another roadside device (Commercial Vehicle Check Subsystem, Toll Collection Subsystem, etc.).
tax filing	Commercial vehicle tax filing data. Authorization for payment is included.
toll administration requests	Instructions indicating toll fees which should be charged.
toll archive data	Data indicating toll facility usage and pricing schedules. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.
toll coordination	This flow supports reciprocity between toll agencies/service centers by exchanging information that supports reconciliation of toll charges by customers that are enrolled with other toll service centers. In addition to toll charge reconciliation, exchanged information may include toll schedule information, customer information and other toll service information that is coordinated between toll agencies or centers.
toll data	Current toll schedules for different types of vehicles as well as advanced toll payment information.
toll data request	Request made to obtain toll schedule information or pay a toll in advance. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.
toll demand management request	Request to change the demand for toll road facility use through pricing or other mechanisms.
toll demand management response	Response to toll demand management change requests indicating level of compliance with request.
toll instructions	Demand management toll pricing information based on current congestion.
toll operator requests	Request for information from toll operator at toll collection site.
toll revenues and summary reports	Summary of toll revenues and toll-related reports to toll service provider.
toll transaction reports	Summary report sent to toll collection point operator containing previous toll transactions.
toll transactions	Detailed list of transactions from a toll station.
track status	Current status of the wayside equipment and notification of an arriving train.
traffic archive data	Information describing the use and vehicle composition on transportation facilities and the traffic control strategies employed. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.
traffic characteristics	Physical traffic characteristics which are monitored and translated into macroscopic measures like occupancy, volume, density, and average speed. Point measures support presence detection and individual vehicle measures like speed.

Architecture Flow	Flow Description
traffic control coordination	Information transfers that enable remote monitoring and control of traffic management devices. This flow is intended to allow cooperative access to, and control of, field equipment during incidents and special events and during day-to-day operations. This flow also allows 24-hour centers to monitor and control assets of other centers during off-hours, allows system redundancies and fail-over capabilities to be established, and otherwise enables integrated traffic control strategies in a region.
traffic control priority request	Request for signal priority at one or more intersections along a particular route.
traffic control priority status	Status of signal priority request functions at the roadside (e.g. enabled or disabled).
traffic flow	Raw and/or processed traffic detector data which allows derivation of traffic flow variables (e.g., speed, volume, and density measures) and associated information (e.g., congestion, potential incidents).
traffic images	High fidelity, real-time traffic images suitable for surveillance monitoring by the operator or for use in machine vision applications. This flow includes the images and the operational status of the surveillance system.
traffic information coordination	Traffic information exchanged between TMC's. Normally would include incidents, congestion data, traffic data, signal timing plans, and real-time signal control information.
traffic operator data	Presentation of traffic operations data to the operator including traffic conditions, current operating status of traffic control equipment, maintenance activity status, incident status, and other information. This data keeps the operator appraised of current road network status, provides feedback to the operator as traffic control actions are implemented, and supports review of historical data and preparation for future traffic operations activities.
traffic operator inputs	Traffic operations requests for information, configuration changes, commands to adjust current traffic control strategies (e.g., adjust signal timing plans, change DMS messages), and other traffic operations data entry.
traffic sensor control	Information used to configure and control traffic sensor systems.
traffic violation notification	Notification to enforcement agency of a detected traffic violation including speed violations, HOV passenger occupancy violations, and vehicle emissions violations.
transaction status	Response to transaction request. Normally dealing with a request for payment.
transit and fare schedules	Specific transit and fare schedule information including schedule adherence.
transit archive data	Data used to describe and monitor transit demand, fares, operations, and system performance. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.
transit demand management request	Request to change the demand for transit facility use through pricing or other mechanisms.
transit demand management response	Response to transit demand management change requests indicating level of compliance with request.
transit driver availability	Transit driver availability data that can be used to develop driver assignments and detailed operations schedules.

Architecture Flow	Flow Description
transit driver display	Display (either video or audio) to transit driver containing status of various ITS services.
transit driver inputs	Transit driver emergency request as well as fare transaction data.
transit emergency coordination data	Data exchanged between centers dealing with a transit-related incident.
transit emergency data	Initial notification of transit emergency at a transit stop or on transit vehicles and further coordination as additional details become available and the response is coordinated.
transit fare payment requests	Information provided from the transit user location that supports fare payments and associated record-keeping.
transit fare payment responses	Information provided by transit management that supports a fare payment transaction.
transit fleet manager inputs	Instructions governing service availability, schedules, emergency response plans, transit personnel assignments, transit maintenance requirements, and other inputs that establish general system operating requirements and procedures.
transit incident information	Information on transit incidents that impact transit services for public dissemination.
transit incidents for media	Report of an incident impacting transit operations for public dissemination through the media.
transit information for media	Report of transit schedule deviations for public dissemination through the media.
transit information request	Request for transit operations information including schedule and fare information. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.
transit information user request	Request for special transit routing, real-time schedule information, and availability information.
transit multimodal information	Transit schedule information for coordination at modal interchange points.
transit operations planning data	Accumulated schedule and fare information, emergency response plans, transit personnel information, maintenance records, and other information intended to support overall planning and management of a transit property.
transit operator display	Display for transit operations personnel regarding performance of the transit fleet, current ridership and on-time performance.
transit operator management data	Information and control provided by transit system operators involving many aspects of managing transit operations.
transit parking coordination	Request for coordinated fare payment and parking lot price data.
transit parking lot response	Response to transit occupancy inquiries and coordination with parking lots.
transit request confirmation	Confirmation of a request for transit information or service.
transit schedule information	Current and projected transit schedule adherence.

Architecture Flow	Flow Description
transit system data	Current transit system operations information indicating current transit routes, the level of service on each route, and the progress of individual vehicles along their routes for use in forecasting demand and estimating current transportation network performance.
transit traveler information	Transit information prepared to support transit users and other travelers. It contains transit schedules, real-time arrival information, fare schedules, and general transit service information.
transit traveler request	Request by a Transit traveler to summon assistance, request transit information, or request any other transit services.
transit user fare status	Status of fare transaction for transit user.
transit user inputs	Requests from transit user through either an on-board or fixed location traveler information station.
transit user outputs	Information for traveler from either an on-board or fixed location traveler information station.
transit vehicle conditions	Operating conditions of transit vehicle (e.g., mileage).
transit vehicle location data	Current transit vehicle location and related operational conditions data provided by a transit vehicle.
transit vehicle measures	Transit vehicle status measured by on-board ITS equipment.
transit vehicle passenger and use data	Data collected on board the transit vehicle pertaining to availability and/or passenger count.
transit vehicle schedule performance	Estimated times of arrival and anticipated schedule deviations reported by a transit vehicle.
transit work schedule	Orders for maintenance of transit vehicle or other transit system equipment.
transportation border clearance assessment	Notification regarding the granting of permission for commercial freight shipment to enter the U.S. Includes directions for commercial driver to proceed to nearest vehicle weigh and inspection station for further review if required.
transportation weather information	Current and forecast road conditions and weather information (e.g., surface condition, flooding, wind advisories, visibility, etc.) associated with the transportation network. This information is of a resolution, timeliness, and accuracy to be useful in transportation decision making.
transportation weather information request	A request for transportation weather information that may specify the area of interest (a geographic region, particular routes within a region, specific road segments), the type of information that is required, the desired spatial resolution of the information, and time horizon.
travel service info	Reservation information or yellow pages data.
travel service request	Request for reservation or other service (e.g., yellow pages).
traveler advisory request	In vehicle communication between transit and vehicle systems includes advisories and advance payment deductions.

Architecture Flow	Flow Description
traveler archive data	Data associated with traveler information services including service requests, facility usage, rideshare, routing, and traveler payment transaction data. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.
traveler card information	The traveler personal information such as name, address, license number, and trip records and profile data.
traveler card update	Information updated concerning traveler's personal data including items such as address, trip records, and profile data.
traveler information	Traveler information comprised of traffic status, advisories, incidents, payment information and many other travel-related data updates and confirmations.
traveler information for media	General traveler information regarding incidents, unusual traffic conditions, transit issues, or other advisory information that has been desensitized and provided to the media.
traveler inputs	Request by a traveler to summon assistance, request travel information, make a reservation, or request any other traveler service.
traveler interface updates	Visual or audio information (e.g., routes, messages, guidance) to the traveler.
traveler profile	Information about a traveler including equipment capabilities, personal preferences and recurring trip characteristics.
traveler request	Request by a traveler to summon assistance, request information, make a reservation, or initiate any other traveler service.
trip confirmation	Acknowledgement by the driver/traveler of acceptance of a route.
trip declaration identifiers	Specific identifiers extracted from notification containing information regarding pending commercial freight shipment into the U.S. includes carrier, vehicle, and driver identification data.
trip identification number	The unique trip load number for a specific cross-border shipment.
trip log	Driver's daily log, vehicle location, mileage, and trip activity (includes screening, inspection and border clearance event data as well as fare payments).
trip log information	Information entered into the trip log, or request for update.
trip log request	Request for trip log.
trip plan	A sequence of links and special instructions comprising of a trip plan indicating efficient routes for navigating the links. Normally coordinated with traffic conditions, other incidents, preemption and prioritization plans.
trip request	Request by a driver/traveler for special routing.
TRMS coord	Coordination information between local/regional transit organizations including schedule, on-time information, incident information, and ridership.
vehicle characteristics	The physical or visible characteristics of an individual vehicle that can be measured to classify a vehicle and imaged to uniquely identify a vehicle.
vehicle control	Vehicular control commands
vehicle location	Location of vehicle and other vehicle characteristics which are exchanged between vehicle subsystems.
vehicle pollution criteria	Vehicular pollution acceptance criteria.
vehicle probe data	Vehicle probe data indicating identity, route segment identity, link time and location.

Architecture Flow	Flow Description
vehicle signage data	In-vehicle signage data generated by the roadway infrastructure indicating either road conditions, street names, or special information.
vehicle to vehicle coordination	Any type of advanced vehicle to vehicle communication.
video surveillance control	Information used to configure and control video surveillance systems.
violation notification	Notification to enforcement agency of a violation. The violation notification flow describes the statute or regulation that was violated and how it was violated (e. g., overweight on specific axle by xxx pounds or which brake was out of adjustment and how far out of adjustment it was). A violation differs from a citation because it is not adjudicated by the courts.
weather information	Accumulated forecasted and current weather data (e.g., temperature, pressure, wind speed, wind direction, humidity, precipitation, visibility, light conditions, etc.).
widearea statistical pollution information	Aggregated region-wide measured emissions data and possible pollution incident information.
work plan coordination	Coordination of work plan schedules and activities between maintenance and construction organizations or systems. This information includes the work plan schedules and comments and suggested changes that are exchanged as work plans are coordinated and finalized.
work plan feedback	Comments and suggested changes to proposed construction and maintenance work schedules and activities. This information influences work plan schedules so that they minimize impact to other system operations and the overall transportation system.
work zone information	Summary of maintenance and construction work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.
work zone status	Current work zone status including current location (and future locations for moving work zones), impact to the roadway, required lane shifts, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits.
work zone warning	Warning of a work zone emergency or safety issue such as the intrusion of a vehicle into the work zone area or movement of field crew into the travel lanes.
work zone warning device control	Data used to configure and control work zone safety monitoring and warning devices.
work zone warning notification	Notification of a work zone emergency or safety issue. This flow identifies that a work zone emergency or safety issue has occurred so that warnings may be generated by more than one system in the work zone.
work zone warning status	Status of a work zone safety monitoring and warning devices. This flow documents system activations and includes additional supporting information (e.g., an image) that allows verification of the alarm.
yellow pages information	Travel service information covering tourist attractions, lodging, restaurants, service stations, emergency services, and other services and businesses of interest to the traveler.
yellow pages request	Request for information through a yellow pages type service.

2.4 Archived Data Management

The Archived Data Management Subsystem collects, archives, manages, and distributes data generated from ITS sources for use in transportation administration, policy evaluation, safety, planning, performance monitoring, program assessment, operations, and research applications. The data received is formatted, tagged with attributes that define the data source, conditions under which it was collected, data transformations, and other information (i.e. meta data) necessary to interpret the data. The subsystem can fuse ITS generated data with data from non-ITS sources and other archives to generate information products utilizing data from multiple functional areas, modes, and jurisdictions. The subsystem prepares data products that can serve as inputs to Federal, State, and local data reporting systems. This subsystem may be implemented in many different ways. It may reside within an operational center and provide focused access to a particular agency's data archives. Alternatively, it may operate as a distinct center that collects data from multiple agencies and sources and provides a general data warehouse service for a region.

2.4.1 Subsystem Equipment Packages and Process Specifications for ADMS

Government Reporting Systems Support

This equipment package selects and formats data residing in an ITS archive to facilitate local, state, and federal government data reporting requirements.

Process Specifications

8.8 Prepare Government Reporting Inputs

ITS Data Repository

This equipment package collects data and data catalogs from one or more data sources and stores the data in a focused repository that is suited to a particular set of ITS data users. This equipment package includes capabilities for performing quality checks on the incoming data, error notification, and archive to archive coordination. This equipment package supports a broad range of implementations, ranging from simple data marts that collect a focused set of data and serve a particular user community to large-scale data warehouses that collect, integrate, and summarize transportation data from multiple sources and serve a broad array of users within a region.

Process Specifications

8.1 Get Archive Data

8.2 Manage Archive

8.3 Manage Archive Data Administrator Interface

8.5 Process Archived Data User System Requests

8.7 Process On Demand Archive Requests

On-Line Analysis and Mining
This equipment package provides advanced data analysis, summarization, and mining features that facilitate discovery of information, patterns, and correlations in large data sets. Multidimensional analysis, selective summarization and expansion of data details, and many other advanced analysis services may be offered by various implementations of this equipment package.

Process Specifications
8.6 Analyze Archive

Traffic and Roadside Data Archival
This equipment package collects and archives traffic, roadway, and environmental information for use in off-line planning, research, and analysis. The equipment package controls and collects information directly from equipment at the roadside, reflecting the deployment of traffic detectors that are used primarily for traffic monitoring and planning purposes rather than for traffic management.

Process Specifications
8.9 Manage Roadside Data Collection

Virtual Data Warehouse Services
This equipment package provides capabilities to access "in-place" data from geographically dispersed archives and coordinate information exchange with a local data warehouse. While many of the functions performed by this equipment package are similar to the functions inherent in other archived data management subsystem equipment packages (e.g. data management, fusion, analysis) this equipment package also provides the specialized publishing, directory services, and transaction management functions associated with coordinating remote archives. In addition, this equipment package performs functions on an as-needed basis, thereby negating the need to maintain the comprehensive set of data from the remote archives in the local data warehouse.

Process Specifications
8.4 Coordinate Archives

2.4.2 Subsystem Interfaces for ADMS

Archived Data Administrator -> Archived Data Management Subsystem

Physical Architecture Flow Name: archive management requests

Commands, requests, and queries that support the administration and management of an ITS data archive.

Logical Architecture Reference Flow(s):
fada_archive_administration_requests

Archived Data Management Subsystem -> Archived Data Administrator

Physical Architecture Flow Name: archive management data

Information used to support the management of an ITS archive including database reports on the condition and quality of the archived data, status of the import and collection process, reports that monitor archive usage, and any special requests that require direct action by the administrator (e.g., requests for access to new data sources).

Logical Architecture Reference Flow(s):
tada_archive_administration_data

Archived Data Management Subsystem -> Archived Data User Systems

Physical Architecture Flow Name: archive analysis results

Processed information products, supporting meta data, and any associated transaction information resulting from data mining, analytical processing, aggregation or summarization, report formulation, or other on-line processing and analysis of archived data.

Logical Architecture Reference Flow(s):
tadu_archive_analysis_results

Physical Architecture Flow Name: archive request confirmation

Confirmation that an archive request has been received and processed with information on the disposition of the request.

Logical Architecture Reference Flow(s):
tadu_on_demand_confirmation

Physical Architecture Flow Name: archived data products

Raw or processed data, meta data, data catalogs and other data products provided to a user system upon request. The response may also include any associated transaction information.

Logical Architecture Reference Flow(s):
tadu_archive_data_product

Archived Data Management Subsystem -> Asset Management

Physical Architecture Flow Name: archive requests

A request to a data source for information on available data (i.e. "catalog") or a request that defines the data to be archived. The request can be a general subscription intended to initiate a continuous or regular data stream or a specific request intended to initiate a one-time response from the recipient.

Logical Architecture Reference Flow(s):
tam_archive_request

Physical Architecture Flow Name: archive status

Notification that data provided to an archive contains erroneous, missing, or suspicious data or verification that the data provided appears valid. If an error has been detected, the offending data and the nature of the potential problem are identified.

Logical Architecture Reference Flow(s):
tam_asset_archive_status

Archived Data Management Subsystem -> Commercial Vehicle Administration

Physical Architecture Flow Name: archive requests

A request to a data source for information on available data (i.e. "catalog") or a request that defines

the data to be archived. The request can be a general subscription intended to initiate a continuous or regular data stream or a specific request intended to initiate a one-time response from the recipient.

Logical Architecture Reference Flow(s):

cv_archive_request

Physical Architecture Flow Name: archive status

Notification that data provided to an archive contains erroneous, missing, or suspicious data or verification that the data provided appears valid. If an error has been detected, the offending data and the nature of the potential problem are identified.

Logical Architecture Reference Flow(s):

cv_archive_status

Archived Data Management Subsystem -> Emergency Management

Physical Architecture Flow Name: archive requests

A request to a data source for information on available data (i.e. "catalog") or a request that defines the data to be archived. The request can be a general subscription intended to initiate a continuous or regular data stream or a specific request intended to initiate a one-time response from the recipient.

Logical Architecture Reference Flow(s):

em_archive_request

Physical Architecture Flow Name: archive status

Notification that data provided to an archive contains erroneous, missing, or suspicious data or verification that the data provided appears valid. If an error has been detected, the offending data and the nature of the potential problem are identified.

Logical Architecture Reference Flow(s):

em_archive_status

Archived Data Management Subsystem -> Emissions Management

Physical Architecture Flow Name: archive requests

A request to a data source for information on available data (i.e. "catalog") or a request that defines the data to be archived. The request can be a general subscription intended to initiate a continuous or regular data stream or a specific request intended to initiate a one-time response from the recipient.

Logical Architecture Reference Flow(s):

emissions_archive_request

Physical Architecture Flow Name: archive status

Notification that data provided to an archive contains erroneous, missing, or suspicious data or verification that the data provided appears valid. If an error has been detected, the offending data and the nature of the potential problem are identified.

Logical Architecture Reference Flow(s):

emissions_archive_status

Archived Data Management Subsystem -> Financial Institution

Physical Architecture Flow Name: payment request

Request for payment from financial institution.

Logical Architecture Reference Flow(s):

tfi_archive_analysis_payment_request
tfi_archive_payment_request

Archived Data Management Subsystem -> Government Reporting Systems

Physical Architecture Flow Name: government reporting system data

Information provided by an ITS archive, formatted as appropriate, that can be used as input to government data reporting systems.

Logical Architecture Reference Flow(s):

tgrs_government_data_report_input

Archived Data Management Subsystem -> Information Service Provider

Physical Architecture Flow Name: archive requests

A request to a data source for information on available data (i.e. "catalog") or a request that defines the data to be archived. The request can be a general subscription intended to initiate a continuous or regular data stream or a specific request intended to initiate a one-time response from the recipient.

Logical Architecture Reference Flow(s):

traveler_archive_request

Physical Architecture Flow Name: archive status

Notification that data provided to an archive contains erroneous, missing, or suspicious data or verification that the data provided appears valid. If an error has been detected, the offending data and the nature of the potential problem are identified.

Logical Architecture Reference Flow(s):

traveler_archive_status

Archived Data Management Subsystem -> Intermodal Freight Depot

Physical Architecture Flow Name: archive requests

A request to a data source for information on available data (i.e. "catalog") or a request that defines the data to be archived. The request can be a general subscription intended to initiate a continuous or regular data stream or a specific request intended to initiate a one-time response from the recipient.

Logical Architecture Reference Flow(s):

tifd_intermodal_archive_request

Physical Architecture Flow Name: archive status

Notification that data provided to an archive contains erroneous, missing, or suspicious data or verification that the data provided appears valid. If an error has been detected, the offending data and the nature of the potential problem are identified.

Logical Architecture Reference Flow(s):

tifd_intermodal_archive_status

Archived Data Management Subsystem -> Maintenance and Construction Management

Physical Architecture Flow Name: archive requests

A request to a data source for information on available data (i.e. "catalog") or a request that defines the data to be archived. The request can be a general subscription intended to initiate a continuous or regular data stream or a specific request intended to initiate a one-time response from the recipient.

Logical Architecture Reference Flow(s):

m_and_c_archive_request

Physical Architecture Flow Name: archive status

Notification that data provided to an archive contains erroneous, missing, or suspicious data or verification that the data provided appears valid. If an error has been detected, the offending data and the nature of the potential problem are identified.

Logical Architecture Reference Flow(s):

m_and_c_archive_status

Archived Data Management Subsystem -> Map Update Provider

Physical Architecture Flow Name: map update request

Request for a map update which could include a new underlying map or map layer updates.

Logical Architecture Reference Flow(s):

tmup_map_archive_status
tmup_map_archive_request

Archived Data Management Subsystem -> Multimodal Transportation Service Provider

Physical Architecture Flow Name: archive requests

A request to a data source for information on available data (i.e. "catalog") or a request that defines the data to be archived. The request can be a general subscription intended to initiate a continuous or regular data stream or a specific request intended to initiate a one-time response from the recipient.

Logical Architecture Reference Flow(s):

tmtsp_multimodal_archive_request

Physical Architecture Flow Name: archive status

Notification that data provided to an archive contains erroneous, missing, or suspicious data or verification that the data provided appears valid. If an error has been detected, the offending data and the nature of the potential problem are identified.

Logical Architecture Reference Flow(s):
tmtsp_multimodal_archive_status

Archived Data Management Subsystem -> Other Archives

Physical Architecture Flow Name: archive coordination

Catalog data, meta data, published data, and other information exchanged between archives to support data synchronization and satisfy user data requests.

Logical Architecture Reference Flow(s):
toa_archive_coordination_data

Archived Data Management Subsystem -> Other Data Sources

Physical Architecture Flow Name: archive requests

A request to a data source for information on available data (i.e. "catalog") or a request that defines the data to be archived. The request can be a general subscription intended to initiate a continuous or regular data stream or a specific request intended to initiate a one-time response from the recipient.

Logical Architecture Reference Flow(s):
tods_other_data_source_archive_request

Physical Architecture Flow Name: archive status

Notification that data provided to an archive contains erroneous, missing, or suspicious data or verification that the data provided appears valid. If an error has been detected, the offending data and the nature of the potential problem are identified.

Logical Architecture Reference Flow(s):
tods_other_data_source_archive_status

Archived Data Management Subsystem -> Parking Management

Physical Architecture Flow Name: archive requests

A request to a data source for information on available data (i.e. "catalog") or a request that defines the data to be archived. The request can be a general subscription intended to initiate a continuous or regular data stream or a specific request intended to initiate a one-time response from the recipient.

Logical Architecture Reference Flow(s):
parking_archive_request

Physical Architecture Flow Name: archive status

Notification that data provided to an archive contains erroneous, missing, or suspicious data or verification that the data provided appears valid. If an error has been detected, the offending data and the nature of the potential problem are identified.

Logical Architecture Reference Flow(s):
parking_archive_status

Archived Data Management Subsystem -> Roadway Subsystem

Physical Architecture Flow Name: data collection and monitoring control

Information used to configure and control data collection and monitoring systems.

Logical Architecture Reference Flow(s):
roadside_archive_control

Archived Data Management Subsystem -> Surface Transportation Weather Service

Physical Architecture Flow Name: archive requests

A request to a data source for information on available data (i.e. "catalog") or a request that defines the data to be archived. The request can be a general subscription intended to initiate a continuous or regular data stream or a specific request intended to initiate a one-time response from the recipient.

Logical Architecture Reference Flow(s):
tstws_archive_request

Physical Architecture Flow Name: archive status

Notification that data provided to an archive contains erroneous, missing, or suspicious data or verification that the data provided appears valid. If an error has been detected, the offending data and the nature of the potential problem are identified.

Logical Architecture Reference Flow(s):
tstws_trans_weather_archive_status

Archived Data Management Subsystem -> Toll Administration

Physical Architecture Flow Name: archive requests

A request to a data source for information on available data (i.e. "catalog") or a request that defines the data to be archived. The request can be a general subscription intended to initiate a continuous or regular data stream or a specific request intended to initiate a one-time response from the recipient.

Logical Architecture Reference Flow(s):
toll_archive_request

Physical Architecture Flow Name: archive status

Notification that data provided to an archive contains erroneous, missing, or suspicious data or verification that the data provided appears valid. If an error has been detected, the offending data and the nature of the potential problem are identified.

Logical Architecture Reference Flow(s):
toll_archive_status

Archived Data Management Subsystem -> **Traffic Management**

Physical Architecture Flow Name: archive requests

A request to a data source for information on available data (i.e. "catalog") or a request that defines the data to be archived. The request can be a general subscription intended to initiate a continuous or regular data stream or a specific request intended to initiate a one-time response from the recipient.

Logical Architecture Reference Flow(s):

traffic_management_archive_request

Physical Architecture Flow Name: archive status

Notification that data provided to an archive contains erroneous, missing, or suspicious data or verification that the data provided appears valid. If an error has been detected, the offending data and the nature of the potential problem are identified.

Logical Architecture Reference Flow(s):

traffic_management_archive_status

Archived Data Management Subsystem -> **Transit Management**

Physical Architecture Flow Name: archive requests

A request to a data source for information on available data (i.e. "catalog") or a request that defines the data to be archived. The request can be a general subscription intended to initiate a continuous or regular data stream or a specific request intended to initiate a one-time response from the recipient.

Logical Architecture Reference Flow(s):

transit_archive_request

Physical Architecture Flow Name: archive status

Notification that data provided to an archive contains erroneous, missing, or suspicious data or verification that the data provided appears valid. If an error has been detected, the offending data and the nature of the potential problem are identified.

Logical Architecture Reference Flow(s):

transit_archive_status

Archived Data Management Subsystem -> **Weather Service**

Physical Architecture Flow Name: archive requests

A request to a data source for information on available data (i.e. "catalog") or a request that defines the data to be archived. The request can be a general subscription intended to initiate a continuous or regular data stream or a specific request intended to initiate a one-time response from the recipient.

Logical Architecture Reference Flow(s):

tws_weather_archive_request

Physical Architecture Flow Name: archive status

Notification that data provided to an archive contains erroneous, missing, or suspicious data or verification that the data provided appears valid. If an error has been detected, the offending data and the nature of the potential problem are identified.

Logical Architecture Reference Flow(s):

tws_weather_archive_status

Archived Data User Systems -> **Archived Data Management Subsystem**

Physical Architecture Flow Name: archive analysis requests

A user request that initiates data mining, analytical processing, aggregation or summarization, report formulation, or other advanced processing and analysis of archived data. The request also includes information that is used to identify and authenticate the user and support electronic payment requirements, if any.

Logical Architecture Reference Flow(s):

fadu_on_demand_archive_request
fadu_archive_analysis_request

Physical Architecture Flow Name: archived data product requests

A user-specified request for archived data products (i.e. data, meta data, or data catalogs). The request also includes information that is used to identify and authenticate the user and support electronic payment requirements, if any.

Logical Architecture Reference Flow(s):

fadu_archive_data_product_request

Asset Management -> **Archived Data Management Subsystem**

Physical Architecture Flow Name: asset archive data

Information describing transportation assets including pavements, bridges, and all other infrastructure included in the transportation network. In addition, information can cover support assets (support equipment and systems, software, etc.). Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.

Logical Architecture Reference Flow(s):

fam_asset_archive_data

Commercial Vehicle Administration -> **Archived Data Management Subsystem**

Physical Architecture Flow Name: commercial vehicle archive data

Information describing commercial vehicle travel and commodity flow characteristics. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.

Logical Architecture Reference Flow(s):

cv_archive_data

Emergency Management -> **Archived Data Management Subsystem**

Physical Architecture Flow Name: emergency archive data

Logged incident information that characterizes the identified incidents and provides a record of the corresponding incident response. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.

Logical Architecture Reference Flow(s):

em_archive_data

Emissions Management -> **Archived Data Management Subsystem**

Physical Architecture Flow Name: emissions archive data

Air quality and vehicle emissions information that is collected by sensors or derived from models. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.

Logical Architecture Reference Flow(s):

emissions_archive_data

Financial Institution -> **Archived Data Management Subsystem**

Physical Architecture Flow Name: transaction status

Response to transaction request. Normally dealing with a request for payment.

Logical Architecture Reference Flow(s):

ffi_archive_analysis_payment_confirm
ffi_archive_payment_confirm

Government Reporting Systems -> **Archived Data Management Subsystem**

Physical Architecture Flow Name: government reporting data receipt

The acknowledgement of satisfactory receipt of information used as input to government data systems or a report identifying problems or issues with the data submittal.

Logical Architecture Reference Flow(s): fgrs_government_data_report_request

Information Service Provider -> **Archived Data Management Subsystem**

Physical Architecture Flow Name: traveler archive data

Data associated with traveler information services including service requests, facility usage, rideshare, routing, and traveler payment transaction data. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.

Logical Architecture Reference Flow(s):
traveler_archive_data

Intermodal Freight Depot -> **Archived Data Management Subsystem**

Physical Architecture Flow Name: intermodal freight archive data

Information describing demand at intermodal freight terminals including loading/unloading activities of trailers and containers. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.

Logical Architecture Reference Flow(s):
fifd_intermodal_archive_data

Maintenance and Construction Management -> **Archived Data Management Subsystem**

Physical Architecture Flow Name: maint and constr archive data

Information describing road construction and maintenance activities identifying the type of activity, the work performed, and work zone information including work zone configuration and safety (e.g., a record of intrusions and vehicle speeds) information.. For construction activities, this information also includes a description of the completed infrastructure, including as-built plans as applicable. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.

Logical Architecture Reference Flow(s):
m_and_c_archive_data

Map Update Provider -> **Archived Data Management Subsystem**

Physical Architecture Flow Name: map updates

Map update which could include a new underlying static or real-time map or map layer(s) update.

Logical Architecture Reference Flow(s):
fmup_map_archive_data

Multimodal Transportation Service Provider -> **Archived Data Management Subsystem**

Physical Architecture Flow Name: multimodal archive data

Operational information from alternate passenger transportation modes including air, rail transit, taxis, and ferries. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.

Logical Architecture Reference Flow(s):
fmtsp_multimodal_archive_data

Other Archives -> **Archived Data Management Subsystem**

Physical Architecture Flow Name: archive coordination

Catalog data, meta data, published data, and other information exchanged between archives to support data synchronization and satisfy user data requests.

Logical Architecture Reference Flow(s):
foa_archive_coordination_data

Other Data Sources -> **Archived Data Management Subsystem**

Physical Architecture Flow Name: other data source archive data

Data extracted from other data sources. A wide range of ITS and non-ITS data and associated meta data may be provided.

Logical Architecture Reference Flow(s):
fods_other_data_source_archive_data

Parking Management -> **Archived Data Management Subsystem**

Physical Architecture Flow Name: parking archive data

Data used to analyze and monitor trends in parking demand, pricing, and operational actions. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.

Logical Architecture Reference Flow(s):
parking_archive_data

Roadway Subsystem -> **Archived Data Management Subsystem**

Physical Architecture Flow Name: roadside archive data

A broad set of data derived from roadside sensors that includes current traffic conditions, environmental conditions, and any other data that can be directly collected by roadside sensors. This data also indicates the status of the sensors and reports of any identified sensor faults.

Logical Architecture Reference Flow(s):
roadside_archive_data

Surface Transportation Weather Service -> **Archived Data Management Subsystem**

Physical Architecture Flow Name: transportation weather information

Current and forecast road conditions and weather information (e.g., surface condition, flooding, wind advisories, visibility, etc.) associated with the transportation network. This information is of a resolution, timeliness, and accuracy to be useful in transportation decision making.

Logical Architecture Reference Flow(s):
fstws_trans_weather_archive_data

Toll Administration -> **Archived Data Management**

Subsystem

Physical Architecture Flow Name: toll archive data

Data indicating toll facility usage and pricing schedules. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.

Logical Architecture Reference Flow(s):
toll_archive_data

Traffic Management -> **Archived Data Management Subsystem**

Physical Architecture Flow Name: traffic archive data

Information describing the use and vehicle composition on transportation facilities and the traffic control strategies employed. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.

Logical Architecture Reference Flow(s):
traffic_management_archive_data

Transit Management -> **Archived Data Management Subsystem**

Physical Architecture Flow Name: transit archive data

Data used to describe and monitor transit demand, fares, operations, and system performance. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.

Logical Architecture Reference Flow(s):
transit_archive_data

Weather Service -> **Archived Data Management Subsystem**

Physical Architecture Flow Name: weather information

Accumulated forecasted and current weather data (e.g., temperature, pressure, wind speed, wind direction, humidity, precipitation, visibility, light conditions, etc.).

Logical Architecture Reference Flow(s):
fws_weather_archive_data

2.4.3 Architecture Flow Diagrams for ADMS

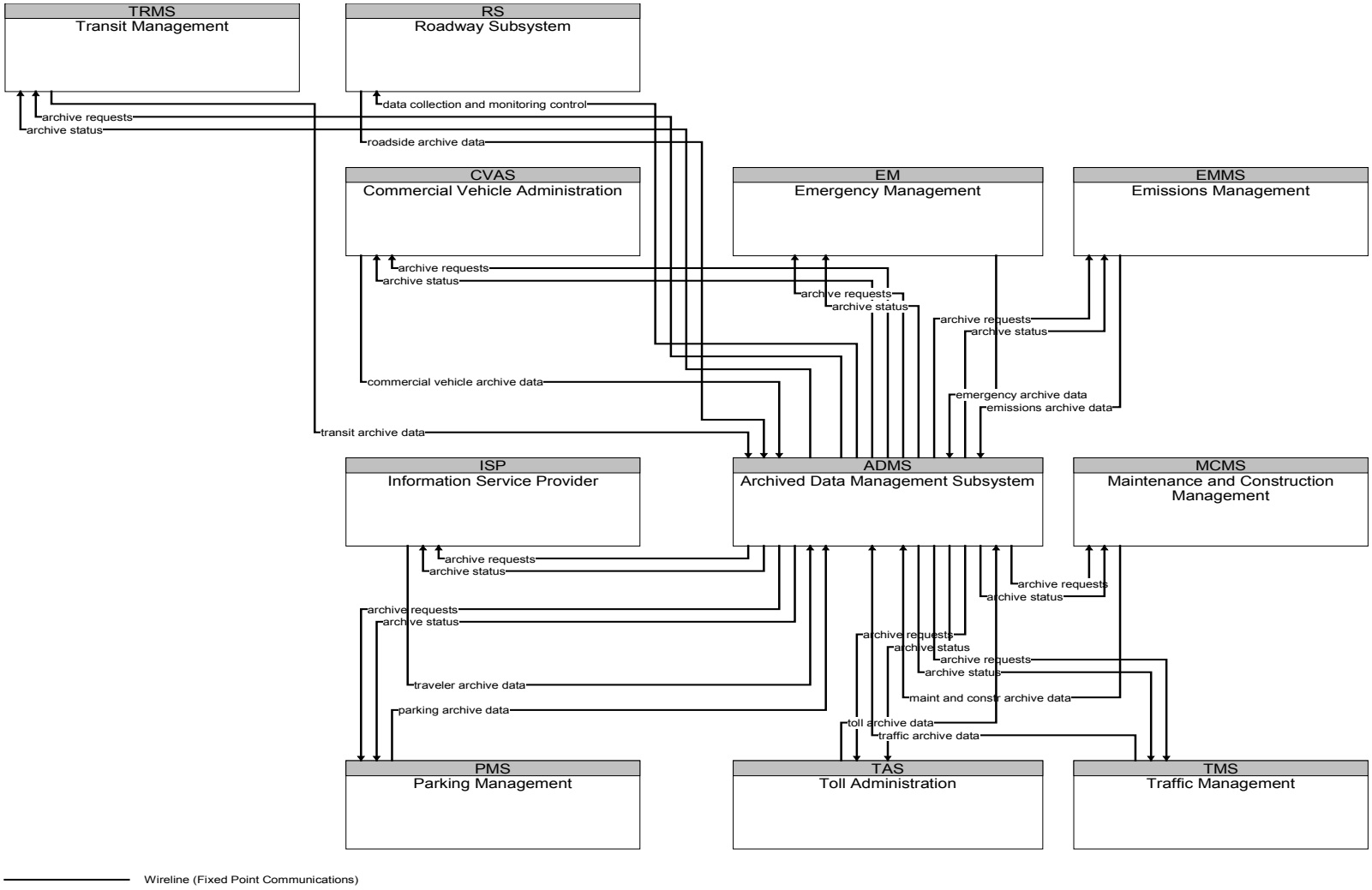


Figure 2-5 Subsystem Architecture Flow Diagram for ADMS

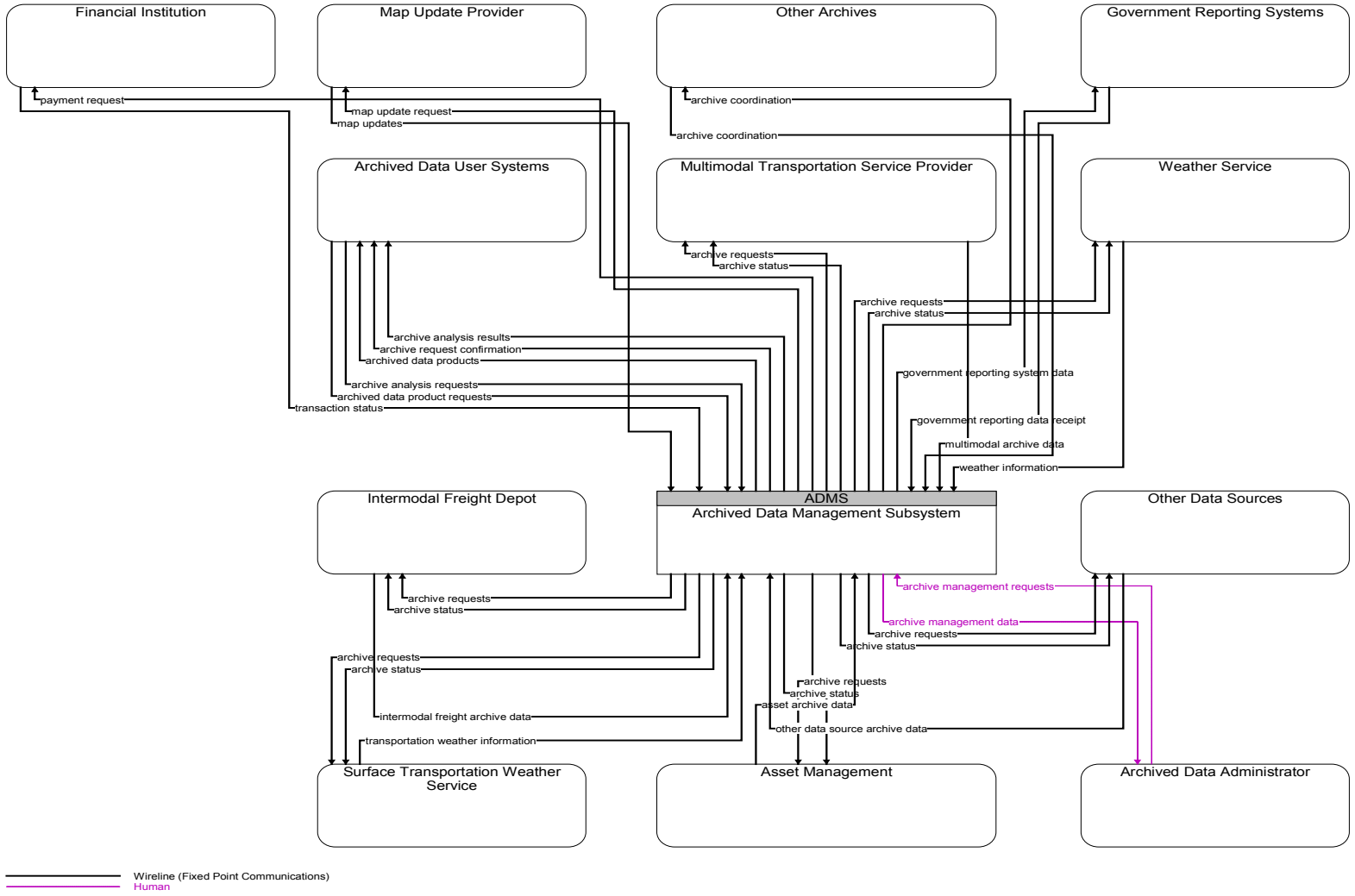


Figure 2-6 Terminator Architecture Flow Diagram for ADMS

2.5 Commercial Vehicle Administration

The Commercial Vehicle Administration Subsystem will operate at one or more fixed locations within a region. This subsystem performs administrative functions supporting credentials, tax, and safety regulations. It issues credentials, collects fees and taxes, and supports enforcement of credential requirements. This subsystem communicates with the Fleet Management Subsystems associated with the motor carriers to process credentials applications and collect fuel taxes, weight/distance taxes, and other taxes and fees associated with commercial vehicle operations. The subsystem also receives applications for, and issues special Oversize/Overweight and HAZMAT permits in coordination with other cognizant authorities. The subsystem coordinates with other Commercial Vehicle Administration Subsystems (in other states/regions) to support nationwide access to credentials and safety information for administration and enforcement functions. This subsystem supports communications with Commercial Vehicle Check Subsystems operating at the roadside to enable credential checking and safety information collection. The collected safety information is processed, stored, and made available to qualified stakeholders to identify carriers and drivers that operate unsafely.

2.5.1 Subsystem Equipment Packages and Process Specifications for CVAS

Credentials and Taxes Administration
This Equipment package provides administrative capabilities for commercial vehicle operations including database management and administrator-to-roadside and administrator-to-administrator interfaces. For example, this Equipment package would manage the electronic credentials database for a state, perform reconciliation of mileage and fuel taxes (possibly post trip), and interface with roadsides performing credential checks. This equipment package communicates with similar packages in other CVAS locations to exchange credentials database information. Example locations would be state agency or regional offices that are involved with commercial vehicle operations.

Process Specifications

2.5.1 Manage Commercial Vehicle Trips and Clearances

2.5.10 Manage CV Database Store

2.5.2 Obtain Electronic Credential and Tax Filing Payment

2.5.4 Communicate with Other Commercial Vehicle Administration System

2.5.5 Manage Commercial Vehicle Credentials and Enrollment

2.5.6 Output Commercial Vehicle Enrollment Data to Roadside Facilities

2.5.7 Process Commercial Vehicle Violations

2.5.8 Process Data Received from Roadside Facilities

5.4.6 Process CV Violations

7.4.1.1 Process Commercial Vehicle Payments

CV Data Collection
This equipment package collects and stores commercial vehicle information that is collected in the course of Commercial Vehicle Administration Subsystem operations. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.

Process Specifications
2.5.9 Manage Commercial Vehicle Archive Data

CV Information Exchange
This equipment package supports the exchange of safety and credentials data among jurisdiction. The package also supports the exchange of safety and credentials data between agencies (for example, an administrative center and the roadside check facilities) within a single jurisdiction. Data are collected from multiple authoritative sources and packaged into snapshots (top-level summary and critical status information) and profiles (detailed and historical data).

Process Specifications
2.5.10 Manage CV Database Store

2.5.4 Communicate with Other Commercial Vehicle Administration System

2.5.6 Output Commercial Vehicle Enrollment Data to Roadside Facilities

2.5.8 Process Data Received from Roadside Facilities

CV Safety Administration
This Equipment package augments the Credentials and Taxes Administration Equipment package with safety data. This package ensures that safety criteria are available for automated roadside safety checks. It supports the collection and review of carrier safety data and determines the carrier safety rating.

Process Specifications
2.5.5 Manage Commercial Vehicle Credentials and Enrollment

International CV Administration
This Equipment package is used by government agencies such as customs and immigration, carriers, and service providers (e.g., brokers) to generate and process the entry documentation necessary to obtain release of vehicle, cargo, and driver across and international border, report the results of the crossing event, and handle duty fee processing.

Process Specifications
2.5.1 Manage Commercial Vehicle Trips and Clearances

2.5.3.1 Communicate with Trade Regulatory Agencies

2.5.3.2 Analyze Border Clearance Data

2.5.2 Subsystem Interfaces for CVAS

Archived Data Management Subsystem -> **Commercial Vehicle Administration**

Physical Architecture Flow Name: archive requests

A request to a data source for information on available data (i.e. "catalog") or a request that defines the data to be archived. The request can be a general subscription intended to initiate a continuous or regular data stream or a specific request intended to initiate a one-time response from the recipient.

Logical Architecture Reference Flow(s):
cv_archive_request

Physical Architecture Flow Name: archive status

Notification that data provided to an archive contains erroneous, missing, or suspicious data or verification that the data provided appears valid. If an error has been detected, the offending data and the nature of the potential problem are identified.

Logical Architecture Reference Flow(s):
cv_archive_status

Commercial Vehicle Administration -> **Archived Data Management Subsystem**

Physical Architecture Flow Name: commercial vehicle archive data

Information describing commercial vehicle travel and commodity flow characteristics. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.

Logical Architecture Reference Flow(s):
cv_archive_data

Commercial Vehicle Administration -> **Commercial Vehicle Check**

Physical Architecture Flow Name: border agency clearance results

Notification regarding the granting of permission for commercial freight shipment to enter the U.S.

Logical Architecture Reference Flow(s):
cvo_border_agency_clearance_results

Physical Architecture Flow Name: credentials information

Response containing full credentials information. "Response" may be provided in reaction to a real-time query or a standing request for updated information. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):
cv_credentials_information_response

Physical Architecture Flow Name: credentials status information

Credentials information such as registration, licensing, insurance, check flags, and electronic screening enrollment data. A unique identifier is included. Corresponds to the credentials portion of CVISN "snapshots." The status information may be provided as a response to a real-time query or as a result of a standing request for updated information (subscription). This may also include information about non-U.S. fleets for use by U.S. authorities, and information regarding U.S. fleets made available to Mexican and Canadian authorities. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):

cv_credentials_database_update

Physical Architecture Flow Name: safety inspection report

Report containing results of commercial vehicle safety inspection. The information may be provided as a response to a real-time query or proactively by the source. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):

cv_safety_information_response

Physical Architecture Flow Name: safety status information

Safety information such as safety ratings, inspection summaries, and violation summaries. A unique identifier is included. Corresponds to the safety portion of CVISN "snapshots." The status information may be provided as a response to a real-time query or as a result of a standing request for updated information (subscription). This may also include information about non-U.S. fleets for use by U.S. authorities, and information regarding U.S. fleets made available to Mexican and Canadian authorities. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):

cv_safety_database_update

Physical Architecture Flow Name: transportation border clearance assessment

Notification regarding the granting of permission for commercial freight shipment to enter the U.S. Includes directions for commercial driver to proceed to nearest vehicle weigh and inspection station for further review if required.

Logical Architecture Reference Flow(s):

cvo_transportation_border_clearance

Physical Architecture Flow Name: trip declaration identifiers

Specific identifiers extracted from notification containing information regarding pending commercial freight shipment into the U.S. includes carrier, vehicle, and driver identification data.

Logical Architecture Reference Flow(s):

cv_border_database_update

Commercial Vehicle Administration -> CVO Information Requestor

Physical Architecture Flow Name: credentials information

Response containing full credentials information. "Response" may be provided in reaction to a real-time query or a standing request for updated information. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):

tcvoir_credentials

Physical Architecture Flow Name: credentials status information

Credentials information such as registration, licensing, insurance, check flags, and electronic screening enrollment data. A unique identifier is included. Corresponds to the credentials portion of CVISN "snapshots." The status information may be provided as a response to a real-time query or as a result of a standing request for updated information (subscription). This may also include information about non-U.S. fleets for use by U.S. authorities, and information regarding U.S. fleets made available to Mexican and Canadian authorities. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):

tcvoir_credential_status

Physical Architecture Flow Name: safety status information

Safety information such as safety ratings, inspection summaries, and violation summaries. A unique identifier is included. Corresponds to the safety portion of CVISN "snapshots." The status information may be provided as a response to a real-time query or as a result of a standing request for updated information (subscription). This may also include information about non-U.S. fleets for use by U.S. authorities, and information regarding U.S. fleets made available to Mexican and Canadian authorities. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):

tcvoir_safety_status

Commercial Vehicle Administration -> Enforcement Agency

Physical Architecture Flow Name: accident report

Report of commercial vehicle safety accident. The information may be provided as a response to a real-time query or proactively by the source. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):

tea_accident_data

Physical Architecture Flow Name: citation

Report of commercial vehicle citation. The citation includes references to the statute(s) that was (were) violated. It includes information on the violator and the officer issuing the citation. A citation differs from a violation because it is adjudicated by the courts. The information may be provided as a response to a real-time query or proactively by the source. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):

tea_cv_citation_data

Physical Architecture Flow Name: violation notification

Notification to enforcement agency of a violation. The violation notification flow describes the statute or regulation that was violated and how it was violated (e. g., overweight on specific axle by xxx pounds or which brake was out of adjustment and how far out of adjustment it was). A violation differs from a citation because it is not adjudicated by the courts.

Logical Architecture Reference Flow(s):

tea_cv_violation_data

Commercial Vehicle Administration -> Financial Institution

Physical Architecture Flow Name: payment request

Request for payment from financial institution.

Logical Architecture Reference Flow(s):
tfi_cv_payment_request

Commercial Vehicle Administration -> Fleet and Freight Management

Physical Architecture Flow Name: accident report

Report of commercial vehicle safety accident. The information may be provided as a response to a real-time query or proactively by the source. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):
cvo_accident_data_for_fleet

Physical Architecture Flow Name: border clearance status

Notification regarding the crossing status of commercial freight shipment scheduled to enter the U.S. Includes portions of border agency and transportation agency clearance results, as they become available. Recipients may include trade regulatory agencies that do not receive status information directly from U.S. Customs (e.g., other transportation agencies with trade related responsibilities, such as NHTSA, MARAD, etc.)

Logical Architecture Reference Flow(s):
cvo_border_clearance_for_fleet

Physical Architecture Flow Name: citation

Report of commercial vehicle citation. The citation includes references to the statute(s) that was (were) violated. It includes information on the violator and the officer issuing the citation. A citation differs from a violation because it is adjudicated by the courts. The information may be provided as a response to a real-time query or proactively by the source. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):
cvo_citation

Physical Architecture Flow Name: compliance review report

Report containing results of carrier compliance review, including concomitant out-of-service notifications, carrier warnings/notifications. The information may be provided as a response to a real-time query of proactively by the source. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):
cf_roadside_activity_report

Physical Architecture Flow Name: credentials information

Response containing full credentials information. "Response" may be provided in reaction to a real-time query or a standing request for updated information. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):
cf_enrollment_payment_confirmation
cf_enrollment_information
cv_enrollment_payment_confirmation
cv_enrollment_information

Physical Architecture Flow Name: credentials status information

Credentials information such as registration, licensing, insurance, check flags, and electronic screening enrollment data. A unique identifier is included. Corresponds to the credentials portion of CVISN "snapshots." The status information may be provided as a response to a real-time

query or as a result of a standing request for updated information (subscription). This may also include information about non-U.S. fleets for use by U.S. authorities, and information regarding U.S. fleets made available to Mexican and Canadian authorities. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):

cvo_credential_status

Physical Architecture Flow Name: safety inspection report

Report containing results of commercial vehicle safety inspection. The information may be provided as a response to a real-time query or proactively by the source. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):

cf_periodic_activity_report

Physical Architecture Flow Name: safety status information

Safety information such as safety ratings, inspection summaries, and violation summaries. A unique identifier is included. Corresponds to the safety portion of CVISN "snapshots." The status information may be provided as a response to a real-time query or as a result of a standing request for updated information (subscription). This may also include information about non-U.S. fleets for use by U.S. authorities, and information regarding U.S. fleets made available to Mexican and Canadian authorities. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):

cvo_safety_status

Commercial Vehicle Administration -> Intermodal Freight Shipper

Physical Architecture Flow Name: border clearance status

Notification regarding the crossing status of commercial freight shipment scheduled to enter the U.S. Includes portions of border agency and transportation agency clearance results, as they become available. Recipients may include trade regulatory agencies that do not receive status information directly from U.S. Customs (e.g., other transportation agencies with trade related responsibilities, such as NHTSA, MARAD, etc.)

Logical Architecture Reference Flow(s):

tifs_border_clearance_status

Commercial Vehicle Administration -> Other CVAS

Physical Architecture Flow Name: border clearance status

Notification regarding the crossing status of commercial freight shipment scheduled to enter the U.S. Includes portions of border agency and transportation agency clearance results, as they become available. Recipients may include trade regulatory agencies that do not receive status information directly from U.S. Customs (e.g., other transportation agencies with trade related responsibilities, such as NHTSA, MARAD, etc.)

Logical Architecture Reference Flow(s):

tocvas_border_clearance

Physical Architecture Flow Name: credential fee coordination

Jurisdiction's rates for various credentials (IRP, IFTA, etc.) that are exchanged between agencies.

Logical Architecture Reference Flow(s):

tocvas_data_table

Physical Architecture Flow Name: credentials information

Response containing full credentials information. "Response" may be provided in reaction to a real-time query or a standing request for updated information. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):

tocvas_credentials

Physical Architecture Flow Name: credentials status information

Credentials information such as registration, licensing, insurance, check flags, and electronic screening enrollment data. A unique identifier is included. Corresponds to the credentials portion of CVISN "snapshots." The status information may be provided as a response to a real-time query or as a result of a standing request for updated information (subscription). This may also include information about non-U.S. fleets for use by U.S. authorities, and information regarding U.S. fleets made available to Mexican and Canadian authorities. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):

tocvas_credentials_status

Physical Architecture Flow Name: safety inspection report

Report containing results of commercial vehicle safety inspection. The information may be provided as a response to a real-time query or proactively by the source. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):

tocvas_safety_inspection

Physical Architecture Flow Name: safety status information

Safety information such as safety ratings, inspection summaries, and violation summaries. A unique identifier is included. Corresponds to the safety portion of CVISN "snapshots." The status information may be provided as a response to a real-time query or as a result of a standing request for updated information (subscription). This may also include information about non-U.S. fleets for use by U.S. authorities, and information regarding U.S. fleets made available to Mexican and Canadian authorities. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):

tocvas_safety_status

Commercial Vehicle Administration -> Trade Regulatory Agencies

Physical Architecture Flow Name: border clearance status

Notification regarding the crossing status of commercial freight shipment scheduled to enter the U.S. Includes portions of border agency and transportation agency clearance results, as they become available. Recipients may include trade regulatory agencies that do not receive status information directly from U.S. Customs (e.g., other transportation agencies with trade related responsibilities, such as NHTSA, MARAD, etc.)

Logical Architecture Reference Flow(s):

ttra_border_clearance_status

Physical Architecture Flow Name: domestic transportation information

Real-time or near real-time data regarding trade transportation activity. Potentially categorized by shipper classification, carrier, commodity, etc. Intended for use as a transportation decision tool.

Logical Architecture Reference Flow(s):
ttra_domestic_transportation_information

Physical Architecture Flow Name: transportation border clearance assessment

Notification regarding the granting of permission for commercial freight shipment to enter the U.S. Includes directions for commercial driver to proceed to nearest vehicle weigh and inspection station for further review if required.

Logical Architecture Reference Flow(s):
ttra_transportation_border_clearance

Commercial Vehicle Check -> Commercial Vehicle Administration

Physical Architecture Flow Name: accident report

Report of commercial vehicle safety accident. The information may be provided as a response to a real-time query or proactively by the source. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):
cvo_accident_data

Physical Architecture Flow Name: border clearance event

Reports clearance event data regarding action taken at border, including acceptance or override of system decision, and date/time stamp

Logical Architecture Reference Flow(s):
cvo_border_clearance

Physical Architecture Flow Name: citation

Report of commercial vehicle citation. The citation includes references to the statute(s) that was (were) violated. It includes information on the violator and the officer issuing the citation. A citation differs from a violation because it is adjudicated by the courts. The information may be provided as a response to a real-time query or proactively by the source. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):
cvo_citation_data

Physical Architecture Flow Name: daily site activity data

Record of daily activities at commercial vehicle check stations including summaries of screening events and inspections.

Logical Architecture Reference Flow(s):
cv_roadside_daily_log

Physical Architecture Flow Name: safety inspection report

Report containing results of commercial vehicle safety inspection. The information may be provided as a response to a real-time query or proactively by the source. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):
cvo_safety_inspection_data

Physical Architecture Flow Name: violation notification

Notification to enforcement agency of a violation. The violation notification flow describes the statute or regulation that was violated and how it was violated (e. g., overweight on specific axle by xxx pounds or which brake was out of adjustment and how far out of adjustment it was). A violation differs from a citation because it is not adjudicated by the courts.

Logical Architecture Reference Flow(s):
cvo_violation

Enforcement Agency -> Commercial Vehicle Administration

Physical Architecture Flow Name: information on violators

Response from law enforcement agency to request for information on violators. May include information about commercial vehicle violations or other kinds of violations associated with the particular entity.

Logical Architecture Reference Flow(s):
fea_cv_enforcement_agency_response

Financial Institution -> Commercial Vehicle Administration

Physical Architecture Flow Name: transaction status

Response to transaction request. Normally dealing with a request for payment.

Logical Architecture Reference Flow(s):
ffi_cv_payment_confirm

Fleet and Freight Management -> Commercial Vehicle Administration

Physical Architecture Flow Name: audit data

Information to support a tax audit.

Logical Architecture Reference Flow(s):
cvo_audit_data

Physical Architecture Flow Name: credential application

Application for commercial vehicle credentials. Authorization for payment is included.

Logical Architecture Reference Flow(s):
cf_enrollment_request
cv_enrollment_request

Physical Architecture Flow Name: tax filing

Commercial vehicle tax filing data. Authorization for payment is included.

Logical Architecture Reference Flow(s):
cf_tax_data

Maintenance and Construction Management -> **Commercial Vehicle Administration**

Physical Architecture Flow Name: current asset restrictions

Restrictions levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.

Logical Architecture Reference Flow(s):
asset_restrictions_for_com_veh

Other CVAS -> **Commercial Vehicle Administration**

Physical Architecture Flow Name: border clearance status

Notification regarding the crossing status of commercial freight shipment scheduled to enter the U.S. Includes portions of border agency and transportation agency clearance results, as they become available. Recipients may include trade regulatory agencies that do not receive status information directly from U.S. Customs (e.g., other transportation agencies with trade related responsibilities, such as NHTSA, MARAD, etc.)

Logical Architecture Reference Flow(s):
focvas_border_clearance

Physical Architecture Flow Name: credential fee coordination

Jurisdiction's rates for various credentials (IRP, IFTA, etc.) that are exchanged between agencies.

Logical Architecture Reference Flow(s):
focvas_data_table

Physical Architecture Flow Name: credentials information

Response containing full credentials information. "Response" may be provided in reaction to a real-time query or a standing request for updated information. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):
focvas_credentials

Physical Architecture Flow Name: credentials status information

Credentials information such as registration, licensing, insurance, check flags, and electronic screening enrollment data. A unique identifier is included. Corresponds to the credentials portion of CVISN "snapshots." The status information may be provided as a response to a real-time query or as a result of a standing request for updated information (subscription). This may also include information about non-U.S. fleets for use by U.S. authorities, and information regarding U.S. fleets made available to Mexican and Canadian authorities. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):
focvas_credentials_status

Physical Architecture Flow Name: safety inspection report

Report containing results of commercial vehicle safety inspection. The information may be provided as a response to a real-time query or proactively by the source. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):
focvas_safety_inspection

Physical Architecture Flow Name: safety status information

Safety information such as safety ratings, inspection summaries, and violation summaries. A unique identifier is included. Corresponds to the safety portion of CVISN "snapshots." The status information may be provided as a response to a real-time query or as a result of a standing request for updated information (subscription). This may also include information about non-U.S. fleets for use by U.S. authorities, and information regarding U.S. fleets made available to Mexican and Canadian authorities. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):
focvas_safety_status

Trade Regulatory Agencies -> Commercial Vehicle Administration

Physical Architecture Flow Name: declaration information

Notification containing information regarding pending commercial freight shipment into the U.S.

Logical Architecture Reference Flow(s):
ftra_declaration_information

Physical Architecture Flow Name: domestic transportation information

Real-time or near real-time data regarding trade transportation activity. Potentially categorized by shipper classification, carrier, commodity, etc. Intended for use as a transportation decision tool.

Logical Architecture Reference Flow(s):
ftra_domestic_transportation_information

2.5.3 Architecture Flow Diagrams for CVAS

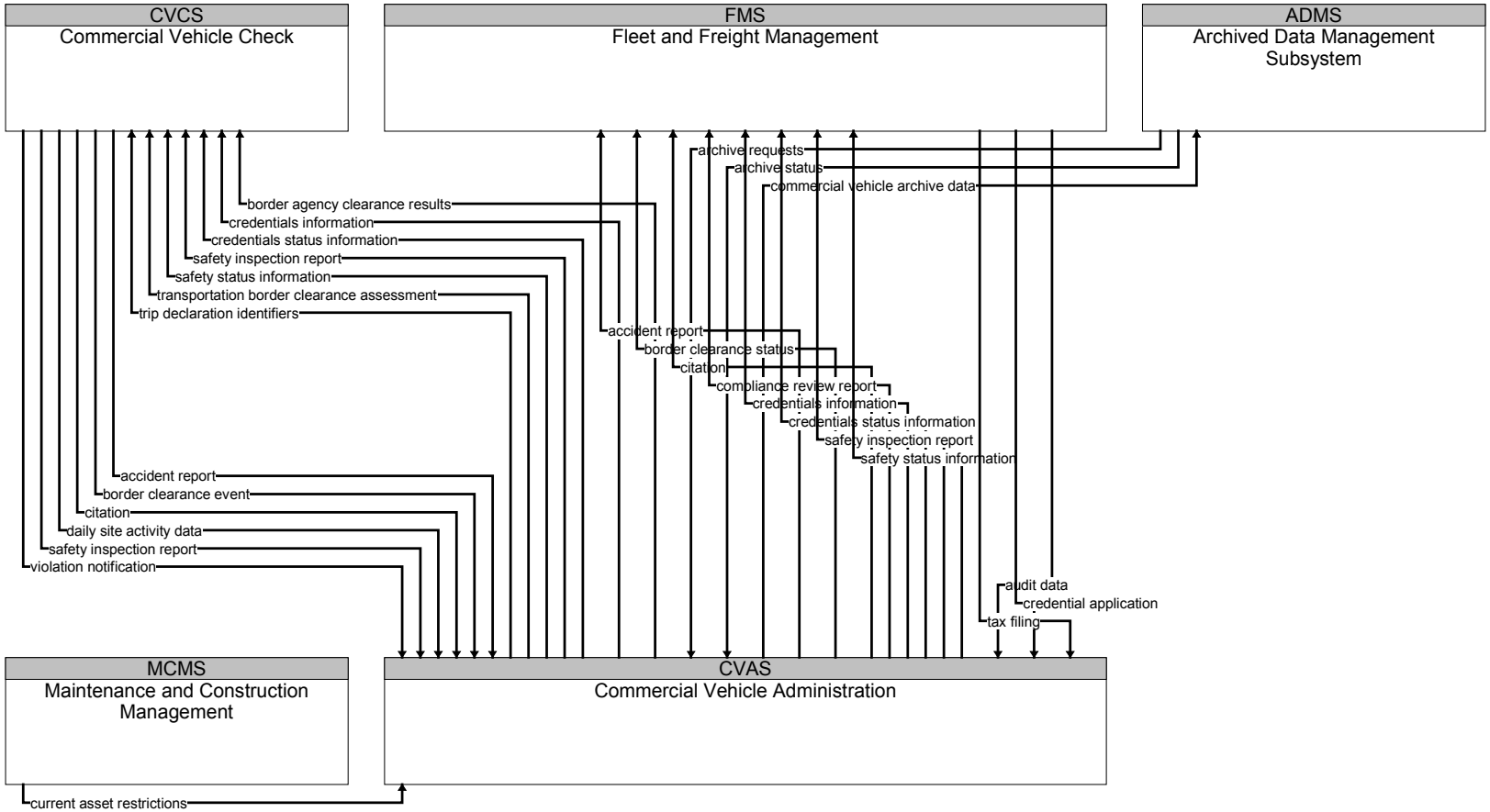


Figure 2-7 Subsystem Architecture Flow Diagram for CVAS

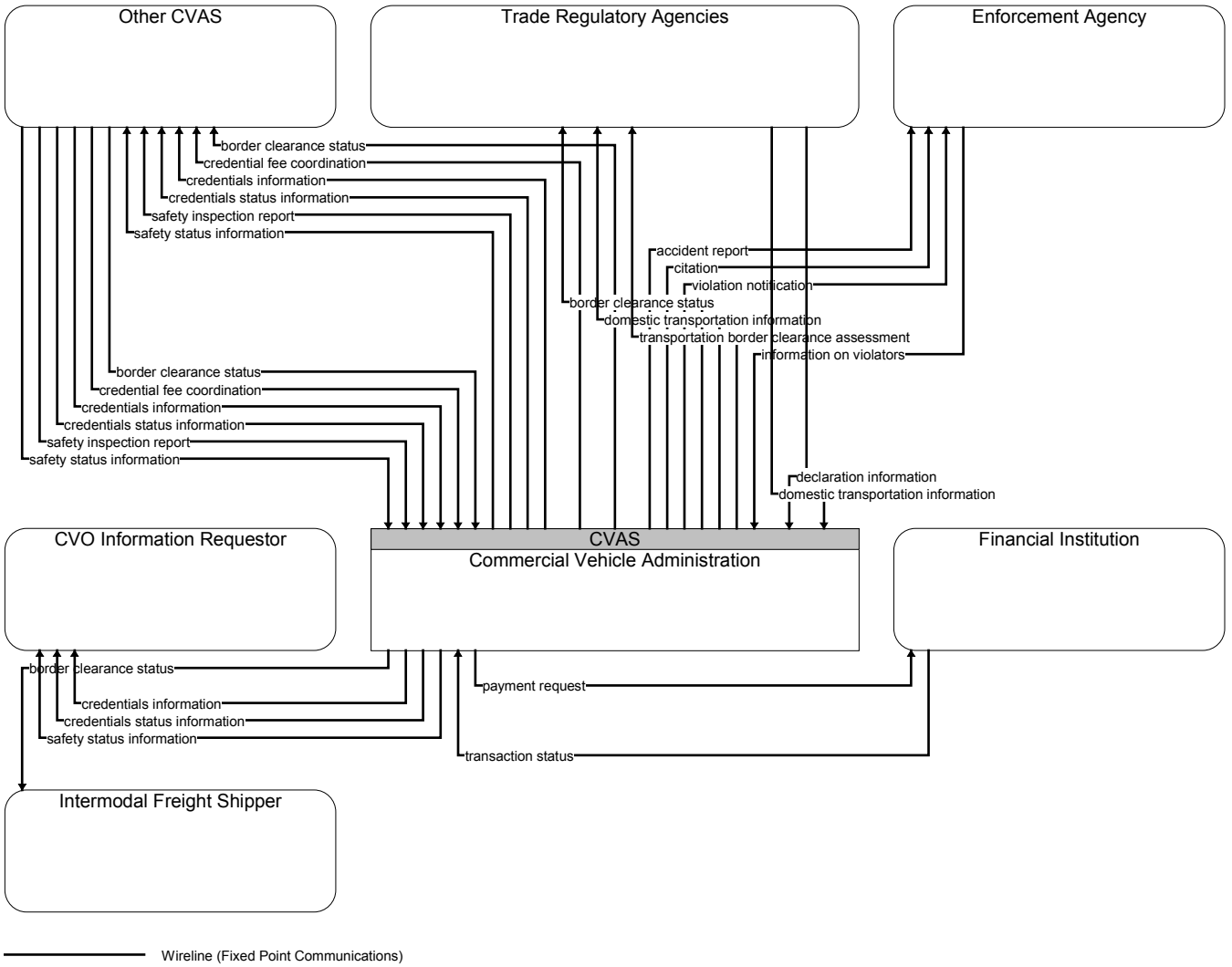


Figure 2-8 Terminator Architecture Flow Diagram for CVAS

2.6 Commercial Vehicle Check Subsystem

The Commercial Vehicle Check Subsystem supports automated vehicle identification at mainline speeds for credential checking, roadside safety inspections, and weigh-in-motion using two-way data exchange. These capabilities include providing warnings to the commercial vehicle drivers, their fleet managers, and proper authorities of any safety problems that have been identified, accessing and examining historical safety data, and automatically deciding whether to allow the vehicle to pass or require it to stop with operator manual override. The Commercial Vehicle Check Subsystem also provides supplemental inspection services to current capabilities by supporting expedited brake inspections, the use of operator hand-held devices, on-board safety database access, and the enrollment of vehicles and carriers in the electronic clearance program.

2.6.1 Subsystem Equipment Packages and Supporting Process Specifications for CVCS

Citation and Accident Electronic Recording
The equipment package documents violations and forwards the information to the Commercial vehicle if available and to the CVAS for processing as part of the normal credentials processing package

Process Specifications
2.3.3.4 Carry-out Commercial Vehicle Roadside Safety Screening

International Border Crossing
This Equipment package is used by government agencies such as customs and immigration to check compliance with import/export and immigration regulations to allow release of cargo, vehicle, and driver across an international border.

Process Specifications
2.3.8 Provide Commercial Vehicle Border Screening

Roadside Electronic Screening
This Equipment package provides the Commercial Vehicle Check Subsystem the capabilities for two-way communication with approaching properly equipped commercial vehicles at mainline speeds, reading tags for automated vehicle identification and credential checking. There will be a capability to appropriately screen all vehicles, not just those that are equipped. This Equipment package shall be able to process the data from the commercial vehicles along with accessed database information to determine whether a pull-in message is needed or to generate random pull-in messages with provisions for facility operators and enforcement officials to have manual override capabilities. Support shall be provided to both interstate and intrastate carriers.

Process Specifications
2.3.1 Produce Commercial Vehicle Driver Message at Roadside

2.3.2.1 Administer Commercial Vehicle Roadside Credentials Database

2.3.2.2 Process Screening Transactions

2.3.3.4 Carry-out Commercial Vehicle Roadside Safety Screening

2.3.4 Detect Commercial Vehicle

2.3.5 Provide Commercial Vehicle Roadside Operator Interface

2.3.6 Provide Commercial Vehicle Reports

Roadside Safety Inspection

This Equipment package provides the Commercial Vehicle Check Subsystem the capabilities for operators to automate the roadside safety inspection process including the support of use of hand held devices to rapidly inspect the vehicle and driver. In addition this Equipment package provides the Roadside Check Subsystem the capabilities for operators to automate the roadside safety inspection process including the support of automated mainline speed reading of on-board safety data to rapidly screen the vehicle and driver. This Equipment package shall also provide the capabilities to collect, store, maintain, and provide safety data and access historical safety data after receiving identification from vehicles at mainline speeds or while stopped at the roadside. Results of screening and summary safety inspection can be written back onto the tag. The capabilities to process safety data and issue pull-in messages or provide warnings to the driver, carrier, and enforcement agencies shall be provided. These capabilities have a prerequisite of the Roadside Electronic Screening Equipment package and shall be provided primarily through the utilization of an additional safety database.

Since a vehicle may cross jurisdiction boundaries during a trip, this equipment package supports the concept of a last clearance event record (aka trip ticket) carried on the vehicle s tag. The last clearance event record reflects the results of the roadside verification action. For example, if the vehicle is pulled over in State A and undergoes credential, weight, and safety checks, the results of the clearance process are written to the vehicle s tag. If the vehicle continues the trip and passes a roadside station in State B, the State B station has access to the results of the previous pull-in because it can read the last clearance event record written by the State A roadside station.

Process Specifications

2.3.1 Produce Commercial Vehicle Driver Message at Roadside

2.3.3.1 Provide Commercial Vehicle Checkstation Communications

2.3.3.2 Provide Commercial Vehicle Inspector Handheld Terminal Interface

2.3.3.3 Administer Commercial Vehicle Roadside Safety Database

2.3.3.4 Carry-out Commercial Vehicle Roadside Safety Screening

2.3.3.5 Carry-out Commercial Vehicle Roadside Inspection

2.3.5 Provide Commercial Vehicle Roadside Operator Interface

Roadside WIM

This Equipment package allows for roadside high speed weigh in motion. This package can be fixed to a location or mobile. It can include an interface to the credential check package and augment electronic credentials check with electronic weight check or it can be a stand alone package with display.

Process Specifications
2.3.1 Produce Commercial Vehicle Driver Message at Roadside

2.3.4 Detect Commercial Vehicle

2.6.2 Subsystem Interfaces for CVCS

Basic Commercial Vehicle -> Commercial Vehicle Check

Physical Architecture Flow Name: CVO weight and presence

Physical attribute of commercial vehicle that can be measured (for example, weight, number of axels, axel spacing, etc.).

Logical Architecture Reference Flow(s):
fbcv_vehicle_characteristics

Physical Architecture Flow Name: identification information

Vehicle identification information such as license plate number, US DOT number, ICC number, bar code, etc.

Logical Architecture Reference Flow(s):
fbcv_vehicle_identification

Commercial Vehicle Administration -> Commercial Vehicle Check

Physical Architecture Flow Name: border agency clearance results

Notification regarding the granting of permission for commercial freight shipment to enter the U.S.

Logical Architecture Reference Flow(s):
cvo_border_agency_clearance_results

Physical Architecture Flow Name: credentials information

Response containing full credentials information. "Response" may be provided in reaction to a real-time query or a standing request for updated information. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):
cv_credentials_information_response

Physical Architecture Flow Name: credentials status information

Credentials information such as registration, licensing, insurance, check flags, and electronic screening enrollment data. A unique identifier is included. Corresponds to the credentials portion of CVISN "snapshots." The status information may be provided as a response to a real-time query or as a result of a standing request for updated information (subscription). This may also include information about non-U.S. fleets for use by U.S. authorities, and information regarding U.S. fleets made available to Mexican and Canadian authorities. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):

cv_credentials_database_update

Physical Architecture Flow Name: safety inspection report

Report containing results of commercial vehicle safety inspection. The information may be provided as a response to a real-time query or proactively by the source. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):

cv_safety_information_response

Physical Architecture Flow Name: safety status information

Safety information such as safety ratings, inspection summaries, and violation summaries. A unique identifier is included. Corresponds to the safety portion of CVISN "snapshots." The status information may be provided as a response to a real-time query or as a result of a standing request for updated information (subscription). This may also include information about non-U.S. fleets for use by U.S. authorities, and information regarding U.S. fleets made available to Mexican and Canadian authorities. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):

cv_safety_database_update

Physical Architecture Flow Name: transportation border clearance assessment

Notification regarding the granting of permission for commercial freight shipment to enter the U.S. Includes directions for commercial driver to proceed to nearest vehicle weigh and inspection station for further review if required.

Logical Architecture Reference Flow(s):

cvo_transportation_border_clearance

Physical Architecture Flow Name: trip declaration identifiers

Specific identifiers extracted from notification containing information regarding pending commercial freight shipment into the U.S. includes carrier, vehicle, and driver identification data.

Logical Architecture Reference Flow(s):

cv_border_database_update

Commercial Vehicle Check -> Commercial Vehicle Administration

Physical Architecture Flow Name: accident report

Report of commercial vehicle safety accident. The information may be provided as a response to a real-time query or proactively by the source. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):

cvo_accident_data

Physical Architecture Flow Name: border clearance event

Reports clearance event data regarding action taken at border, including acceptance or override of system decision, and date/time stamp

Logical Architecture Reference Flow(s):

cvo_border_clearance

Physical Architecture Flow Name: citation

Report of commercial vehicle citation. The citation includes references to the statute(s) that was (were) violated. It includes information on the violator and the officer issuing the citation. A citation differs from a violation because it is adjudicated by the courts. The information may be provided as a response to a real-time query or proactively by the source. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):

cvo_citation_data

Physical Architecture Flow Name: daily site activity data

Record of daily activities at commercial vehicle check stations including summaries of screening events and inspections.

Logical Architecture Reference Flow(s):

cv_roadside_daily_log

Physical Architecture Flow Name: safety inspection report

Report containing results of commercial vehicle safety inspection. The information may be provided as a response to a real-time query or proactively by the source. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):

cvo_safety_inspection_data

Physical Architecture Flow Name: violation notification

Notification to enforcement agency of a violation. The violation notification flow describes the statute or regulation that was violated and how it was violated (e. g., overweight on specific axle by xxx pounds or which brake was out of adjustment and how far out of adjustment it was). A violation differs from a citation because it is not adjudicated by the courts.

Logical Architecture Reference Flow(s):

cvo_violation

Commercial Vehicle Check -> Commercial Vehicle Driver

Physical Architecture Flow Name: CVO pass/pull-in message

Message sent to commercial vehicle driver indicating whether to bypass or requesting pull in to inspection/verification stop along with inspection results (e. g., LED indicator on transponder or variable message sign).

Logical Architecture Reference Flow(s):

tcvd_safety_pull_in_output
tcvd_general_pull_in_output
tcvd_border_pull_in_output
tcvd_clearance_pull_in_output
tcvd_inspection_results

Commercial Vehicle Check -> Commercial Vehicle Subsystem

Physical Architecture Flow Name: border clearance data request

Request for trip specific data regarding the movement of goods across international borders.

Includes trip identification number. May also include results from recent border crossing screening events.

Logical Architecture Reference Flow(s):
cvo_border_clearance_request

Physical Architecture Flow Name: border clearance event

Reports clearance event data regarding action taken at border, including acceptance or override of system decision, and date/time stamp

Logical Architecture Reference Flow(s):
cv_on_board_border_record

Physical Architecture Flow Name: driver log request

Request for driver log data.

Logical Architecture Reference Flow(s):
cvo_driver_log_request

Physical Architecture Flow Name: electronic lock data request

Request from roadside for data regarding presence and status of electronic cargo locks.

Logical Architecture Reference Flow(s):
cv_request_electronic_clearance_data

Physical Architecture Flow Name: electronic screening request

Request for identification data to support electronic screening.

Logical Architecture Reference Flow(s):
cv_request_electronic_screening_data

Physical Architecture Flow Name: on-board safety request

Request for on-board vehicle safety data by the roadside equipment.

Logical Architecture Reference Flow(s):
cv_request_on_board_data

Physical Architecture Flow Name: pass/pull-in

Command to commercial vehicle to pull into or bypass inspection station.

Logical Architecture Reference Flow(s):
cv_on_board_pull_in_output

Physical Architecture Flow Name: request tag data

Request for tag information including credit identity, stored value card cash, etc.

Logical Architecture Reference Flow(s):
cvo_request_tag_data

Physical Architecture Flow Name: safety inspection record

Record containing results of commercial vehicle safety inspection.

Logical Architecture Reference Flow(s):

cv_inspection_data_output

Physical Architecture Flow Name: safety inspection request

Request for safety inspection record.

Logical Architecture Reference Flow(s):

cvo_safety_inspection_request

Physical Architecture Flow Name: screening event record

Results of CVO electronic screening activity.

Logical Architecture Reference Flow(s):

cv_on_board_screening_record

Commercial Vehicle Check -> CVO Inspector

Physical Architecture Flow Name: CVO inspector information

Credential, safety, and preclearance information and instructions to the commercial vehicle inspector.

Logical Architecture Reference Flow(s):

tci_output_log_report
tci_inspection_report
tci_credentials_data_output
tci_safety_data_output
tci_pull_in_information

Commercial Vehicle Subsystem -> Commercial Vehicle Check

Physical Architecture Flow Name: border clearance data

Trip specific data regarding the movement of goods across international borders. Includes trip identification number. May also include results from recent border crossing screening events.

Logical Architecture Reference Flow(s):

cvo_border_clearance_data

Physical Architecture Flow Name: driver log

A daily log showing hours in service for the current driver.

Logical Architecture Reference Flow(s):

cvo_driver_log

Physical Architecture Flow Name: electronic lock data

Notification to roadside (via transponder) of the presence and status of electronic cargo locks.

Logical Architecture Reference Flow(s):

cv_electronic_clearance_data

Physical Architecture Flow Name: on-board safety data

Safety data measured by on-board sensors. Includes information about the vehicle, vehicle components, cargo, and driver.

Logical Architecture Reference Flow(s):

cv_on_board_data

Physical Architecture Flow Name: safety inspection record

Record containing results of commercial vehicle safety inspection.

Logical Architecture Reference Flow(s):

cvo_safety_inspection

Physical Architecture Flow Name: screening event record

Results of CVO electronic screening activity.

Logical Architecture Reference Flow(s):

cv_electronic_screening_data

Physical Architecture Flow Name: tag data

Unique tag ID and related vehicle information.

Logical Architecture Reference Flow(s):

cvo_tag_data

CVO Inspector -> Commercial Vehicle Check

Physical Architecture Flow Name: CVC override mode

Manual override of automated pass/pull-in decisions generated by the Commercial Vehicle Check station.

Logical Architecture Reference Flow(s):

fci_pull_in_action

Physical Architecture Flow Name: CVO inspector input

Requests from the commercial vehicle inspector to operate the commercial vehicle inspection station.

Logical Architecture Reference Flow(s):

fci_start_inspection
fci_request_log_report
fci_safety_data_request
fci_credentials_data_request
fci_inspection_data_input

Enforcement Agency -> Commercial Vehicle Check

Physical Architecture Flow Name: information on violators

Response from law enforcement agency to request for information on violators. May include information about commercial vehicle violations or other kinds of violations associated with the particular entity.

Logical Architecture Reference Flow(s):

fea_violator_information

2.6.3 Architecture Flow Diagrams for CVCS

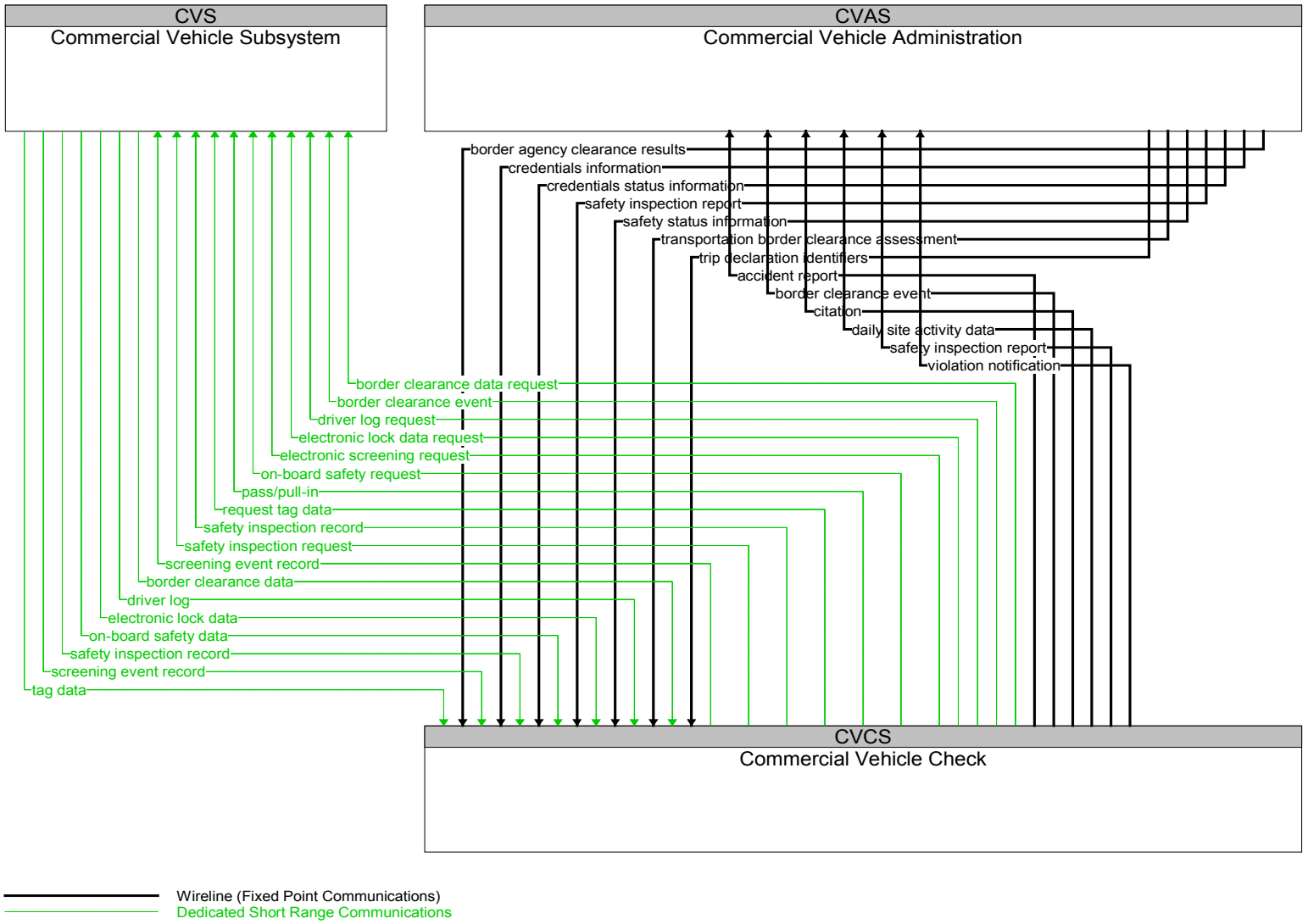


Figure 2-9 Subsystem Architecture Flow Diagram for CVCS

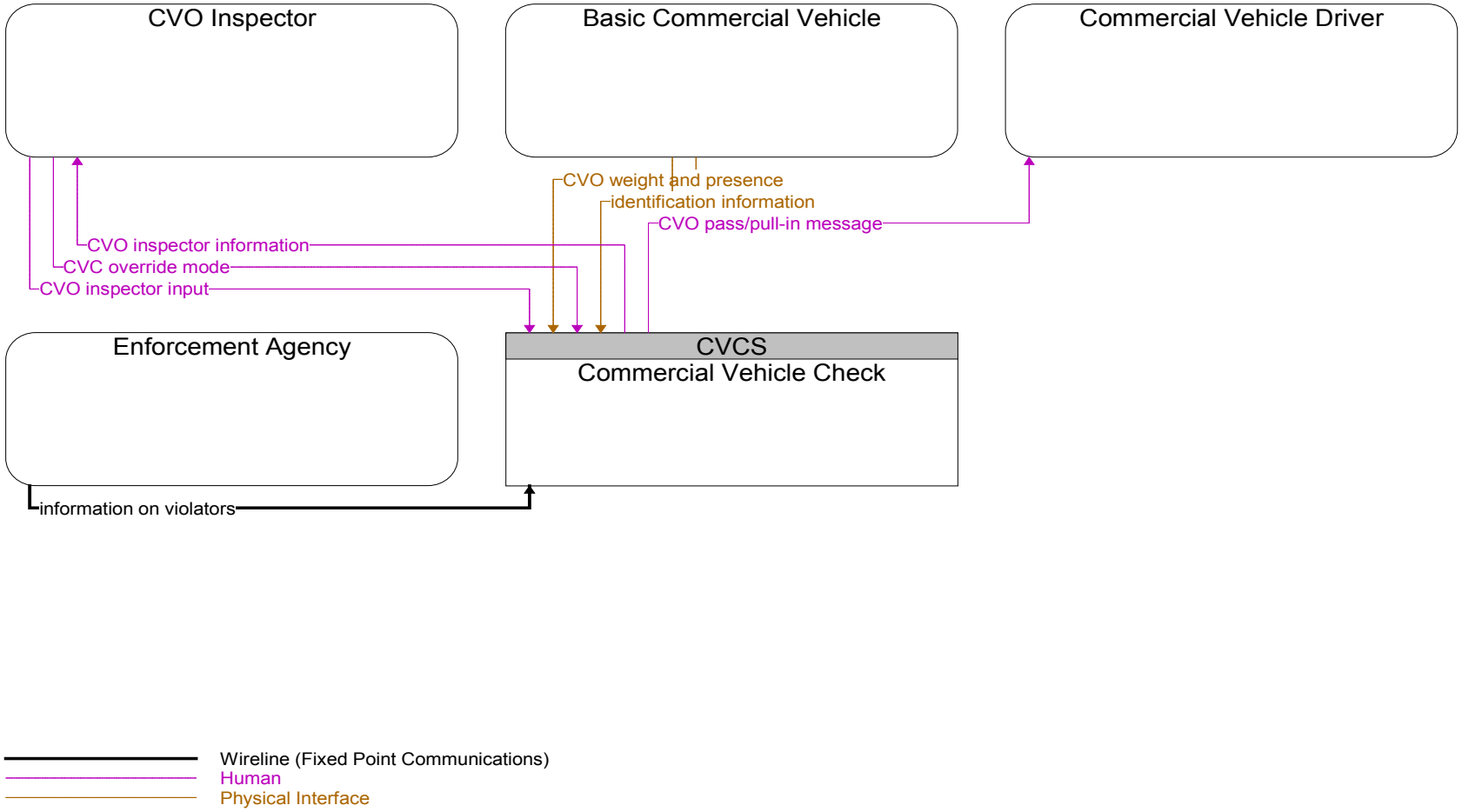


Figure 2-10 Terminator Architecture Flow Diagram for CVCS

2.7 Commercial Vehicle Subsystem

This subsystem resides in a commercial vehicle and provides the sensory, processing, storage, and communications functions necessary to support safe and efficient commercial vehicle operations. The Commercial Vehicle Subsystem provides two-way communications between the commercial vehicle drivers, their fleet managers, and roadside officials, and provides HAZMAT response teams with timely and accurate cargo contents information after a vehicle incident. This subsystem provides the capability to collect and process vehicle, cargo, and driver safety data and status and alert the driver whenever there is a potential safety problem. Basic identification and safety status data are supplied to inspection facilities at mainline speeds. In addition, the subsystem will automatically collect and record mileage, fuel usage, and border crossings.

2.7.1 Subsystem Equipment Packages and Supporting Process Specifications for CVS

On-board Cargo Monitoring
This Equipment package provides the Commercial Vehicle Subsystem the capability to monitor both interstate and intrastate cargo safety such that enforcement and HAZMAT response teams can be provided with timely and accurate information. This includes only the equipment on board the cargo container such as a communication device, possibly the addition of a cell-based radio, and equipment for the processing and storage of cargo material. This can also include optional sensors for temperature, pressure, load leveling, or acceleration depending upon the items monitored. It is already expected that the cargo location devices such as GPS equipment and an integration processor already exist. These items are presented as part of the On-board Trip Monitoring Equipment package.

Process Specifications
2.4.2 Collect On-board Commercial Vehicle Sensor Data

2.4.3 Analyze Commercial Vehicle On-board Data

2.4.5 Communicate Commercial Vehicle On-board Data to Vehicle Manager

2.4.6 Provide Commercial Vehicle On-board Data Store Interface

2.4.7 Manage CV On-board Sensor Data Store

On-board CV Electronic Data
This Equipment package provides the Commercial Vehicle Subsystem the capability for two-way data exchange between the vehicle and the roadside facility with the transmission of information such as status of driver, vehicle, and carrier IDs and cargo information. The driver, vehicle and carrier are identified via the tag so that actual weight from roadside mainline weigh-in-motion may be checked. This includes only the equipment on the commercial vehicle including a processor/tag for identification, especially a HAZMAT identification. The actual reading and processing required for the credential checking and weigh-in-motion will be performed by the roadside.

Process Specifications
2.2.3 Provide CV Driver Electronic Credential and Tax Filing Interface

2.3.7 Produce Commercial Vehicle Driver Message on Vehicle

2.4.2 Collect On-board Commercial Vehicle Sensor Data

2.4.3 Analyze Commercial Vehicle On-board Data

2.4.4 Provide Commercial Vehicle Driver Interface
2.4.6 Provide Commercial Vehicle On-board Data Store Interface

2.6.2 Transmit Commercial Vehicle Tag Data

2.6.3 Provide Commercial Driver Tag Data Interface

2.6.4 Provide Lock Tag Data Interface

2.6.5 Manage Commercial Vehicle Tag Data Store

On-board CV Safety
This Equipment package provides the Commercial Vehicle Subsystem the capability to collect and process on board vehicle and driver safety information to monitor the safety status and supply this information to the roadside facilities both at mainline speeds and while stopped for inspections. The capability to alert the commercial vehicle driver whenever there is a critical safety problem or potential emergency shall also be provided. These capabilities include only the equipment on the commercial vehicle including the sensors and processors to monitor the vehicle and driver with the information stored on the vehicle. When the information is transmitted to the roadside facility or after the trip, it will utilize the communication devices already in place. The package will also support onboard driver safety log maintenance and checking.

Process Specifications
2.4.1 Communicate Commercial Vehicle On-board Data to Roadside

2.4.2 Collect On-board Commercial Vehicle Sensor Data

2.4.3 Analyze Commercial Vehicle On-board Data

2.4.4 Provide Commercial Vehicle Driver Interface

2.4.7 Manage CV On-board Sensor Data Store

On-board Trip Monitoring
This Equipment package provides the capabilities to support fleet management with automatic vehicle location and

automated mileage and fuel reporting and auditing. This package may also record other special events resulting from communication with roadside equipment. This includes only the equipment on board the vehicle to support this function including the vehicle location devices such as GPS equipment, communication interfaces, a processor to record trip length, and the sensors/actuators/interfaces necessary to record mileage and fuel usage.

Process Specifications

2.1.5 Provide Commercial Vehicle Driver Routing Interface
2.2.2 Provide Vehicle Static Route

2.2.4 Provide Commercial Vehicle Driver Communications

2.4.1 Communicate Commercial Vehicle On-board Data to Roadside

2.4.2 Collect On-board Commercial Vehicle Sensor Data

2.4.3 Analyze Commercial Vehicle On-board Data

2.4.4 Provide Commercial Vehicle Driver Interface

2.4.5 Communicate Commercial Vehicle On-board Data to Vehicle Manager
2.4.7 Manage CV On-board Sensor Data Store

2.7.2 Subsystem Interfaces for CVS

Basic Commercial Vehicle -> Commercial Vehicle Subsystem

Physical Architecture Flow Name: commercial vehicle measures

Commercial vehicle, driver, and cargo safety status measured by on-board ITS equipment.

Logical Architecture Reference Flow(s):

fbcv_distance_traveled
fbcv_brake_condition
fbcv_driver_safety_status
fbcv_cargo_data
fbcv_cargo_safety_status
fbcv_lock_tag_data
fbcv_driver_status
fbcv_weight
fbcv_vehicle_safety_status

Commercial Vehicle Check -> Commercial Vehicle Subsystem

Physical Architecture Flow Name: border clearance data request

Request for trip specific data regarding the movement of goods across international borders. Includes trip identification number. May also include results from recent border crossing screening events.

Logical Architecture Reference Flow(s):
cvo_border_clearance_request

Physical Architecture Flow Name: border clearance event

Reports clearance event data regarding action taken at border, including acceptance or override of system decision, and date/time stamp

Logical Architecture Reference Flow(s):
cv_on_board_border_record

Physical Architecture Flow Name: driver log request

Request for driver log data.

Logical Architecture Reference Flow(s):
cvo_driver_log_request

Physical Architecture Flow Name: electronic lock data request

Request from roadside for data regarding presence and status of electronic cargo locks.

Logical Architecture Reference Flow(s):
cv_request_electronic_clearance_data

Physical Architecture Flow Name: electronic screening request

Request for identification data to support electronic screening.

Logical Architecture Reference Flow(s):
cv_request_electronic_screening_data

Physical Architecture Flow Name: on-board safety request

Request for on-board vehicle safety data by the roadside equipment.

Logical Architecture Reference Flow(s):
cv_request_on_board_data

Physical Architecture Flow Name: pass/pull-in

Command to commercial vehicle to pull into or bypass inspection station.

Logical Architecture Reference Flow(s):
cv_on_board_pull_in_output

Physical Architecture Flow Name: request tag data

Request for tag information including credit identity, stored value card cash, etc.

Logical Architecture Reference Flow(s):
cvo_request_tag_data

Physical Architecture Flow Name: safety inspection record

Record containing results of commercial vehicle safety inspection.

Logical Architecture Reference Flow(s):
cv_inspection_data_output

Physical Architecture Flow Name: safety inspection request

Request for safety inspection record.

Logical Architecture Reference Flow(s):
cvo_safety_inspection_request

Physical Architecture Flow Name: screening event record

Results of CVO electronic screening activity.

Logical Architecture Reference Flow(s):
cv_on_board_screening_record

Commercial Vehicle Driver -> Commercial Vehicle Subsystem

Physical Architecture Flow Name: CVO driver initialization

Commercial vehicle driver and vehicle information and requests to the commercial vehicle managing system.

Logical Architecture Reference Flow(s):
fcvd_enrollment_payment_request
fcvd_activity_request
fcvd_carrier_number
fcvd_driver_data_input
fcvd_request_tag_data_output
fcvd_route_request
fcvd_driver_general_message
fcvd_other_data_input
fcvd_route_data
fcvd_vehicle_number
fcvd_driver_number
fcvd_driver_input_type
fcvd_request_routing_instructions
fcvd_enrollment_request

Physical Architecture Flow Name: trip identification number

The unique trip load number for a specific cross-border shipment.

Logical Architecture Reference Flow(s):
fcvd_trip_identification_number

Commercial Vehicle Subsystem -> Commercial Vehicle Check

Physical Architecture Flow Name: border clearance data

Trip specific data regarding the movement of goods across international borders. Includes trip identification number. May also include results from recent border crossing screening events.

Logical Architecture Reference Flow(s):
cvo_border_clearance_data

Physical Architecture Flow Name: driver log

A daily log showing hours in service for the current driver.

Logical Architecture Reference Flow(s):
cvo_driver_log

Physical Architecture Flow Name: electronic lock data

Notification to roadside (via transponder) of the presence and status of electronic cargo locks.

Logical Architecture Reference Flow(s):
cv_electronic_clearance_data

Physical Architecture Flow Name: on-board safety data

Safety data measured by on-board sensors. Includes information about the vehicle, vehicle components, cargo, and driver.

Logical Architecture Reference Flow(s):
cv_on_board_data

Physical Architecture Flow Name: safety inspection record

Record containing results of commercial vehicle safety inspection.

Logical Architecture Reference Flow(s):
cvo_safety_inspection

Physical Architecture Flow Name: screening event record

Results of CVO electronic screening activity.

Logical Architecture Reference Flow(s):
cv_electronic_screening_data

Physical Architecture Flow Name: tag data

Unique tag ID and related vehicle information.

Logical Architecture Reference Flow(s):
cvo_tag_data

Commercial Vehicle Subsystem -> Commercial Vehicle Driver

Physical Architecture Flow Name: alerts

Specific alerts and messages related to commercial vehicles (e.g. trucks not advised, trucks over 10 tons not allowed on bridge, route details). This also includes warning indications detected by on-board sensors (cargo, safety).

Logical Architecture Reference Flow(s):
tcvd_route_data
tcvd_critical_safety_problem
tcvd_routing_instructions
tcvd_data_request

Physical Architecture Flow Name: CVO pass/pull-in message

Message sent to commercial vehicle driver indicating whether to bypass or requesting pull in to inspection/verification stop along with inspection results (e. g., LED indicator on transponder or variable message sign).

Logical Architecture Reference Flow(s):
tcvd_on_board_pull_in_output

Physical Architecture Flow Name: trip log information

Information entered into the trip log, or request for update.

Logical Architecture Reference Flow(s):
tcvd_enrollment_confirmation
tcvd_data_input_request
tcvd_confirm_data_stored
tcvd_other_data_request
tcvd_enrollment_payment_confirmation
tcvd_output_data
tcvd_output_tag_data
tcvd_type_input_request

Commercial Vehicle Subsystem -> Emergency Management

Physical Architecture Flow Name: hazmat spill notification

This data flow is used by the on-board cargo monitoring equipment package to contact emergency response organizations when the cargo sensors detect a release of hazardous material. This information will include the vehicle location discussed above as well as identifying the carrier. The information may be provided as a response to a real-time query or proactively by the source. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):
cvo_hazmat_spill_data

Commercial Vehicle Subsystem -> Fleet and Freight Management

Physical Architecture Flow Name: driver to fleet request

Requests from the driver and vehicle for routing, payment, and enrollment information.

Logical Architecture Reference Flow(s):
cv_driver_storage_request
cv_static_route_data
cf_driver_route_instructions_request
cv_driver_enrollment_payment_request
cv_driver_enrollment_request
cv_driver_route_request

Physical Architecture Flow Name: on-board safety data

Safety data measured by on-board sensors. Includes information about the vehicle, vehicle components, cargo, and driver.

Logical Architecture Reference Flow(s):
cvo_on_board_safety_data
cvo_tag_safety_data

Physical Architecture Flow Name: on-board vehicle data

Information about the commercial vehicle stored on-board (for maintenance purposes, gate access, cargo status, lock status, etc.).

Logical Architecture Reference Flow(s):
cf_tag_data_store_output
cf_on_board_vehicle_data

Physical Architecture Flow Name: trip log

Driver's daily log, vehicle location, mileage, and trip activity (includes screening, inspection and border clearance event data as well as fare payments).

Logical Architecture Reference Flow(s):
cvo_trip_log_data

Commercial Vehicle Subsystem -> Vehicle

Physical Architecture Flow Name: commercial vehicle data

Information about the commercial vehicles cargo, credentials, and payments.

Logical Architecture Reference Flow(s):
cv_driver_enrollment_cost
processed_cargo_data

Fleet and Freight Management -> Commercial Vehicle Subsystem

Physical Architecture Flow Name: fleet to driver update

Updated instructions to the driver including dispatch, routing, and special instructions.

Logical Architecture Reference Flow(s):
cf_driver_route_instructions
cv_driver_enrollment_information
cv_static_route_request
cv_driver_route_data
cf_tag_data_store_request
cvo_general_message
cf_tag_data_store_write
cv_driver_enrollment_payment_confirmation

Physical Architecture Flow Name: on-board safety request

Request for on-board vehicle safety data by the roadside equipment.

Logical Architecture Reference Flow(s):
cvo_tag_safety_data_request
cvo_on_board_safety_data_request

Physical Architecture Flow Name: on-board vehicle request

Request for on-board vehicle data.

Logical Architecture Reference Flow(s):
cvo_tag_data_store_request
cvo_on_board_vehicle_data_request

Physical Architecture Flow Name: trip identification number

The unique trip load number for a specific cross-border shipment.

Logical Architecture Reference Flow(s):
cvo_trip_identification_number

Physical Architecture Flow Name: trip log request

Request for trip log.

Logical Architecture Reference Flow(s):
cvo_trip_log_data_request

Intermodal Freight Shipper -> **Commercial Vehicle Subsystem**

Physical Architecture Flow Name: trip identification number

The unique trip load number for a specific cross-border shipment.

Logical Architecture Reference Flow(s):
fifs_trip_identification_number

Vehicle -> **Commercial Vehicle Subsystem**

Physical Architecture Flow Name: commercial vehicle data request

Requests from the vehicle for information about the commercial vehicle's cargo, credentials, and payments.

Logical Architecture Reference Flow(s):
cargo_data_request
cv_driver_credit_identity

Physical Architecture Flow Name: vehicle location

Location of vehicle and other vehicle characteristics which are exchanged between vehicle subsystems.

Logical Architecture Reference Flow(s):
vehicle_location_for_cv

2.7.3 Architecture Flow Diagrams for CVS

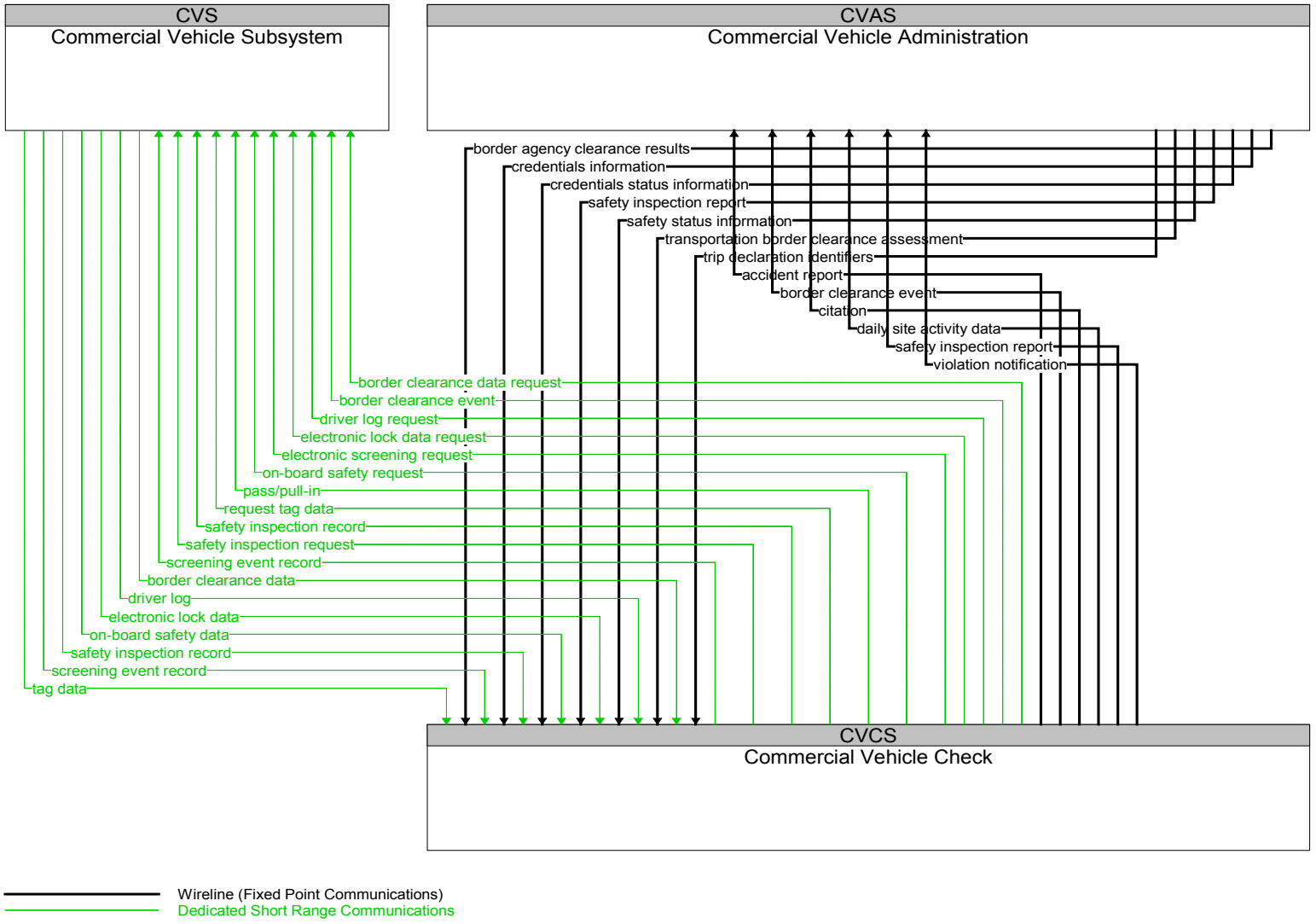


Figure 2-11 Subsystem Architecture Flow Diagram for CVS

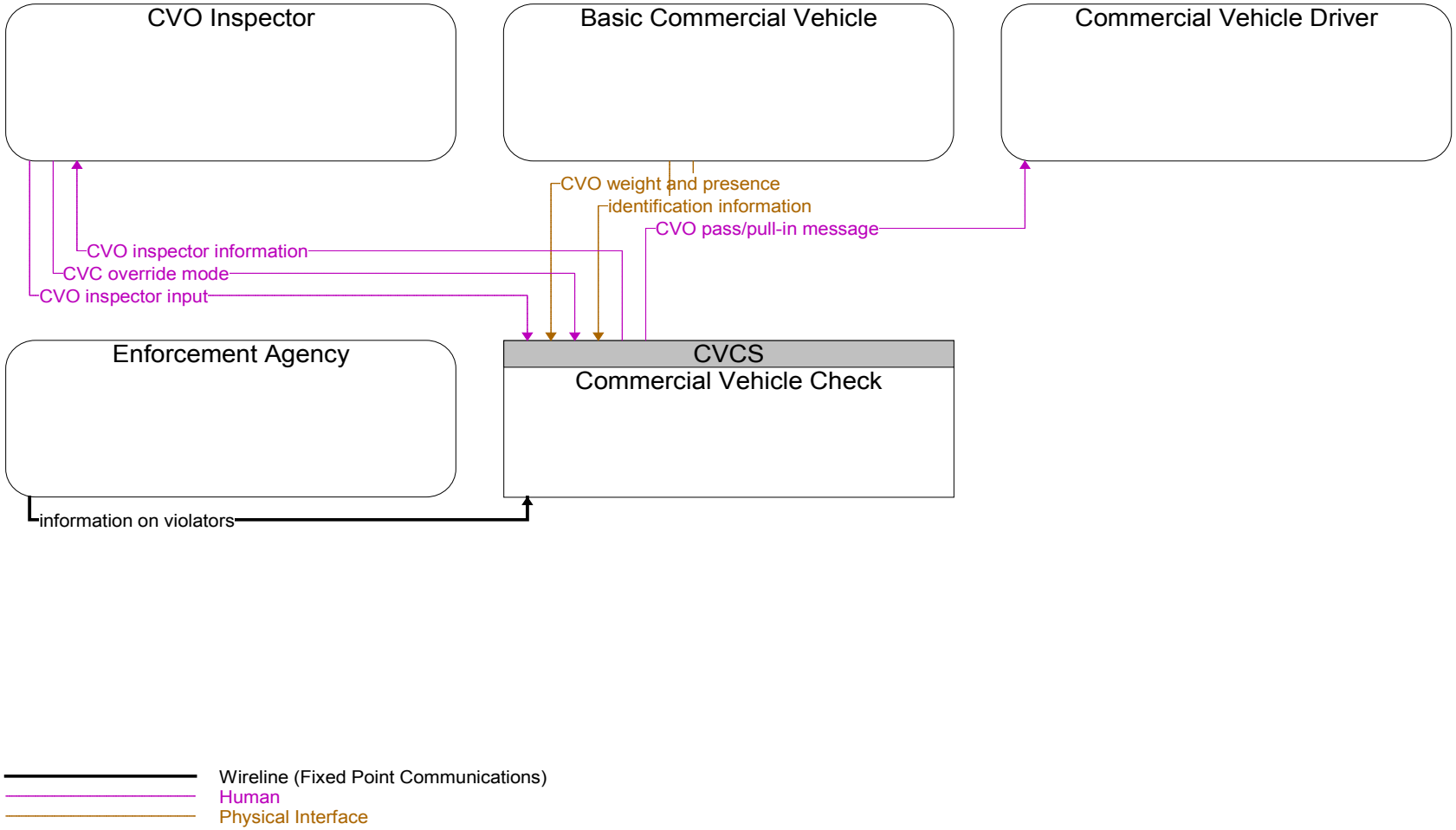


Figure 2-12 Terminator Architecture Flow Diagram for CVS

2.8 Emergency Management

The Emergency Management Subsystem represents public safety and other allied agency systems that support coordinated traffic incident management and emergency response. The subsystem includes the functions associated with fixed and mobile public safety communications centers includes various public safety call taker and dispatch centers operated by police, fire, and emergency medical services. This subsystem also represents other allied systems including centers associated with towing and recovery, freeway service patrols, HAZMAT response teams, mayday service providers, and security/surveillance services that improve traveler security in public areas. This subsystem interfaces with other Emergency Management Subsystems to support coordinated emergency response involving multiple agencies. The subsystem creates, stores, and utilizes emergency response plans to facilitate coordinated response. The subsystem tracks and manages emergency vehicle fleets using automated vehicle location technology and two way communications with the vehicle fleet. Real-time traffic information received from the other center subsystems is used to further aide the emergency dispatcher in selecting the emergency vehicle(s) and routes that will provide the most timely response. Interface with the Traffic Management Subsystem allows strategic coordination in tailoring traffic control to support en-route emergency vehicles. Interface with the Transit Management Subsystem allows coordinated use of transit vehicles to facilitate response to major emergencies.

2.8.1 Subsystem Equipment Packages and Supporting Process Specifications for EM

Emergency Call-Taking
This Equipment package supports the emergency call-taker, collecting available information about the caller and the reported emergency, and forwarding this information to other equipment packages that formulate and manage the emergency response. This equipment package receives 9-1-1, 7-digit local access, and motorist call-box calls and interfaces to other agencies to assist in the verification and assessment of the emergency and to forward the emergency information to the appropriate response agency.

Process Specifications
5.1.1 Identify Emergencies from Inputs

5.1.3 Communicate Emergency Status

5.2 Provide Operator Interface for Emergency Data

Emergency Data Collection
This equipment package collects and stores emergency information that is collected in the course of operations by the Emergency Management Subsystem. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.

Process Specifications
5.6 Manage Emergency Services Data

Emergency Dispatch
This Equipment package supports efficient dispatch of emergency vehicles. It tracks emergency vehicles, dispatches these vehicles to an incident, and provides safe and efficient routes based on real-time traffic information.

Process Specifications
5.2 Provide Operator Interface for Emergency Data

5.3.2 Dispatch Vehicle

5.3.6 Maintain Vehicle Status

5.3.7 Provide Emergency Vehicle Route

5.5 Update Emergency Display Map Data

Emergency Environmental Monitoring

This equipment package assimilates current and forecast road conditions and surface weather information from a variety of sources, including both weather service providers and vehicle probes. The collected environmental information is monitored and presented to the operator. This information can be used to more effectively manage incidents.

Process Specifications

5.1.4 Manage Emergency Response

5.3.6 Maintain Vehicle Status

Emergency Response Management

This Equipment package develops and stores emergency response plans and manages overall coordinated response to emergencies. It tracks the availability of resources and assists in the appropriate allocation of these resources for a particular emergency response. This Equipment package provides coordination between multiple allied agencies before and during emergencies to implement emergency response plans and track progress through the incident. It provides vital communications linkages which provide real-time information to emergency response personnel in the field.

Process Specifications

5.1.2 Determine Coordinated Response Plan

5.1.3 Communicate Emergency Status

5.1.4 Manage Emergency Response

5.1.5 Manage Emergency Service Allocation Store

5.2 Provide Operator Interface for Emergency Data

5.3.1 Select Response Mode

5.3.4 Assess Response Status

5.5 Update Emergency Display Map Data

Emergency Secure Area Surveillance
This Equipment package monitors Remote Traveler Subsystem locations such as transit stations, rest areas, tourist centers, park and ride lots, and other locations frequented by travelers. It provides both video and audio surveillance information to emergency personnel. It automatically alerts emergency personnel of potential incidents and supports traveler activated alarms at these locations.

Process Specifications
5.1.1 Identify Emergencies from Inputs

5.2 Provide Operator Interface for Emergency Data

Mayday Support
This Equipment package receives Mayday messages, determines an appropriate response, and either uses internal resources or contacts a local agency to provide that response. The nature of the emergency is determined based on the information in the mayday message as well as other inputs. This package effectively serves as an interface between automated mobile mayday systems and the local public safety answering point for messages which require a public safety response.

Process Specifications
5.1.1 Identify Emergencies from Inputs

5.1.2 Determine Coordinated Response Plan

5.1.3 Communicate Emergency Status

5.1.6 Process Mayday Messages

5.2 Provide Operator Interface for Emergency Data

Service Patrol Management
This equipment package supports dispatch and communication with roadway service patrol vehicles.

Process Specifications
5.1.3 Communicate Emergency Status

5.2 Provide Operator Interface for Emergency Data

5.3.2 Dispatch Vehicle

5.3.4 Assess Response Status
5.3.6 Maintain Vehicle Status

2.8.2 Subsystem Interfaces for EM

Archived Data Management Subsystem -> Emergency Management

Physical Architecture Flow Name: archive requests

A request to a data source for information on available data (i.e. "catalog") or a request that defines the data to be archived. The request can be a general subscription intended to initiate a continuous or regular data stream or a specific request intended to initiate a one-time response from the recipient.

Logical Architecture Reference Flow(s):
em_archive_request

Physical Architecture Flow Name: archive status

Notification that data provided to an archive contains erroneous, missing, or suspicious data or verification that the data provided appears valid. If an error has been detected, the offending data and the nature of the potential problem are identified.

Logical Architecture Reference Flow(s):
em_archive_status

Care Facility -> Emergency Management

Physical Architecture Flow Name: care facility status

Information regarding facility type and capabilities, facility status, and its ability to admit new patients.

Logical Architecture Reference Flow(s):
fcf_care_facility_status_response

Commercial Vehicle Subsystem -> Emergency Management

Physical Architecture Flow Name: hazmat spill notification

This data flow is used by the on-board cargo monitoring equipment package to contact emergency response organizations when the cargo sensors detect a release of hazardous material. This information will include the vehicle location discussed above as well as identifying the carrier. The information may be provided as a response to a real-time query or proactively by the source. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):
cvo_hazmat_spill_data

Emergency Management -> Archived Data Management Subsystem

Physical Architecture Flow Name: emergency archive data

Logged incident information that characterizes the identified incidents and provides a record of the corresponding incident response. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived

information.

Logical Architecture Reference Flow(s):
em_archive_data

Emergency Management -> Care Facility

Physical Architecture Flow Name: care facility status request

Request for information regarding care facility availability and status.

Logical Architecture Reference Flow(s):
tcf_care_facility_status_request

Emergency Management -> Emergency System Operator

Physical Architecture Flow Name: emergency operations status

Emergency operations data supporting a range of emergency operating positions including call taker, dispatch, and various other operations and communications center operator positions.

Logical Architecture Reference Flow(s):
teso_emergency_data_output
teso_emergency_vehicle_dispatch_failure
teso_archive_status
teso_emergency_action_log_output

Emergency Management -> Emergency Telecommunications System

Physical Architecture Flow Name: incident notification response

Interactive acknowledgement and verification of the incident information received, requests for additional information, and general information on incident response status.

Logical Architecture Reference Flow(s):
tets_incident_acknowledge

Emergency Management -> Emergency Vehicle Subsystem

Physical Architecture Flow Name: emergency dispatch requests

Emergency vehicle dispatch instructions including incident location and available information concerning the incident.

Logical Architecture Reference Flow(s):
emergency_vehicle_dispatch_request

Physical Architecture Flow Name: incident command information

Information that supports local management of an incident. It includes resource deployment status, hazardous material information, traffic, road, and weather conditions, evacuation advice, and other information that enables emergency or maintenance personnel in the field to implement an effective, safe incident response.

Logical Architecture Reference Flow(s):

local_decision_support

Physical Architecture Flow Name: suggested route

Suggested route for a dispatched emergency or maintenance vehicle that may reflect current network conditions and the additional routing options available to en route emergency or maintenance vehicles that are not available to the general public.

Logical Architecture Reference Flow(s):
emergency_vehicle_suggested_route

Emergency Management -> Event Promoters

Physical Architecture Flow Name: event confirmation

Confirmation that special event details have been received and processed.

Logical Architecture Reference Flow(s):
tevp_planned_event_confirmation

Emergency Management -> Fleet and Freight Management

Physical Architecture Flow Name: hazmat information request

Request for information about a particular hazmat load.

Logical Architecture Reference Flow(s):
cf_hazmat_request

Emergency Management -> Information Service Provider

Physical Architecture Flow Name: incident information

Notification of existence of incident and expected severity, location, time and nature of incident.

Logical Architecture Reference Flow(s):
incident_information

Emergency Management -> Maintenance and Construction Management

Physical Architecture Flow Name: incident information

Notification of existence of incident and expected severity, location, time and nature of incident.

Logical Architecture Reference Flow(s):
incident_info_from_emerg

Physical Architecture Flow Name: incident response status

Status of the current incident response including traffic management strategies implemented at the site (e.g., closures, diversions, traffic signal control overrides).

Logical Architecture Reference Flow(s):
incident_response_status_from_emerg

Physical Architecture Flow Name: maint and constr resource request

Request for road maintenance and construction resources that can be used in the diversion of traffic (cones, portable signs), clearance of a road hazard, repair of ancillary damage, or any other incident response.

Logical Architecture Reference Flow(s):

roadway_maint_action_req_from_emerg
m_and_c_resource_request_from_emerg

Physical Architecture Flow Name: road network probe information

Aggregated route usage, travel times, environmental conditions, and other aggregated data collected from probe vehicles.

Logical Architecture Reference Flow(s):

env_probe_info_from_emergency

Physical Architecture Flow Name: work plan feedback

Comments and suggested changes to proposed construction and maintenance work schedules and activities. This information influences work plan schedules so that they minimize impact to other system operations and the overall transportation system.

Logical Architecture Reference Flow(s):

m_and_c_plan_feedback_from_emerg

Emergency Management -> Map Update Provider

Physical Architecture Flow Name: map update request

Request for a map update which could include a new underlying map or map layer updates.

Logical Architecture Reference Flow(s):

tmup_emergency_route_map_request
tmup_request_emergency_display_update

Emergency Management -> Media

Physical Architecture Flow Name: incident information for media

Report of current desensitized incident information prepared for public dissemination through the media.

Logical Architecture Reference Flow(s):

tm_emergency_information

Emergency Management -> Other EM

Physical Architecture Flow Name: incident report

Report of an identified incident including incident location, type, severity and other information necessary to initiate an appropriate incident response.

Logical Architecture Reference Flow(s):

toec_mayday_emergency_data
toec_incident_details
toec_emergency_center_identity

Physical Architecture Flow Name: incident response coordination

Incident response procedures, resource coordination, and current incident response status that are shared between allied response agencies to support a coordinated response to incidents. This flow also coordinates a positive hand off of responsibility for all or part of an incident response between agencies.

Logical Architecture Reference Flow(s):
toec_incident_response_coordination

Emergency Management -> Personal Information Access

Physical Architecture Flow Name: emergency acknowledge

Acknowledge request for emergency assistance and provide additional details regarding actions and verification requirements.

Logical Architecture Reference Flow(s):
emergency_request_personal_traveler_acknowledge

Emergency Management -> Remote Traveler Support

Physical Architecture Flow Name: emergency acknowledge

Acknowledge request for emergency assistance and provide additional details regarding actions and verification requirements.

Logical Architecture Reference Flow(s):
operator_monitoring_action_command
emergency_request_traveler_acknowledge

Physical Architecture Flow Name: secure area monitoring support

Commands that control surveillance equipment and security sensors that monitor secure public transportation areas. Also includes information for general advisories and alerts intended for general dissemination in these same public areas.

Logical Architecture Reference Flow(s):
secure_area_broadcast_message

Emergency Management -> Surface Transportation Weather Service

Physical Architecture Flow Name: transportation weather information request

A request for transportation weather information that may specify the area of interest (a geographic region, particular routes within a region, specific road segments), the type of information that is required, the desired spatial resolution of the information, and time horizon.

Logical Architecture Reference Flow(s):
tstws_trans_weather_info_request

Emergency Management -> Traffic Management

Physical Architecture Flow Name: emergency traffic control request

Special request to preempt the current traffic control strategy in effect at one or more signalized intersections or highway segments. For example, this flow can request all signals to red-flash,

request a progression of traffic control preemptions along an emergency vehicle route, or request another special traffic control plan.

Logical Architecture Reference Flow(s):
emergency_traffic_control_request

Physical Architecture Flow Name: incident information

Notification of existence of incident and expected severity, location, time and nature of incident.

Logical Architecture Reference Flow(s):
incident_details

Physical Architecture Flow Name: incident response status

Status of the current incident response including traffic management strategies implemented at the site (e.g., closures, diversions, traffic signal control overrides).

Logical Architecture Reference Flow(s):
incident_response_status

Physical Architecture Flow Name: remote surveillance control

The control commands used to remotely operate another center's sensors or surveillance equipment so that roadside surveillance assets can be shared by more than one agency.

Logical Architecture Reference Flow(s):
remote_video_image_control

Physical Architecture Flow Name: resource request

A request for traffic management resources to implement special traffic control measures, assist in clean up, verify an incident, etc.

Logical Architecture Reference Flow(s):
resource_request

Physical Architecture Flow Name: road network probe information

Aggregated route usage, travel times, environmental conditions, and other aggregated data collected from probe vehicles.

Logical Architecture Reference Flow(s):
traffic_probe_info_from_evs_for_traffic

Emergency Management -> Transit Management

Physical Architecture Flow Name: transit emergency coordination data

Data exchanged between centers dealing with a transit-related incident.

Logical Architecture Reference Flow(s):
transit_incident_coordination_data

Emergency Management -> Vehicle

Physical Architecture Flow Name: emergency acknowledge

Acknowledge request for emergency assistance and provide additional details regarding actions and verification requirements.

Logical Architecture Reference Flow(s):
emergency_request_vehicle_acknowledge
emergency_request_driver_acknowledge

Physical Architecture Flow Name: emergency data request

A request for additional information or a control command issued by the emergency response agency in response to an emergency request for assistance from a traveler.

Logical Architecture Reference Flow(s):
emergency_data_request
vehicle_security_system_commands

Emergency System Operator -> Emergency Management

Physical Architecture Flow Name: emergency operations request

Emergency operator inputs supporting call taking, dispatch, and other operations and communications center operator functions.

Logical Architecture Reference Flow(s):
feso_archive_commands
feso_emergency_display_update_request
feso_emergency_data_output_request
feso_emergency_data_input
feso_emergency_allocation_override
feso_emergency_action_log_request

Emergency Telecommunications System -> Emergency Management

Physical Architecture Flow Name: incident notification

The notification of an incident including its nature, severity, and location.

Logical Architecture Reference Flow(s):
fets_incident_information
fets_caller_information

Emergency Vehicle Subsystem -> Emergency Management

Physical Architecture Flow Name: emergency dispatch response

Request for additional emergency dispatch information (e.g., a suggested route) and provision of en route status.

Logical Architecture Reference Flow(s):
emergency_vehicle_dispatch_response

Physical Architecture Flow Name: emergency vehicle tracking data

The current location and operating status of the emergency vehicle.

Logical Architecture Reference Flow(s):
emergency_vehicle_tracking_data

Physical Architecture Flow Name: environmental probe data

Current environmental conditions (e.g., air temperature, wind speed, surface temperature) as

measured by vehicle-based environmental sensors. In addition to environmental sensor inputs, this flow may also include vehicle control system information that may indicate adverse road surface conditions (e.g., traction control system activations).

Logical Architecture Reference Flow(s):
env_probe_data_from_evs

Physical Architecture Flow Name: incident command request

Request for resources, commands for relay to other allied response agencies, and other requests that reflect local command of an evolving incident response.

Logical Architecture Reference Flow(s):
incident_command_request

Physical Architecture Flow Name: incident status

Information gathered at the incident site that more completely characterizes the incident and provides current incident response status.

Logical Architecture Reference Flow(s):
incident_status_update
incident_status_data

Event Promoters -> Emergency Management

Physical Architecture Flow Name: event plans

Plans for major events possibly impacting traffic.

Logical Architecture Reference Flow(s):
fevp_planned_event_data

Fleet and Freight Management -> Emergency Management

Physical Architecture Flow Name: hazmat information

Information about a particular hazmat load including nature of the load and unloading instructions. May also include hazmat vehicle route and route update information.

Logical Architecture Reference Flow(s):
cf_hazmat_vehicle_information
cf_hazmat_route_information

Information Service Provider -> Emergency Management

Physical Architecture Flow Name: incident information request

Request for incident information, clearing time, severity. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.

Logical Architecture Reference Flow(s):
incident_information_request

Maintenance and Construction Management -> Emergency Management

Physical Architecture Flow Name: current asset restrictions

Restrictions levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.

Logical Architecture Reference Flow(s):

asset_restrictions_for_emerg

Physical Architecture Flow Name: incident information

Notification of existence of incident and expected severity, location, time and nature of incident.

Logical Architecture Reference Flow(s):

incident_info_for_emerg

Physical Architecture Flow Name: maint and constr resource response

Current status of maintenance and construction resources including availability and deployment status.

Logical Architecture Reference Flow(s):

m_and_c_resource_response_to_emerg

Physical Architecture Flow Name: maint and constr work plans

Future construction and maintenance work schedules and activities including anticipated closures with anticipated impact to the roadway, alternate routes, anticipated delays, closure times, and durations.

Logical Architecture Reference Flow(s):

m_and_c_work_plans_for_emerg

Physical Architecture Flow Name: road weather information

Road conditions and weather information that are made available by road maintenance operations to other transportation system operators.

Logical Architecture Reference Flow(s):

road_weather_info_for_emergency

Physical Architecture Flow Name: roadway maintenance status

Summary of maintenance fleet operations affecting the road network. This includes the status of winter maintenance (snow plow schedule and current status).

Logical Architecture Reference Flow(s):

roadway_maint_status_for_emerg

Physical Architecture Flow Name: work zone information

Summary of maintenance and construction work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

Logical Architecture Reference Flow(s):

work_zone_info_for_emergency

Map Update Provider -> **Emergency Management**

Physical Architecture Flow Name: map updates

Map update which could include a new underlying static or real-time map or map layer(s) update.

Logical Architecture Reference Flow(s):

fmup_emergency_route_map_update
fmup_emergency_display_update

Media -> **Emergency Management**

Physical Architecture Flow Name: media information request

Request from the media for current transportation information.

Logical Architecture Reference Flow(s):

fm_emergency_information_request

Other EM -> **Emergency Management**

Physical Architecture Flow Name: incident report

Report of an identified incident including incident location, type, severity and other information necessary to initiate an appropriate incident response.

Logical Architecture Reference Flow(s):

foec_emergency_center_identity
foec_incident_details
foec_mayday_emergency_data

Physical Architecture Flow Name: incident response coordination

Incident response procedures, resource coordination, and current incident response status that are shared between allied response agencies to support a coordinated response to incidents. This flow also coordinates a positive hand off of responsibility for all or part of an incident response between agencies.

Logical Architecture Reference Flow(s):

foec_incident_response_coordination

Personal Information Access -> **Emergency Management**

Physical Architecture Flow Name: emergency notification

An emergency request for assistance originated by a traveler using an in-vehicle, public access, or personal device.

Logical Architecture Reference Flow(s):

emergency_request_personal_traveler_details

Remote Traveler Support -> **Emergency Management**

Physical Architecture Flow Name: emergency notification

An emergency request for assistance originated by a traveler using an in-vehicle, public access, or personal device.

Logical Architecture Reference Flow(s):
secure_area_emergency_data_request
emergency_request_traveler_details

Physical Architecture Flow Name: secure area surveillance data

Data collected from surveillance systems used to monitor secure areas. Includes video, audio, and other security sensor outputs.

Logical Architecture Reference Flow(s):
secure_area_incident_data

Surface Transportation Weather Service -> Emergency Management

Physical Architecture Flow Name: transportation weather information

Current and forecast road conditions and weather information (e.g., surface condition, flooding, wind advisories, visibility, etc.) associated with the transportation network. This information is of a resolution, timeliness, and accuracy to be useful in transportation decision making.

Logical Architecture Reference Flow(s):
fstws_surface_trans_weather_forecasts
fstws_surface_trans_weather_observations

Traffic Management -> Emergency Management

Physical Architecture Flow Name: emergency traffic control response

Status of the special traffic signal control strategy implemented in response to the emergency traffic control request.

Logical Architecture Reference Flow(s):
emergency_traffic_control_response

Physical Architecture Flow Name: incident information

Notification of existence of incident and expected severity, location, time and nature of incident.

Logical Architecture Reference Flow(s):
incident_response_clear
wrong_way_vehicle_detection
incident_alert

Physical Architecture Flow Name: incident information request

Request for incident information, clearing time, severity. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.

Logical Architecture Reference Flow(s):
incident_details_request

Physical Architecture Flow Name: resource deployment status

Status of traffic management center resource deployment identifying the resources available and their current deployment status.

Logical Architecture Reference Flow(s):
resource_deployment_status

Physical Architecture Flow Name: road network conditions

Current and forecasted traffic information, road and weather conditions, incident information, and other road network status. Either raw data, processed data, or some combination of both may be provided by this architecture flow.

Logical Architecture Reference Flow(s):

incident_video_for_emergency_services
traffic_data_for_emergency_services

Transit Management -> **Emergency Management**

Physical Architecture Flow Name: transit emergency data

Initial notification of transit emergency at a transit stop or on transit vehicles and further coordination as additional details become available and the response is coordinated.

Logical Architecture Reference Flow(s):

transit_emergency_data
transit_incident_details
transit_coordination_data

Vehicle -> **Emergency Management**

Physical Architecture Flow Name: emergency notification

An emergency request for assistance originated by a traveler using an in-vehicle, public access, or personal device.

Logical Architecture Reference Flow(s):

emergency_request_driver_details
vehicle_status_update
driver_status_update
vehicle_security_system_commands_request
emergency_request_vehicle_details

Weather Service -> **Emergency Management**

Physical Architecture Flow Name: weather information

Accumulated forecasted and current weather data (e.g., temperature, pressure, wind speed, wind direction, humidity, precipitation, visibility, light conditions, etc.).

Logical Architecture Reference Flow(s):

fws_weather_forecasts
fws_current_weather_observations

2.8.3 Architecture Flow Diagrams for EM

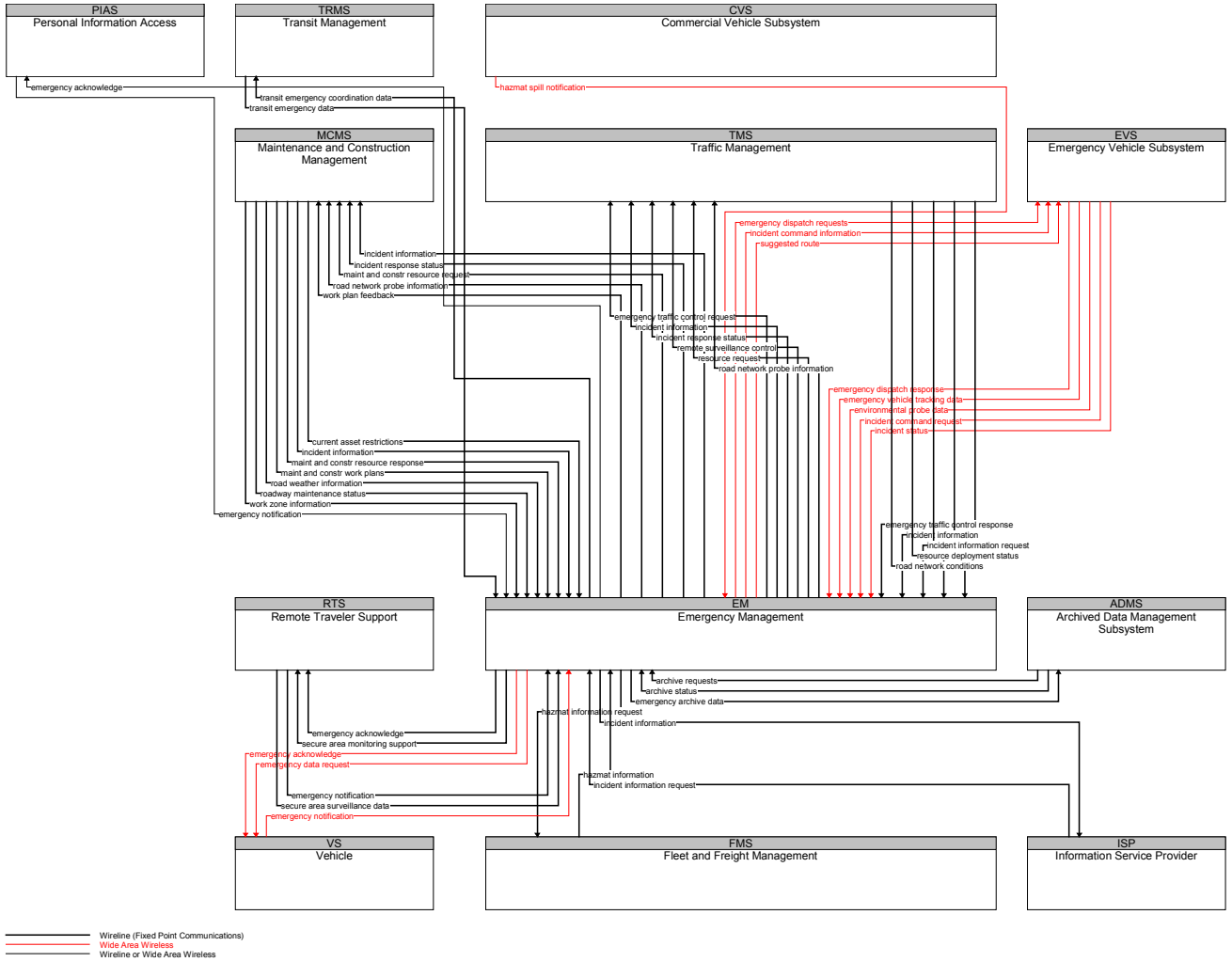


Figure 2-13 Subsystem Architecture Flow Diagram for EM

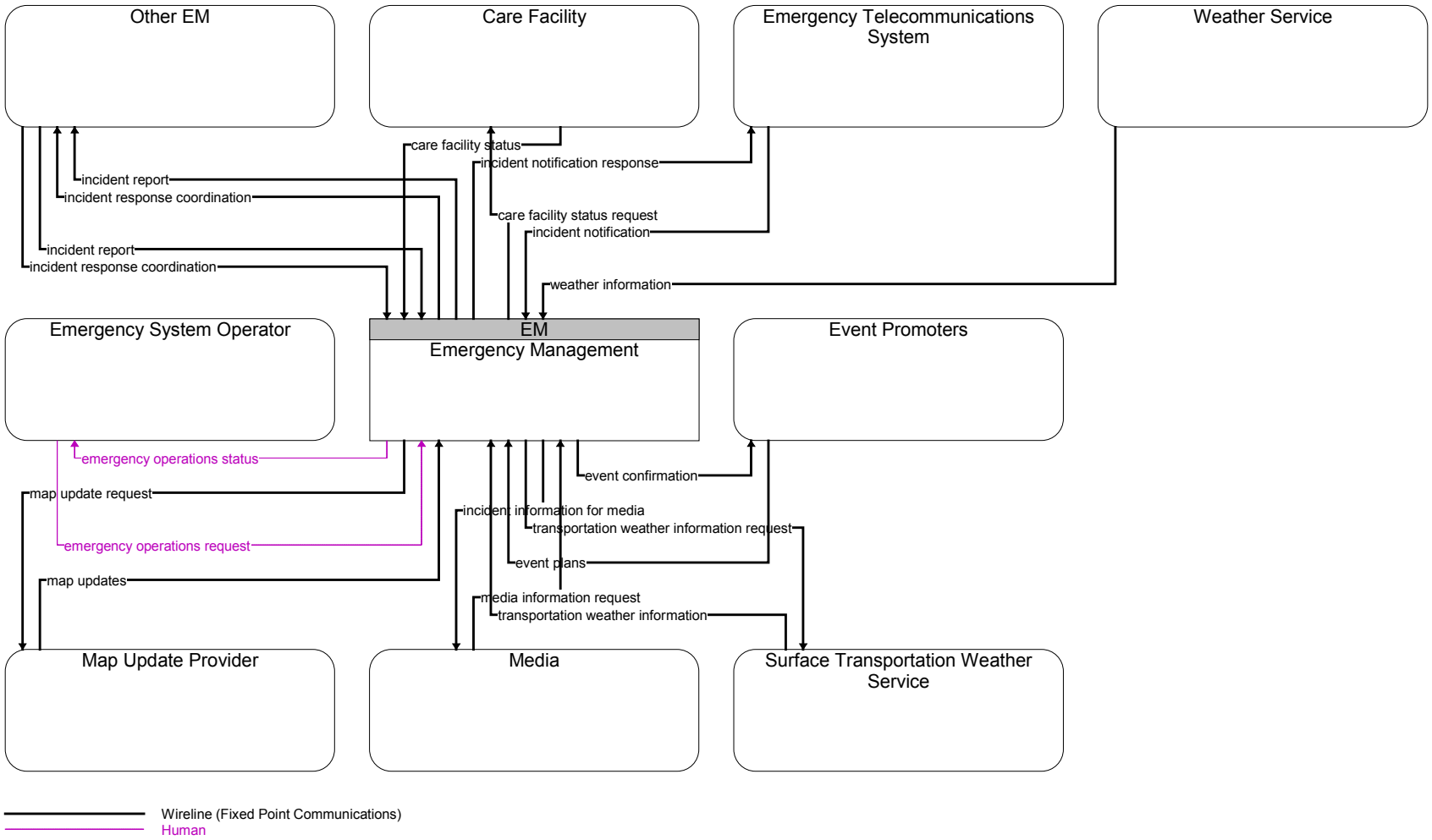


Figure 2-14 Terminator Architecture Flow Diagram for EM

2.9 Emergency Vehicle Subsystem

This subsystem resides in an emergency vehicle and provides the sensory, processing, storage, and communications functions necessary to support safe and efficient incident response. The subsystem represents a range of vehicles including those operated by police, fire, and emergency medical services. In addition, this subsystem represents other incident response vehicles including towing and recovery vehicles and freeway service patrols. The Emergency Vehicle Subsystem includes two-way communications to support coordinated response to emergencies in accordance with an associated Emergency Management Subsystem. Emergency vehicles are equipped with automated vehicle location capability for monitoring by vehicle tracking and fleet management functions in the Emergency Management Subsystem. Using these capabilities, the appropriate emergency vehicle to respond to each emergency is determined. Route guidance capabilities within the vehicle enable safe and efficient routing to the emergency. In addition, the emergency vehicle may be equipped to support signal preemption through communications with the Roadway Subsystem.

2.9.1 Subsystem Equipment Packages and Supporting Process Specifications for EVS

On-board EV En Route Support

This Equipment package provides capabilities that support safe and expedient arrival to and departure from the incident scene. This package provides dispatch and routing information, tracks the vehicle, and preempt signals via short range communication directly with traffic control equipment at the roadside.

Process Specifications

5.3.3 Track Vehicle

5.3.5 Provide Emergency Personnel Interface

On-Board EV Environmental Monitoring

This equipment package collects current road and weather conditions using sensor systems. Environmental information including road surface temperature and air temperature is measured and spatially located and time stamped.

Process Specifications

5.3.8 Collect Environmental Data on Emergency Vehicle

On-board EV Incident Management Communication

This Equipment package provides a direct interface between the emergency vehicle and incident management personnel.

Process Specifications

5.3.5 Provide Emergency Personnel Interface

2.9.2 Subsystem Interfaces for EVS

Care Facility	->	**Emergency Vehicle Subsystem**

Physical Architecture Flow Name: care facility status

Information regarding facility type and capabilities, facility status, and its ability to admit new patients.

Logical Architecture Reference Flow(s):

fcf_care_facility_vehicle_status_response

Emergency Management -> Emergency Vehicle Subsystem

Physical Architecture Flow Name: emergency dispatch requests

Emergency vehicle dispatch instructions including incident location and available information concerning the incident.

Logical Architecture Reference Flow(s):

emergency_vehicle_dispatch_request

Physical Architecture Flow Name: incident command information

Information that supports local management of an incident. It includes resource deployment status, hazardous material information, traffic, road, and weather conditions, evacuation advice, and other information that enables emergency or maintenance personnel in the field to implement an effective, safe incident response.

Logical Architecture Reference Flow(s):

local_decision_support

Physical Architecture Flow Name: suggested route

Suggested route for a dispatched emergency or maintenance vehicle that may reflect current network conditions and the additional routing options available to en route emergency or maintenance vehicles that are not available to the general public.

Logical Architecture Reference Flow(s):

emergency_vehicle_suggested_route

Emergency Personnel -> Emergency Vehicle Subsystem

Physical Architecture Flow Name: emergency personnel inputs

Current incident status information and requests from emergency personnel in the field for information and/or resources.

Logical Architecture Reference Flow(s):

fep_emergency_dispatch_acknowledge
fep_incident_status
fep_incident_command_request

Emergency Vehicle Subsystem -> Care Facility

Physical Architecture Flow Name: care facility status request

Request for information regarding care facility availability and status.

Logical Architecture Reference Flow(s):
tcf_care_facility_vehicle_status_request

Physical Architecture Flow Name: patient status

Information that supports assessment of the patient's condition. Information could include general categorization of patient status, patient vital signs, pertinent medical history, and emergency care information.

Logical Architecture Reference Flow(s):
tcf_emergency_vehicle_patient_status_update

Emergency Vehicle Subsystem -> Emergency Management

Physical Architecture Flow Name: emergency dispatch response

Request for additional emergency dispatch information (e.g., a suggested route) and provision of en route status.

Logical Architecture Reference Flow(s):
emergency_vehicle_dispatch_response

Physical Architecture Flow Name: emergency vehicle tracking data

The current location and operating status of the emergency vehicle.

Logical Architecture Reference Flow(s):
emergency_vehicle_tracking_data

Physical Architecture Flow Name: environmental probe data

Current environmental conditions (e.g., air temperature, wind speed, surface temperature) as measured by vehicle-based environmental sensors. In addition to environmental sensor inputs, this flow may also include vehicle control system information that may indicate adverse road surface conditions (e.g., traction control system activations).

Logical Architecture Reference Flow(s):
env_probe_data_from_evs

Physical Architecture Flow Name: incident command request

Request for resources, commands for relay to other allied response agencies, and other requests that reflect local command of an evolving incident response.

Logical Architecture Reference Flow(s):
incident_command_request

Physical Architecture Flow Name: incident status

Information gathered at the incident site that more completely characterizes the incident and provides current incident response status.

Logical Architecture Reference Flow(s):
incident_status_data
incident_status_update

Emergency Vehicle Subsystem -> Emergency Personnel

Physical Architecture Flow Name: dispatch information

Dispatch information and command to emergency personnel.

Logical Architecture Reference Flow(s):
tep_emergency_dispatch_order

Physical Architecture Flow Name: incident command information presentation

Presentation of information to emergency personnel in the field that supports local tactical decision-making within an incident command system structure.

Logical Architecture Reference Flow(s):
tep_decision_support

Emergency Vehicle Subsystem -> Roadway Subsystem

Physical Architecture Flow Name: local signal preemption request

Direct control signal or message to a signalized intersection that results in preemption of the current control plan and grants right-of-way to the requesting vehicle.

Logical Architecture Reference Flow(s):
emergency_vehicle_preemptions

Roadway Environment -> Emergency Vehicle Subsystem

Physical Architecture Flow Name: environmental conditions

Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) that are measured by environmental sensors.

Logical Architecture Reference Flow(s):
fre_environmental_conditions

Vehicle -> Emergency Vehicle Subsystem

Physical Architecture Flow Name: vehicle location

Location of vehicle and other vehicle characteristics which are exchanged between vehicle subsystems.

Logical Architecture Reference Flow(s):
vehicle_location_for_emergency_services

2.9.3 Architecture Flow Diagrams for EVS

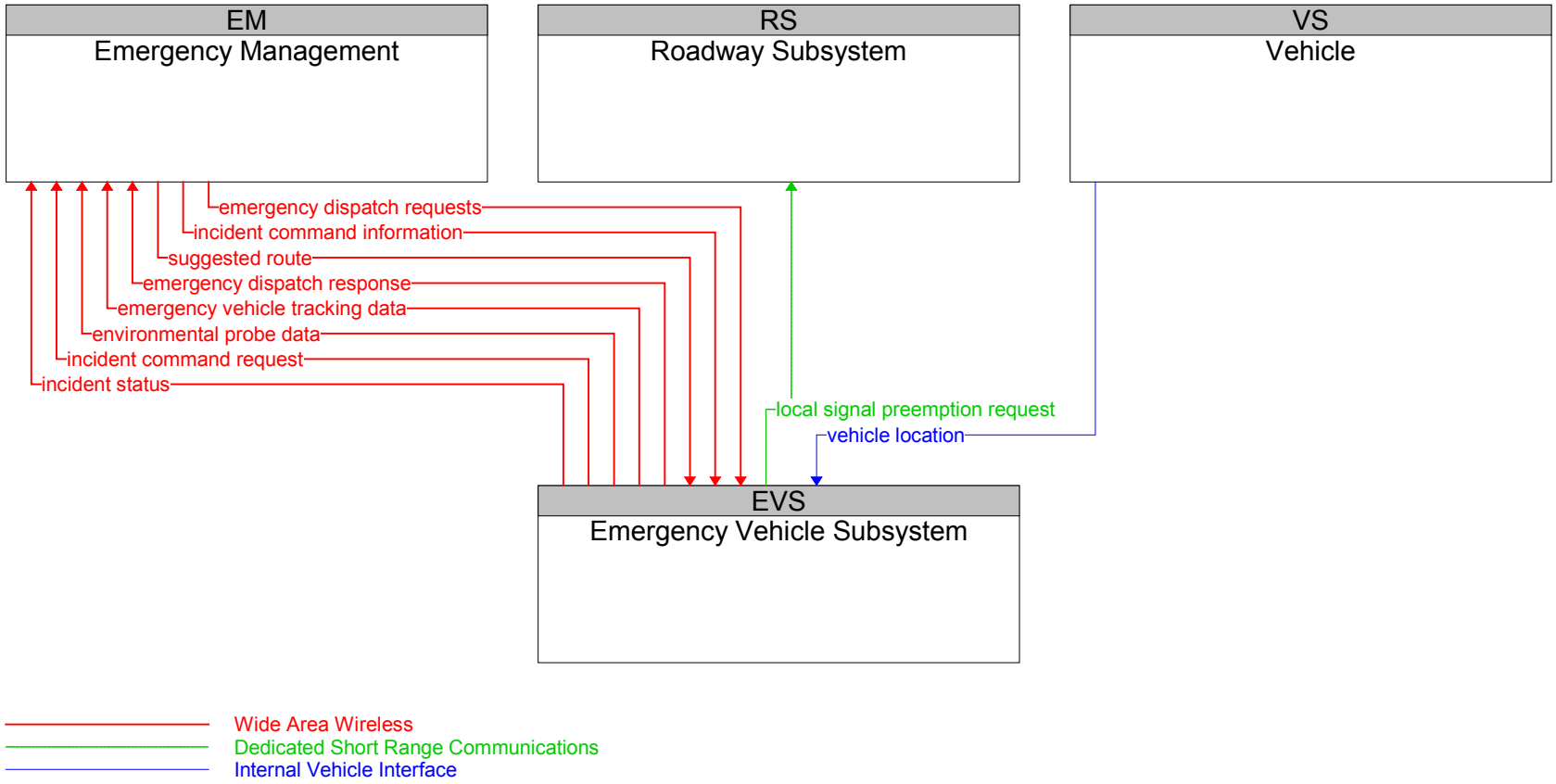


Figure 2-15 Subsystem Architecture Flow Diagram for EVS

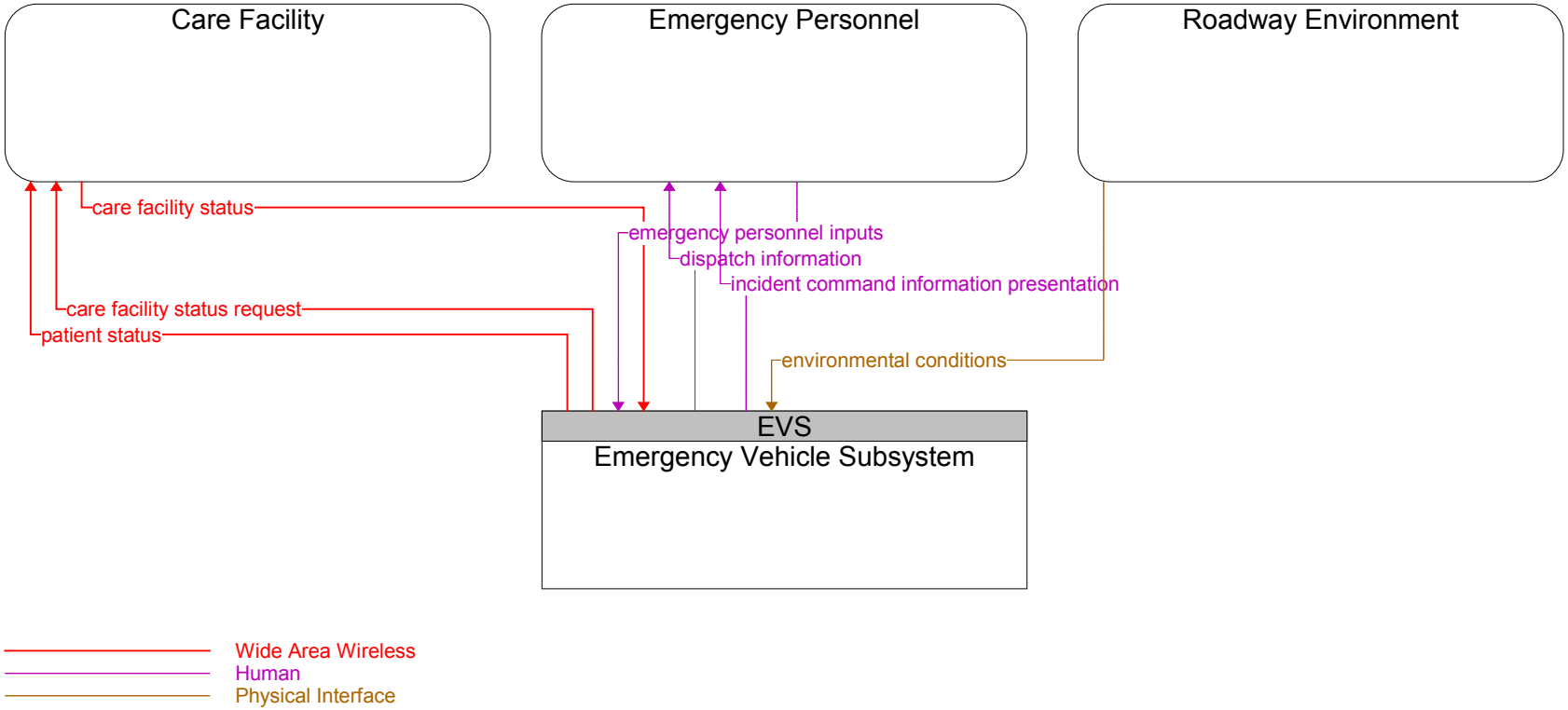


Figure 2-16 Terminator Architecture Flow Diagram for EVS

2.10 Emissions Management Subsystem

This subsystem operates at a fixed location and may co-reside with the Traffic Management Subsystem or may operate in its own distinct location depending on regional preferences and priorities. This subsystem provides the capabilities for air quality managers to monitor and manage air quality. These capabilities include collecting emissions data from distributed emissions sensors within the roadway subsystem. These sensors monitor general air quality within each sector of the area and also monitor the emissions of individual vehicles on the roadway. The sector emissions measures are collected, processed, and used to identify sectors exceeding safe pollution levels. This information is provided to toll administration, traffic management, and transit management systems and used to implement strategies intended to reduce emissions in and around the problem areas. Emissions data associated with individual vehicles, supplied by the Roadway Subsystem, is also processed and monitored to identify vehicles that exceed standards. This subsystem provides any functions necessary to inform the violators and otherwise ensure timely compliance with the emissions standards.

2.10.1 Subsystem Equipment Packages and Supporting Process Specifications for EMMS

Emissions Data Collection
This equipment package collects and stores air quality and emissions management information that is collected in the course of Emissions Management Subsystem operations. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.

Process Specifications
1.5.9 Manage Pollution Archive Data

Emissions Data Management
This Equipment package assimilates and stores air quality measures and roadside collected emissions data. General air quality measures are distributed as general traveler information and also may be used for in demand management programs. Collected roadside emissions are analyzed and used to detect, identify, and notify concerned parties regarding vehicles that exceed emissions standards.

Process Specifications
1.5.1 Provide Traffic Operations Personnel Pollution Data Interface

1.5.2 Process Pollution Data

1.5.3 Update Pollution Display Map Data

1.5.4 Manage Pollution State Data Store

1.5.7 Manage Pollution Data Log

1.5.8 Manage Pollution Reference Data Store

2.10.2 Subsystem Interfaces for EMMS

Archived Data Management Subsystem -> **Emissions Management**

Physical Architecture Flow Name: archive requests

A request to a data source for information on available data (i.e. "catalog") or a request that defines the data to be archived. The request can be a general subscription intended to initiate a continuous or regular data stream or a specific request intended to initiate a one-time response from the recipient.

Logical Architecture Reference Flow(s):

emissions_archive_request

Physical Architecture Flow Name: archive status

Notification that data provided to an archive contains erroneous, missing, or suspicious data or verification that the data provided appears valid. If an error has been detected, the offending data and the nature of the potential problem are identified.

Logical Architecture Reference Flow(s):

emissions_archive_status

Emissions Management -> **Archived Data Management Subsystem**

Physical Architecture Flow Name: emissions archive data

Air quality and vehicle emissions information that is collected by sensors or derived from models. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.

Logical Architecture Reference Flow(s):

emissions_archive_data

Emissions Management -> **Information Service Provider**

Physical Architecture Flow Name: air quality information

Aggregated region-wide measured air quality data and possible pollution incident information.

Logical Architecture Reference Flow(s):

current_traffic_pollution_data

Emissions Management -> **Map Update Provider**

Physical Architecture Flow Name: map update request

Request for a map update which could include a new underlying map or map layer updates.

Logical Architecture Reference Flow(s):

tmup_request_pollution_display_update

Emissions Management -> **Media**

Physical Architecture Flow Name: air quality information

Aggregated region-wide measured air quality data and possible pollution incident information.

Logical Architecture Reference Flow(s):

tm_pollution_data

Emissions Management -> Roadway Subsystem

Physical Architecture Flow Name: vehicle pollution criteria

Vehicular pollution acceptance criteria.

Logical Architecture Reference Flow(s):

pollution_state_vehicle_acceptance_criteria

Emissions Management -> Traffic Management

Physical Architecture Flow Name: widearea statistical pollution information

Aggregated region-wide measured emissions data and possible pollution incident information.

Logical Architecture Reference Flow(s):

pollution_incident
pollution_state_data
wide_area_pollution_data

Emissions Management -> Traffic Operations Personnel

Physical Architecture Flow Name: pollution data display

Both reference and current pollution status details for a given geographic area.

Logical Architecture Reference Flow(s):

ttop_pollution_data_display

Environment -> Emissions Management

Physical Architecture Flow Name: pollutant levels

Atmospheric pollutant levels as monitored by air quality sensors.

Logical Architecture Reference Flow(s):

fe_area_pollutant_levels

Map Update Provider -> Emissions Management

Physical Architecture Flow Name: map updates

Map update which could include a new underlying static or real-time map or map layer(s) update.

Logical Architecture Reference Flow(s):

fmup_pollution_display_update

Roadway Subsystem -> Emissions Management

Physical Architecture Flow Name: pollution data

Measured emissions data comprised of various atmospheric pollutants.

Logical Architecture Reference Flow(s):

pollution_state_vehicle_collection
pollution_state_vehicle_log_data

pollution_state_roadside_collection

Traffic Management -> **Emissions Management**

Physical Architecture Flow Name: pollution state data request

Aggregated emissions data information request.

Logical Architecture Reference Flow(s):

pollution_state_data_request

Traffic Operations Personnel -> **Emissions Management**

Physical Architecture Flow Name: pollution data parameters

Nominal pollution data compliance (reference) levels for each sector of an urban area.

Logical Architecture Reference Flow(s):

ftop_pollution_data_information_request
ftop_pollution_parameter_updates

2.10.3 Architecture Flow Diagrams for EMMS

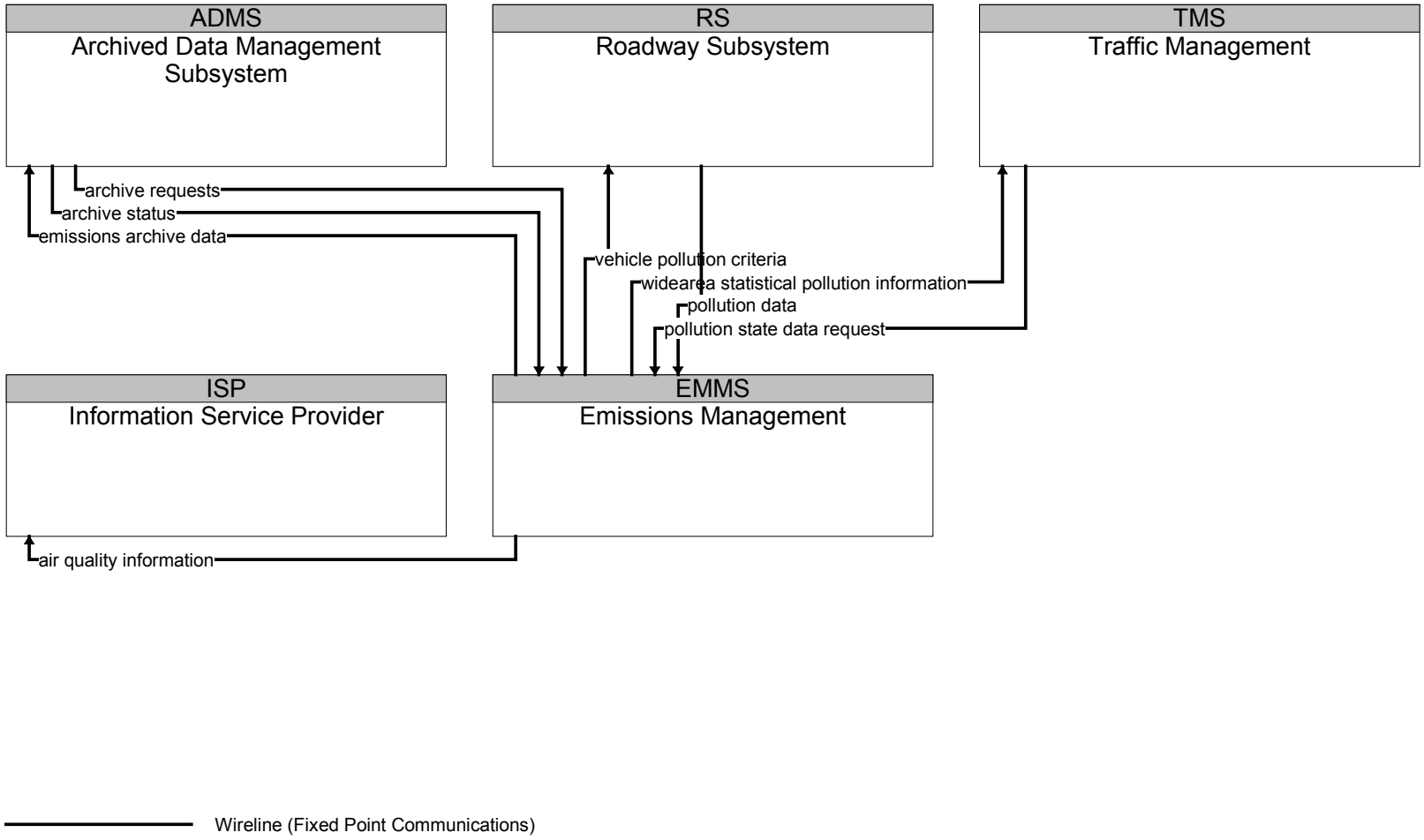


Figure 2-17 Subsystem Architecture Flow Diagram for EMMS

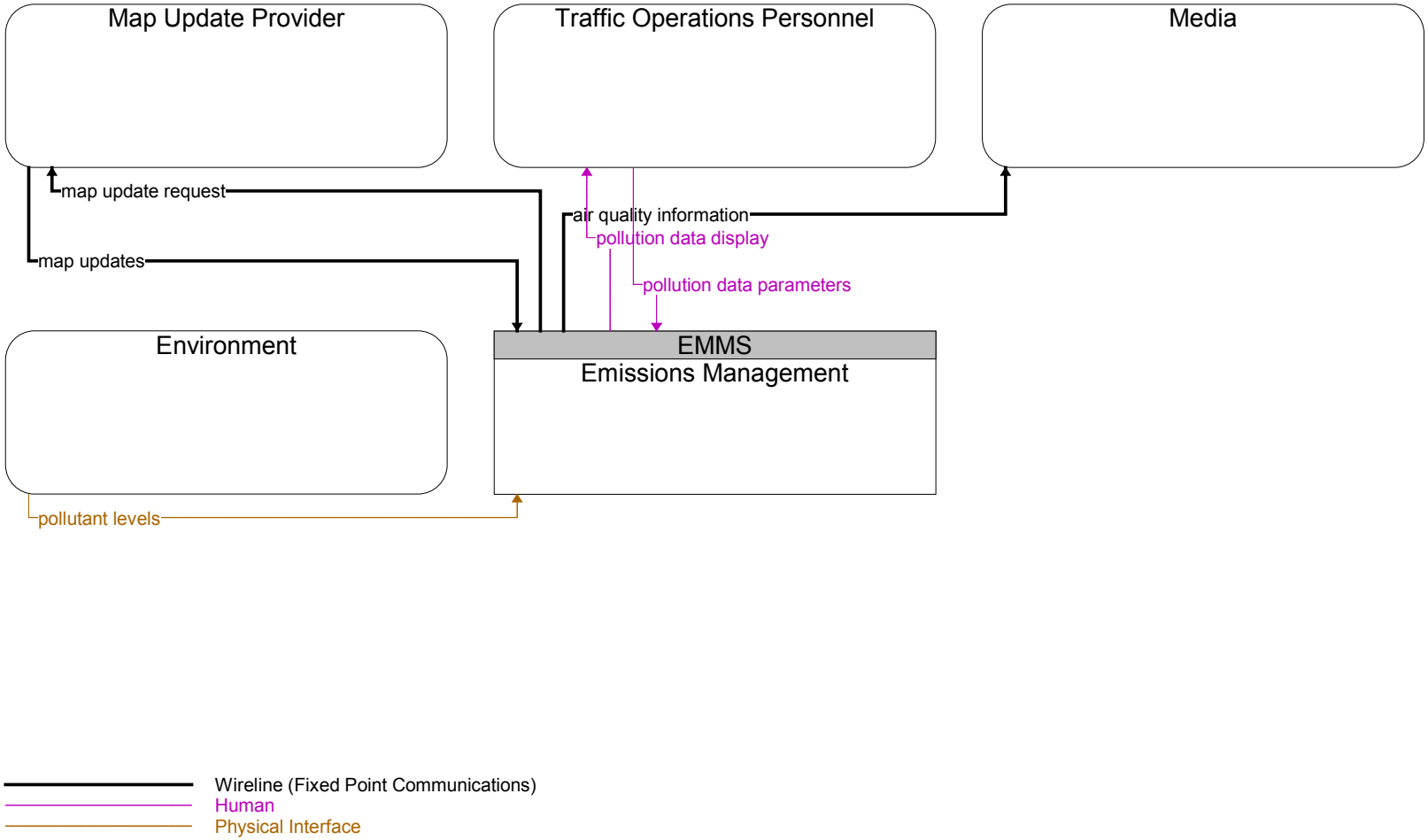


Figure 2-18 Terminator Architecture Flow Diagram for EMMS

2.11 Fleet and Freight Management

The Fleet and Freight Management Subsystem provides the capability for commercial drivers and dispatchers to receive real-time routing information and access databases containing vehicle and cargo locations as well as carrier, vehicle, cargo and driver information. In addition, the capability to purchase credentials electronically shall also be provided, with automated and efficient connections to financial institutions and regulatory agencies, along with post-trip automated mileage and fuel usage reporting. The Fleet Management Subsystem also provides the capability for fleet managers to monitor the safety of their commercial vehicle drivers and fleet. The subsystem also supports application for hazmat credentials and makes information about hazmat cargo available to agencies as required. Within this subsystem lies all the functionality associated with subsystems and components necessary to enroll and participate in international goods movement programs aimed at enhancing trade and transportation safety.

2.11.1 Subsystem Equipment Packages and Supporting Process Specifications for FMS

Fleet Administration
This Equipment package provides vehicle tracking, dispatch, and reporting capabilities to fleet management center personnel. It gathers current road conditions and traffic information, prepares vehicle routes, and provides a fleet interface for toll collection. It also provides route plan information for network performance evaluation.

Process Specifications

2.1.1 Manage Commercial Fleet Electronic Credentials and Tax Filing

2.1.2 Provide Commercial Fleet Static Route

2.1.3 Provide Flt Mgr Electronic Credentials and Tax Filing Interface

2.1.4 Provide Fleet Manager Commercial Vehicle Communications

2.1.6 Manage Driver Instruction Store

2.6.1 Provide Commercial Vehicle Manager Tag Data Interface

Fleet Credentials and Taxes Management and Reporting
This Equipment package provides the Fleet and Freight Management Subsystem the capabilities to purchase credentials and file trip reports electronically by the fleet managers, to perform automated enrollment at the roadside facilities, and electronically manage the credentials checking by the roadside commercial vehicle inspectors. The electronic purchase shall be performed in accordance with developing standards such that a single integrated system for electronic payments might develop ensuring that deployment across multiple agency political boundaries is performed without degradation. Inherent to credential management shall be the management of the vehicles, with a prerequisite of the vehicle tracking software from the Fleet Administration Equipment package.

Process Specifications

2.1.1 Manage Commercial Fleet Electronic Credentials and Tax Filing

2.1.3 Provide Flt Mgr Electronic Credentials and Tax Filing Interface

2.2.1 Manage CV Electronic Credential and Tax Filing Interface

Fleet HAZMAT Management
This Equipment package provides the Fleet and Freight Management Subsystem the capabilities to enhance the Fleet Administration Equipment package functions by adding HAZMAT tracking. The additional requirements to perform this function include enhanced processing and enhanced fleet management software. In order to effectively track HAZMAT cargo, communication interfaces to Information Service Providers, and Emergency Management Subsystems shall be provided, including additional communication software.

Process Specifications
2.1.1 Manage Commercial Fleet Electronic Credentials and Tax Filing

Fleet Maintenance Management
This Equipment package provides the capability to use vehicle mileage data to automatically generate preventative maintenance schedules for each specific vehicle by utilizing vehicle tracking data from the prerequisite tracking Equipment package. In addition, capability to automatically ensure that proper service personnel are provided information for maintenance activities and to record and verify that maintenance work was performed shall be provided.

Process Specifications
2.1.3 Provide Flt Mgr Electronic Credentials and Tax Filing Interface

2.1.6 Manage Driver Instruction Store

Freight Administration and Management
This equipment package provides the communication necessary to track cargo from source to destination via links to intermodal freight shippers and depots. There are also communication links to cargo routing services.

Process Specifications
2.6.1 Provide Commercial Vehicle Manager Tag Data Interface
2.7 Manage Cargo

2.11.2 Subsystem Interfaces for FMS

Commercial Vehicle Administration -> Fleet and Freight Management

Physical Architecture Flow Name: accident report

Report of commercial vehicle safety accident. The information may be provided as a response to a real-time query or proactively by the source. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):
cvo_accident_data_for_fleet

Physical Architecture Flow Name: border clearance status

Notification regarding the crossing status of commercial freight shipment scheduled to enter the U.S. Includes portions of border agency and transportation agency clearance results, as they become available. Recipients may include trade regulatory agencies that do not receive status information directly from U.S. Customs (e.g., other transportation agencies with trade related responsibilities, such as NHTSA, MARAD, etc.)

Logical Architecture Reference Flow(s):

cvo_border_clearance_for_fleet

Physical Architecture Flow Name: citation

Report of commercial vehicle citation. The citation includes references to the statute(s) that was (were) violated. It includes information on the violator and the officer issuing the citation. A citation differs from a violation because it is adjudicated by the courts. The information may be provided as a response to a real-time query or proactively by the source. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):

cvo_citation

Physical Architecture Flow Name: compliance review report

Report containing results of carrier compliance review, including concomitant out-of-service notifications, carrier warnings/notifications. The information may be provided as a response to a real-time query of proactively by the source. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):

cf_roadside_activity_report

Physical Architecture Flow Name: credentials information

Response containing full credentials information. "Response" may be provided in reaction to a real-time query or a standing request for updated information. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):

cv_enrollment_payment_confirmation
cv_enrollment_information
cf_enrollment_information
cf_enrollment_payment_confirmation

Physical Architecture Flow Name: credentials status information

Credentials information such as registration, licensing, insurance, check flags, and electronic screening enrollment data. A unique identifier is included. Corresponds to the credentials portion of CVISN "snapshots." The status information may be provided as a response to a real-time query or as a result of a standing request for updated information (subscription). This may also include information about non-U.S. fleets for use by U.S. authorities, and information regarding U.S. fleets made available to Mexican and Canadian authorities. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):

cvo_credential_status

Physical Architecture Flow Name: safety inspection report

Report containing results of commercial vehicle safety inspection. The information may be provided as a response to a real-time query or proactively by the source. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):

cf_periodic_activity_report

Physical Architecture Flow Name: safety status information

Safety information such as safety ratings, inspection summaries, and violation summaries. A unique identifier is included. Corresponds to the safety portion of CVISN "snapshots." The status information may be provided as a response to a real-time query or as a result of a standing request for updated information (subscription). This may also include information about non-U.S. fleets for use by U.S. authorities, and information regarding U.S. fleets made available to Mexican and Canadian authorities. The query flow is not explicitly shown.

Logical Architecture Reference Flow(s):
cvo_safety_status

Commercial Vehicle Manager -> Fleet and Freight Management

Physical Architecture Flow Name: fleet manager inquiry

Inquiry from fleet manager requesting data from commercial vehicle management system.

Logical Architecture Reference Flow(s):
fcvm_carrier_number
fcvm_enrollment_payment_request
fcvm_update_driver_route_instructions
fcvm_enrollment_request
fcvm_route_data
fcvm_trip_identity
fcvm_vehicle_number
fcvm_request_on_board_vehicle_data
fcvm_other_data_input
fcvm_request_tag_data_output
fcvm_roadside_activity_report_request
fcvm_preclearance_data
fcvm_route_function_request
fcvm_request_driver_route_instructions
fcvm_driver_number

Commercial Vehicle Subsystem -> Fleet and Freight Management

Physical Architecture Flow Name: driver to fleet request

Requests from the driver and vehicle for routing, payment, and enrollment information.

Logical Architecture Reference Flow(s):
cv_static_route_data
cf_driver_route_instructions_request
cv_driver_enrollment_payment_request
cv_driver_enrollment_request
cv_driver_storage_request
cv_driver_route_request

Physical Architecture Flow Name: on-board safety data

Safety data measured by on-board sensors. Includes information about the vehicle, vehicle components, cargo, and driver.

Logical Architecture Reference Flow(s):
cvo_tag_safety_data
cvo_on_board_safety_data

Physical Architecture Flow Name: on-board vehicle data

Information about the commercial vehicle stored on-board (for maintenance purposes, gate access, cargo status, lock status, etc.).

Logical Architecture Reference Flow(s):
cf_tag_data_store_output
cf_on_board_vehicle_data

Physical Architecture Flow Name: trip log

Driver's daily log, vehicle location, mileage, and trip activity (includes screening, inspection and border clearance event data as well as fare payments).

Logical Architecture Reference Flow(s):
cvo_trip_log_data

Emergency Management -> Fleet and Freight Management

Physical Architecture Flow Name: hazmat information request

Request for information about a particular hazmat load.

Logical Architecture Reference Flow(s):
cf_hazmat_request

Fleet and Freight Management -> Commercial Vehicle Administration

Physical Architecture Flow Name: audit data

Information to support a tax audit.

Logical Architecture Reference Flow(s):
cvo_audit_data

Physical Architecture Flow Name: credential application

Application for commercial vehicle credentials. Authorization for payment is included.

Logical Architecture Reference Flow(s):
cv_enrollment_request
cf_enrollment_request

Physical Architecture Flow Name: tax filing

Commercial vehicle tax filing data. Authorization for payment is included.

Logical Architecture Reference Flow(s):
cf_tax_data

Fleet and Freight Management -> Commercial Vehicle Manager

Physical Architecture Flow Name: fleet status

Fleet status information including enrollment status, routing information, current vehicle information, and emergency information.

Logical Architecture Reference Flow(s):
tcvm_enrollment_payment_confirmation
tcvm_confirm_enrollment_data_stored
tcvm_route_data
tcvm_data_input_request
tcvm_roadside_activity_report
tcvm_output_tag_data
tcvm_enrollment_confirmation
tcvm_preclearance_results
tcvm_other_data_request
tcvm_driver_route_instructions

Fleet and Freight Management -> Commercial Vehicle Subsystem

Physical Architecture Flow Name: fleet to driver update

Updated instructions to the driver including dispatch, routing, and special instructions.

Logical Architecture Reference Flow(s):

cv_static_route_request
cv_driver_enrollment_information
cf_driver_route_instructions
cf_tag_data_store_request
cvo_general_message
cf_tag_data_store_write
cv_driver_enrollment_payment_confirmation
cv_driver_route_data

Physical Architecture Flow Name: on-board safety request

Request for on-board vehicle safety data by the roadside equipment.

Logical Architecture Reference Flow(s):

cvo_on_board_safety_data_request
cvo_tag_safety_data_request

Physical Architecture Flow Name: on-board vehicle request

Request for on-board vehicle data.

Logical Architecture Reference Flow(s):

cvo_on_board_vehicle_data_request
cvo_tag_data_store_request

Physical Architecture Flow Name: trip identification number

The unique trip load number for a specific cross-border shipment.

Logical Architecture Reference Flow(s):

cvo_trip_identification_number

Physical Architecture Flow Name: trip log request

Request for trip log.

Logical Architecture Reference Flow(s):

cvo_trip_log_data_request

Fleet and Freight Management -> Emergency Management

Physical Architecture Flow Name: hazmat information

Information about a particular hazmat load including nature of the load and unloading instructions. May also include hazmat vehicle route and route update information.

Logical Architecture Reference Flow(s):

cf_hazmat_vehicle_information
cf_hazmat_route_information

Fleet and Freight Management -> Information Service Provider

Physical Architecture Flow Name: route request

Request for a tailored route based on given constraints.

Logical Architecture Reference Flow(s):

cv_route_request
cf_route_request

Physical Architecture Flow Name: toll data request

Request made to obtain toll schedule information or pay a toll in advance. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.

Logical Architecture Reference Flow(s):

cvo_advanced_payments_request
toll_price_for_cvo_request

Fleet and Freight Management -> Intermodal Freight Depot

Physical Architecture Flow Name: intermod CVO coord

Cargo movement logs, routing information, and cargo ID's.

Logical Architecture Reference Flow(s):

tifd_freight_request

Fleet and Freight Management -> Intermodal Freight Shipper

Physical Architecture Flow Name: intermod CVO coord

Cargo movement logs, routing information, and cargo ID's.

Logical Architecture Reference Flow(s):

To_Intermodal_Freight_Shipper

Fleet and Freight Management -> Toll Administration

Physical Architecture Flow Name: toll data request

Request made to obtain toll schedule information or pay a toll in advance. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.

Logical Architecture Reference Flow(s):

cvo_advanced_toll_request
cvo_toll_price_request

Information Service Provider -> Fleet and Freight Management

Physical Architecture Flow Name: road network conditions

Current and forecasted traffic information, road and weather conditions, incident information, and other road network status. Either raw data, processed data, or some combination of both may be

provided by this architecture flow.

Logical Architecture Reference Flow(s):
traffic_data_for_cvo

Physical Architecture Flow Name: route plan

Tailored route provided by ISP in response to a specific request.

Logical Architecture Reference Flow(s):
cf_route
cv_route

Physical Architecture Flow Name: toll data

Current toll schedules for different types of vehicles as well as advanced toll payment information.

Logical Architecture Reference Flow(s):
cvo_advanced_toll_payment_information
toll_price_for_cvo

Intermodal Freight Depot -> Fleet and Freight Management

Physical Architecture Flow Name: intermod CVO coord

Cargo movement logs, routing information, and cargo ID's.

Logical Architecture Reference Flow(s):
fifd_freight_data

Intermodal Freight Shipper -> Fleet and Freight Management

Physical Architecture Flow Name: intermod CVO coord

Cargo movement logs, routing information, and cargo ID's.

Logical Architecture Reference Flow(s):
From_Intermodal_Freight_Shipper

Toll Administration -> Fleet and Freight Management

Physical Architecture Flow Name: toll data

Current toll schedules for different types of vehicles as well as advanced toll payment information.

Logical Architecture Reference Flow(s):
cvo_advanced_toll_confirmation
cvo_toll_price

2.11.3 Architecture Flow Diagrams for FMS

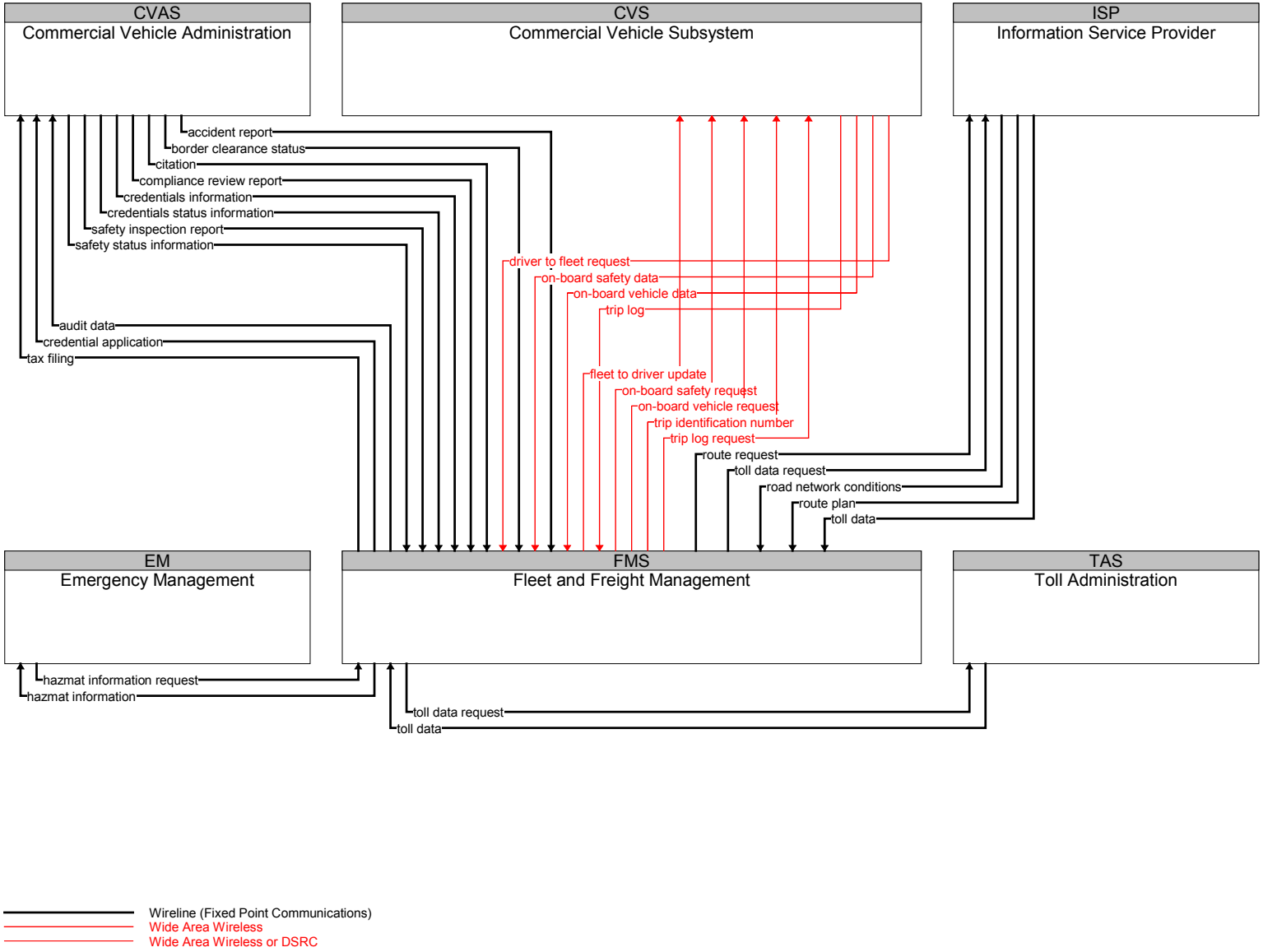


Figure 2-19 Subsystem Architecture Flow Diagram for FMS

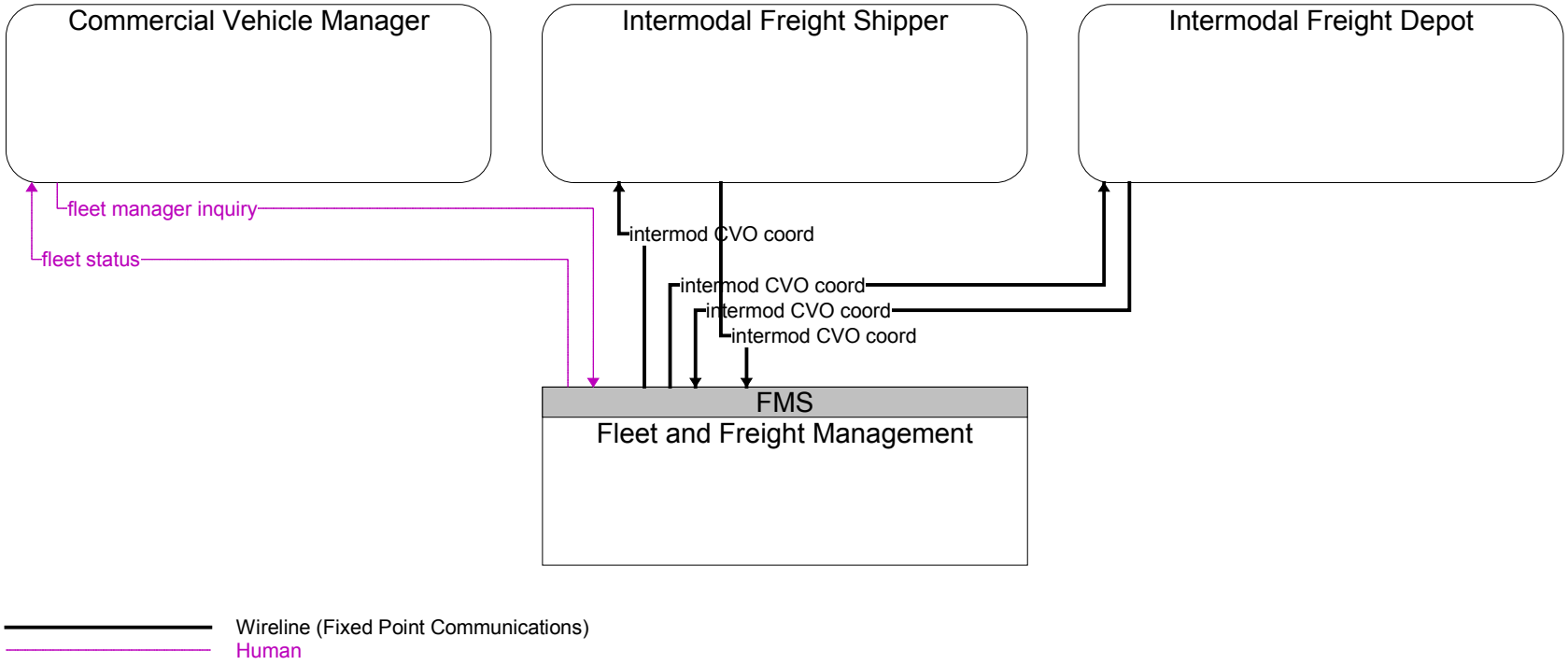


Figure 2-20 Terminator Architecture Flow Diagram for FMS

2.12 Information Service Provider

This subsystem collects, processes, stores, and disseminates transportation information to system operators and the traveling public. The subsystem can play several different roles in an integrated ITS. In one role, the ISP provides a general data warehousing function, collecting information from transportation system operators and redistributing this information to other system operators in the region and other ISPs. In this information redistribution role, the ISP provides a bridge between the various transportation systems that produce the information and the other ISPs and their subscribers that use the information. The second role of an ISP is focused on delivery of traveler information to subscribers and the public at large. Information provided includes basic advisories, traffic and road conditions, transit schedule information, yellow pages information, ridematching information, and parking information. The subsystem also provides the capability to provide specific directions to travelers by receiving origin and destination requests from travelers, generating route plans, and returning the calculated plans to the users. In addition to general route planning for travelers, the ISP also supports specialized route planning for vehicle fleets. In this third role, the ISP function may be dedicated to, or even embedded within, the dispatch system. Reservation services are also provided in advanced implementations. The information is provided to the traveler through the Personal Information Access Subsystem, Remote Traveler Support Subsystem, and various Vehicle Subsystems through available communications links. Both basic one-way (broadcast) and personalized two-way information provision is supported. The subsystem provides the capability for an informational infrastructure to connect providers and consumers, and gather that market information needed to assist in the planning of service improvements and in maintenance of operations..

2.12.1 Subsystem Equipment Packages and Supporting Process Specifications for ISP

Basic Information Broadcast
This Equipment package provides the capabilities to collect, process, store, bill, and disseminate traveler information including traveler, transit, ride matching, traffic, and parking information. The traveler information shall include maintaining a database of local area services available to travelers with up-to-the-minute information and providing an interactive connectivity between, sponsors, and providers of services. The transit information shall include the latest available information on transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence. The traffic information shall include latest available information on traffic and highway conditions, and current situation information in real-time including incidents, road construction, recommended routes, current speeds on specific routes, current parking conditions in key areas, schedules for any current or soon to start events, and current weather situations. This Equipment package shall also provide users with real-time travel related information while they are traveling, and disseminate to assist the travelers in making decisions about transfers and modification of trips. These capabilities shall be provided using equipment such as a fixed facility with a communications system such as a data Subcarrier multiplexing device.

Process Specifications

1.1.4.5 Provide Media System Traffic Data Interface

1.1.4.6 Provide Traffic Data Retrieval Interface

4.1.8 Provide Transit Operations Data Distribution Interface

6.1.1 Provide Trip Planning Information to Traveler

6.2.1.1 Collect Traffic Data for Advisory Messages

6.2.1.3 Collect Transit Data for Advisory Messages

6.2.1.4 Provide Traffic and Transit Broadcast Messages

6.2.1.5 Provide ISP Operator Broadcast Parameters Interface

6.2.4 Collect Yellow Pages Data

6.5.1 Collect and Update Traveler Information

7.4.2 Collect Price Data for ITS Use

Infrastructure Provided Dynamic Ridesharing

This Equipment package shall have as prerequisite the capabilities of the Interactive Infrastructure Information Equipment package. In addition, this Equipment package provides dynamic rideshare matches, including rider and driver information and reservations.

Process Specifications

6.1.1 Provide Trip Planning Information to Traveler

6.1.2 Confirm Traveler's Trip Plan

6.1.4 Provide ISP Operator Interface for Trip Planning Parameters

6.2.4 Collect Yellow Pages Data

6.4.1 Screen Rider Requests

6.4.2 Match Rider and Provider

6.4.3 Report Ride Match Results to Requestor

6.4.4 Confirm Traveler Rideshare Request

6.6.2.1 Calculate Vehicle Route

6.6.2.3 Provide Route Segment Data for Other Areas

6.6.2.4 Update Vehicle Route Selection Map Data

6.6.3 Update Other Routes Selection Map Data

7.4.1.8 Process Traveler Rideshare Payments

Infrastructure Provided Route Selection

This Equipment package shall have as prerequisite the capabilities of the Interactive Infrastructure Information Equipment package. In addition, this Equipment package provides the capability to provide specific directions to travelers by receiving origin and destination requests from travelers, generating route plans, returning the calculated plans to the users, and then potentially logging the route plans with Traffic Management Subsystem. Route plans can include bicycle routes, walkways, skyways, and multi-use trails. This additional capability shall be provided using equipment such as a workstation type processor and software for route planning and traffic measurements along with additional communications capabilities including dialup lines, PCS telephones, and wireless data transceivers.

Process Specifications

1.1.4.6 Provide Traffic Data Retrieval Interface

6.1.1 Provide Trip Planning Information to Traveler

6.1.2 Confirm Traveler's Trip Plan

6.6.1 Provide Multimodal Route Selection

6.6.2.1 Calculate Vehicle Route

6.6.2.2 Provide Vehicle Route Calculation Data

6.6.2.3 Provide Route Segment Data for Other Areas

6.6.2.4 Update Vehicle Route Selection Map Data

6.6.2.5 Provide ISP Operator Route Parameters Interface

6.6.3 Update Other Routes Selection Map Data

6.6.4 Select Transit Route

6.6.5 Select Other Routes

Infrastructure Provided Yellow Pages & Reservation

This Equipment package shall have as prerequisite the capabilities of the Interactive Infrastructure Information

Equipment package. In addition, this Equipment package provides the capability to provide specific traveler information, such as Yellow Pages information, with reservation capabilities and information on non-motorized transportation services (e.g., bicycle shops and parking accommodations).

Process Specifications

6.1.1 Provide Trip Planning Information to Traveler

6.1.2 Confirm Traveler's Trip Plan

6.1.3 Manage Multimodal Service Provider Interface

6.2.1.2 Provide Traffic and Transit Advisory Messages

6.2.4 Collect Yellow Pages Data

6.2.6 Provide Yellow Pages Data and Reservations

6.5.1 Collect and Update Traveler Information

6.5.2 Provide Traveler Yellow Pages Information and Reservations

6.5.3 Register Yellow Pages Service Providers

6.6.2.3 Provide Route Segment Data for Other Areas

6.6.2.4 Update Vehicle Route Selection Map Data

7.1.6 Distribute Advanced Charges and Fares

7.2.6 Distribute Advanced Tolls and Fares

7.3.2 Distribute Advanced Tolls and Parking Lot Charges

7.4.1.2 Process Yellow Pages Services Provider Payments

7.4.1.3 Process Driver Map Update Payments

7.4.1.4 Process Traveler Map Update Payments

7.4.1.6 Process Traveler Trip and Other Services Payments

7.4.2 Collect Price Data for ITS Use

7.4.3 Route Traveler Advanced Payments

Interactive Infrastructure Information
This Equipment package shall have as prerequisite the capabilities of the Basic Information Broadcast Equipment package. This Equipment package augments the Basic Information Broadcast Equipment package by providing the capabilities for interactive traveler information.

Process Specifications
1.1.4.5 Provide Media System Traffic Data Interface

1.1.4.6 Provide Traffic Data Retrieval Interface

4.1.8 Provide Transit Operations Data Distribution Interface

6.1.1 Provide Trip Planning Information to Traveler

6.1.2 Confirm Traveler's Trip Plan

6.1.3 Manage Multimodal Service Provider Interface

6.1.4 Provide ISP Operator Interface for Trip Planning Parameters

6.2.1.2 Provide Traffic and Transit Advisory Messages

6.2.4 Collect Yellow Pages Data

6.5.1 Collect and Update Traveler Information

6.5.4 Provide Traveler Event Information

6.6.1 Provide Multimodal Route Selection
6.6.2.3 Provide Route Segment Data for Other Areas

6.6.2.4 Update Vehicle Route Selection Map Data

6.6.4 Select Transit Route

6.6.5 Select Other Routes

7.1.6 Distribute Advanced Charges and Fares

7.2.6 Distribute Advanced Tolls and Fares

7.3.2 Distribute Advanced Tolls and Parking Lot Charges

7.4.1.3 Process Driver Map Update Payments

7.4.1.4 Process Traveler Map Update Payments

7.4.1.6 Process Traveler Trip and Other Services Payments

7.4.2 Collect Price Data for ITS Use

7.4.3 Route Traveler Advanced Payments

ISP Advanced Integrated Control Support
This Equipment package supports the traffic management center provide real-time optimized signal control by providing ISP route planning information.

Process Specifications
6.6.2.2 Provide Vehicle Route Calculation Data

ISP Data Collection
This equipment package collects and stores traveler information that is collected in the course of operation of the ISP subsystem. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.

Process Specifications
6.1.5 Collect Service Requests and Confirmation for Archive

6.1.6 Manage Traveler Info Archive Data

6.2.1.1 Collect Traffic Data for Advisory Messages

7.4.1.7 Collect Payment Transaction Records

ISP Probe Information Collection
This Equipment package supports the collection of vehicle probe data by the ISP. It provides the capability to accept and process probe vehicle information. This capability shall be provided through the use of additional hardware and probe vehicle control and tracking software.

Process Specifications
6.2.1.6 Collect Environmental Probe Data

6.6.2.2 Provide Vehicle Route Calculation Data
6.6.2.6 Calculate Vehicle Probe Data for Guidance

2.12.2 Subsystem Interfaces for ISP

Archived Data Management Subsystem -> **Information Service Provider**

Physical Architecture Flow Name: archive requests

A request to a data source for information on available data (i.e. "catalog") or a request that defines the data to be archived. The request can be a general subscription intended to initiate a continuous or regular data stream or a specific request intended to initiate a one-time response from the recipient.

Logical Architecture Reference Flow(s):
traveler_archive_request

Physical Architecture Flow Name: archive status

Notification that data provided to an archive contains erroneous, missing, or suspicious data or verification that the data provided appears valid. If an error has been detected, the offending data and the nature of the potential problem are identified.

Logical Architecture Reference Flow(s):
traveler_archive_status

Emergency Management -> **Information Service Provider**

Physical Architecture Flow Name: incident information

Notification of existence of incident and expected severity, location, time and nature of incident.

Logical Architecture Reference Flow(s):
incident_information

Emissions Management -> **Information Service Provider**

Physical Architecture Flow Name: air quality information

Aggregated region-wide measured air quality data and possible pollution incident information.

Logical Architecture Reference Flow(s):
current_traffic_pollution_data

Event Promoters -> **Information Service Provider**

Physical Architecture Flow Name: event information

Special event information for travelers. This would include a broader array of information than the similar "event plans" that conveys only information necessary to support traffic management for the event.

Logical Architecture Reference Flow(s):

fevp_event_information_for_travelers

Financial Institution -> Information Service Provider

Physical Architecture Flow Name: transaction status

Response to transaction request. Normally dealing with a request for payment.

Logical Architecture Reference Flow(s):

ffi_registration_payment_confirm
ffi_traveler_other_services_payments_confirm
ffi_traveler_rideshare_payment_confirm
ffi_traveler_map_payment_confirm
ffi_traveler_display_payment_confirm
ffi_driver_map_payment_confirm

Fleet and Freight Management -> Information Service Provider

Physical Architecture Flow Name: route request

Request for a tailored route based on given constraints.

Logical Architecture Reference Flow(s):

cv_route_request
cf_route_request

Physical Architecture Flow Name: toll data request

Request made to obtain toll schedule information or pay a toll in advance. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.

Logical Architecture Reference Flow(s):

toll_price_for_cvo_request
cvo_advanced_payments_request

Information Service Provider -> Archived Data Management Subsystem

Physical Architecture Flow Name: traveler archive data

Data associated with traveler information services including service requests, facility usage, rideshare, routing, and traveler payment transaction data. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.

Logical Architecture Reference Flow(s):

traveler_archive_data

Information Service Provider -> Emergency Management

Physical Architecture Flow Name: incident information request

Request for incident information, clearing time, severity. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.

Logical Architecture Reference Flow(s):
incident_information_request

Information Service Provider -> Event Promoters

Physical Architecture Flow Name: event information request

Request for special event information.

Logical Architecture Reference Flow(s):
tevp_event_information_request

Information Service Provider -> Financial Institution

Physical Architecture Flow Name: payment request

Request for payment from financial institution.

Logical Architecture Reference Flow(s):
tfi_traveler_display_payment_request
tfi_driver_map_payment_request
tfi_traveler_map_payment_request
tfi_traveler_other_services_payments_request
tfi_registration_payment_request
tfi_traveler_rideshare_payment_request

Information Service Provider -> Fleet and Freight Management

Physical Architecture Flow Name: road network conditions

Current and forecasted traffic information, road and weather conditions, incident information, and other road network status. Either raw data, processed data, or some combination of both may be provided by this architecture flow.

Logical Architecture Reference Flow(s):
traffic_data_for_cvo

Physical Architecture Flow Name: route plan

Tailored route provided by ISP in response to a specific request.

Logical Architecture Reference Flow(s):
cf_route
cv_route

Physical Architecture Flow Name: toll data

Current toll schedules for different types of vehicles as well as advanced toll payment information.

Logical Architecture Reference Flow(s):
toll_price_for_cvo
cvo_advanced_toll_payment_information

Information Service Provider -> ISP Operator

Physical Architecture Flow Name: ISP operating parameters

Parameters provided to the ISP Operator by the ISP including broadcast information settings, route selection controls, and travel optimization algorithms.

Logical Architecture Reference Flow(s):

tispo_trip_planning_parameters
tispo_archive_status
tispo_broadcast_data_parameters_output
tispo_route_selection_parameters

Information Service Provider -> Maintenance and Construction Management

Physical Architecture Flow Name: road network probe information

Aggregated route usage, travel times, environmental conditions, and other aggregated data collected from probe vehicles.

Logical Architecture Reference Flow(s):

env_probe_info_from_isp
traffic_probe_info_from_info_provider

Information Service Provider -> Map Update Provider

Physical Architecture Flow Name: map update request

Request for a map update which could include a new underlying map or map layer updates.

Logical Architecture Reference Flow(s):

tmup_request_other_routes_map_update
tmup_request_route_selection_map_update

Information Service Provider -> Media

Physical Architecture Flow Name: traveler information for media

General traveler information regarding incidents, unusual traffic conditions, transit issues, or other advisory information that has been desensitized and provided to the media.

Logical Architecture Reference Flow(s):

tm_transit_vehicle_deviations
tm_traffic_information
tm_incident_information
tm_traveler_information_request

Information Service Provider -> Multimodal Transportation Service Provider

Physical Architecture Flow Name: multimodal information request

Information request for alternate mode transportation providers such as train, ferry, air and bus.

Logical Architecture Reference Flow(s):

tmtsp_air_services_request
tmtsp_non_motorized_services_request
tmtsp_confirm_multimodal_service
tmtsp_rail_services_request

tmtsp_ferry_services_request

Information Service Provider -> Other ISP

Physical Architecture Flow Name: ISP coordination

Coordination and exchange of transportation information between centers. This flow allows a broad range of transportation information collected by one ISP to be redistributed to many other ISPs and their clients.

Logical Architecture Reference Flow(s):

toisp_traffic_information
toisp_request_data
toisp_transit_information
toisp_traffic_data_request
toisp_transit_data_request
toisp_data_supply

Information Service Provider -> Parking Management

Physical Architecture Flow Name: parking lot data request

Request for parking lot occupancy, fares, and availability. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.

Logical Architecture Reference Flow(s):

advanced_other_charges_request
parking_lot_data_request
parking_lot_price_data_request
advanced_traveler_charges_request

Physical Architecture Flow Name: parking reservations request

Reservation request for parking lot.

Logical Architecture Reference Flow(s):

parking_lot_reservation_request

Information Service Provider -> Personal Information Access

Physical Architecture Flow Name: broadcast information

General broadcast information that contains link travel times, incidents, advisories, transit services and a myriad of other traveler information.

Logical Architecture Reference Flow(s):

transit_deviations_for_broadcast_to_personal_devices
traffic_data_for_broadcast_to_personal_devices

Physical Architecture Flow Name: traveler information

Traveler information comprised of traffic status, advisories, incidents, payment information and many other travel-related data updates and confirmations.

Logical Architecture Reference Flow(s):

traveler_personal_display_update_payment_response
traffic_data_for_personal_devices
traveler_personal_event_information
traveler_personal_payment_confirmation
traveler_personal_transaction_confirmation

traveler_map_update_payment_response
transit_deviations_for_personal_devices

Physical Architecture Flow Name: trip plan

A sequence of links and special instructions comprising of a trip plan indicating efficient routes for navigating the links. Normally coordinated with traffic conditions, other incidents, preemption and prioritization plans.

Logical Architecture Reference Flow(s):

traveler_guidance_route
traveler_personal_trip_information

Physical Architecture Flow Name: yellow pages information

Travel service information covering tourist attractions, lodging, restaurants, service stations, emergency services, and other services and businesses of interest to the traveler.

Logical Architecture Reference Flow(s):

traveler_personal_yellow_pages_data

Information Service Provider -> Remote Traveler Support

Physical Architecture Flow Name: broadcast information

General broadcast information that contains link travel times, incidents, advisories, transit services and a myriad of other traveler information.

Logical Architecture Reference Flow(s):

transit_deviations_for_broadcast_to_kiosks
traffic_data_for_broadcast_to_kiosks

Physical Architecture Flow Name: traveler information

Traveler information comprised of traffic status, advisories, incidents, payment information and many other travel-related data updates and confirmations.

Logical Architecture Reference Flow(s):

advanced_tolls_and_charges_roadside_confirm
traffic_data_for_kiosks
traveler_payment_confirmation
traveler_event_information
transit_deviations_for_kiosks
traveler_transaction_confirmation

Physical Architecture Flow Name: trip plan

A sequence of links and special instructions comprising of a trip plan indicating efficient routes for navigating the links. Normally coordinated with traffic conditions, other incidents, preemption and prioritization plans.

Logical Architecture Reference Flow(s):

traveler_trip_information

Physical Architecture Flow Name: yellow pages information

Travel service information covering tourist attractions, lodging, restaurants, service stations, emergency services, and other services and businesses of interest to the traveler.

Logical Architecture Reference Flow(s):

traveler_yellow_pages_data

Information Service Provider -> Surface Transportation Weather Service

Physical Architecture Flow Name: transportation weather information request

A request for transportation weather information that may specify the area of interest (a geographic region, particular routes within a region, specific road segments), the type of information that is required, the desired spatial resolution of the information, and time horizon.

Logical Architecture Reference Flow(s):

tstws_trans_weather_info_request

Information Service Provider -> Toll Administration

Physical Architecture Flow Name: toll data request

Request made to obtain toll schedule information or pay a toll in advance. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.

Logical Architecture Reference Flow(s):

toll_price_data_request
advanced_other_tolls_request
advanced_traveler_tolls_request

Information Service Provider -> Traffic Management

Physical Architecture Flow Name: fare and price information

Current transit, parking, and toll fee schedule information.

Logical Architecture Reference Flow(s):

transit_fare_details
parking_lot_charge_details
toll_price_details

Physical Architecture Flow Name: logged special vehicle route

Anticipated route information for special vehicles (e.g., oversize vehicles) or groups of vehicles (e.g., governor's motorcade) that may require changes in traffic control strategy.

Logical Architecture Reference Flow(s):

logged_special_vehicle_route
special_vehicle_priority_routing

Physical Architecture Flow Name: request for road network conditions

Request for traffic information, road conditions, surface weather conditions, incident information, and other road network status. The request specifies the region/route of interest, the desired effective time period, and other parameters that allow preparation of a tailored response. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.

Logical Architecture Reference Flow(s):

traffic_data_distribution_request

Physical Architecture Flow Name: road network probe information

Aggregated route usage, travel times, environmental conditions, and other aggregated data collected from probe vehicles.

Logical Architecture Reference Flow(s):
current_transit_routes_use
current_road_network_use
current_other_routes_use

Information Service Provider -> Transit Management

Physical Architecture Flow Name: demand responsive transit request

Request for paratransit support.

Logical Architecture Reference Flow(s):
paratransit_trip_request

Physical Architecture Flow Name: selected routes

Routes selected based on route request criteria.

Logical Architecture Reference Flow(s):
paratransit_service_confirmation
advanced_tolls_and_charges_vehicle_confirm

Physical Architecture Flow Name: transit information request

Request for transit operations information including schedule and fare information. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.

Logical Architecture Reference Flow(s):
advanced_other_fares_request
transit_vehicle_deviations_details_request
transit_services_guidance_request
transit_fare_data_request
advanced_traveler_fares_request
transit_services_advisories_request

Information Service Provider -> Vehicle

Physical Architecture Flow Name: broadcast information

General broadcast information that contains link travel times, incidents, advisories, transit services and a myriad of other traveler information.

Logical Architecture Reference Flow(s):
broadcast_data
link_and_queue_data

Physical Architecture Flow Name: traveler information

Traveler information comprised of traffic status, advisories, incidents, payment information and many other travel-related data updates and confirmations.

Logical Architecture Reference Flow(s):
advisory_data
event_information_advisory_data
driver_map_update_payment_response
link_and_queue_data
advanced_fares_and_charges_response
advanced_tolls_and_fares_response

Physical Architecture Flow Name: trip plan

A sequence of links and special instructions comprising of a trip plan indicating efficient routes for navigating the links. Normally coordinated with traffic conditions, other incidents, preemption and prioritization plans.

Logical Architecture Reference Flow(s):
vehicle_guidance_route

Physical Architecture Flow Name: yellow pages information

Travel service information covering tourist attractions, lodging, restaurants, service stations, emergency services, and other services and businesses of interest to the traveler.

Logical Architecture Reference Flow(s):
yellow_pages_advisory_data

Information Service Provider -> Yellow Pages Service Providers

Physical Architecture Flow Name: provider profile confirm

Confirmation of profile information received by a service provider (e.g. for a hotel or restaurant).

Logical Architecture Reference Flow(s):
typsp_provider_update_confirm

Physical Architecture Flow Name: travel service request

Request for reservation or other service (e.g., yellow pages).

Logical Architecture Reference Flow(s):
typsp_yellow_pages_info_request
typsp_transaction_request

ISP Operator -> Information Service Provider

Physical Architecture Flow Name: ISP operating parameter updates

Tuning and performance enhancement parameters to ISP algorithms.

Logical Architecture Reference Flow(s):
fispo_trip_planning_parameters_update
fispo_route_selection_parameters_request
fispo_broadcast_data_parameters_request
fispo_broadcast_data_parameters_update
fispo_trip_planning_parameters_request
fispo_request_route_selection_map_data_update
fispo_route_selection_parameters_update
fispo_archive_commands
fispo_request_other_routes_selection_map_data_update

Maintenance and Construction Management -> Information Service Provider

Physical Architecture Flow Name: current asset restrictions

Restrictions levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.

Logical Architecture Reference Flow(s):
asset_restrictions_for_info_provider

Physical Architecture Flow Name: maint and constr work plans

Future construction and maintenance work schedules and activities including anticipated closures with anticipated impact to the roadway, alternate routes, anticipated delays, closure times, and durations.

Logical Architecture Reference Flow(s):
m_and_c_work_plans_for_info_provider

Physical Architecture Flow Name: road weather information

Road conditions and weather information that are made available by road maintenance operations to other transportation system operators.

Logical Architecture Reference Flow(s):
road_weather_info_for_isp

Physical Architecture Flow Name: roadway maintenance status

Summary of maintenance fleet operations affecting the road network. This includes the status of winter maintenance (snow plow schedule and current status).

Logical Architecture Reference Flow(s):
roadway_maint_status_for_info_provider

Physical Architecture Flow Name: work zone information

Summary of maintenance and construction work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

Logical Architecture Reference Flow(s):
work_zone_images_for_isp
work_zone_info_for_isp

Map Update Provider -> Information Service Provider

Physical Architecture Flow Name: map updates

Map update which could include a new underlying static or real-time map or map layer(s) update.

Logical Architecture Reference Flow(s):
fmup_other_routes_map_data
fmup_route_selection_map_data

Media -> Information Service Provider

Physical Architecture Flow Name: external reports

Traffic and incident information that is collected by the media through a variety of mechanisms (e.g., radio station call-in programs, air surveillance).

Logical Architecture Reference Flow(s):
fm_incident_details
fm_traveler_information

Physical Architecture Flow Name: media information request

Request from the media for current transportation information.

Logical Architecture Reference Flow(s):

fm_incident_information_request
fm_traffic_information_request
fm_transit_vehicle_deviations_request

Multimodal Transportation Service Provider -> Information Service Provider

Physical Architecture Flow Name: multimodal information

Schedule information for alternate mode transportation providers such as train, ferry, air and bus.

Logical Architecture Reference Flow(s):

fmtsp_ferry_services
fmtsp_multimodal_service_confirmation
fmtsp_air_services
fmtsp_rail_services
fmtsp_non_motorized_services

Other ISP -> Information Service Provider

Physical Architecture Flow Name: ISP coordination

Coordination and exchange of transportation information between centers. This flow allows a broad range of transportation information collected by one ISP to be redistributed to many other ISPs and their clients.

Logical Architecture Reference Flow(s):

foisp_traffic_information_request
foisp_transit_data
foisp_request_data
foisp_transit_information_request
foisp_traffic_data
foisp_data_supply

Parking Management -> Information Service Provider

Physical Architecture Flow Name: parking information

General parking information and current parking availability.

Logical Architecture Reference Flow(s):

parking_lot_price_data
parking_lot_availability

Physical Architecture Flow Name: parking lot reservation confirmation

Confirmation for parking lot reservation.

Logical Architecture Reference Flow(s):

advanced_other_charges_confirm
parking_lot_reservation_confirm
advanced_traveler_charges_confirm

Personal Information Access -> Information Service Provider

Physical Architecture Flow Name: traveler profile

Information about a traveler including equipment capabilities, personal preferences and recurring trip characteristics.

Logical Architecture Reference Flow(s):

traveler_traffic_profile
traveler_transit_profile

Physical Architecture Flow Name: traveler request

Request by a traveler to summon assistance, request information, make a reservation, or initiate any other traveler service.

Logical Architecture Reference Flow(s):

traveler_personal_current_condition_request
traveler_personal_event_information_request
traveler_map_update_payment_request
transit_deviations_personal_request
traveler_personal_display_update_payment_request
traffic_data_personal_request

Physical Architecture Flow Name: trip confirmation

Acknowledgement by the driver/traveler of acceptance of a route.

Logical Architecture Reference Flow(s):

traveler_personal_payment_information
traveler_personal_trip_confirmation
traveler_route_accepted

Physical Architecture Flow Name: trip request

Request by a driver/traveler for special routing.

Logical Architecture Reference Flow(s):

traveler_personal_trip_request
traveler_route_request

Physical Architecture Flow Name: yellow pages request

Request for information through a yellow pages type service.

Logical Architecture Reference Flow(s):

traveler_personal_yellow_pages_information_request
traveler_personal_transaction_request

Remote Traveler Support -> Information Service Provider

Physical Architecture Flow Name: traveler request

Request by a traveler to summon assistance, request information, make a reservation, or initiate any other traveler service.

Logical Architecture Reference Flow(s):

traveler_payment_information
transit_deviation_kiosk_request
traffic_data_kiosk_request
traveler_current_condition_request
traveler_event_information_request

advanced_tolls_and_charges_roadside_request
traveler_transaction_request
traveler_yellow_pages_information_request

Physical Architecture Flow Name: trip confirmation

Acknowledgement by the driver/traveler of acceptance of a route.

Logical Architecture Reference Flow(s):
traveler_trip_confirmation

Physical Architecture Flow Name: trip request

Request by a driver/traveler for special routing.

Logical Architecture Reference Flow(s):
traveler_trip_request

Physical Architecture Flow Name: yellow pages request

Request for information through a yellow pages type service.

Logical Architecture Reference Flow(s):
traveler_yellow_pages_information_request

Surface Transportation Weather Service -> Information Service Provider

Physical Architecture Flow Name: transportation weather information

Current and forecast road conditions and weather information (e.g., surface condition, flooding, wind advisories, visibility, etc.) associated with the transportation network. This information is of a resolution, timeliness, and accuracy to be useful in transportation decision making.

Logical Architecture Reference Flow(s):
fstws_surface_trans_weather_forecasts
fstws_surface_trans_weather_observations

Toll Administration -> Information Service Provider

Physical Architecture Flow Name: probe data

Aggregate data from probe vehicles including location, speed for a given link or collection of links.

Logical Architecture Reference Flow(s):
vehicle_toll_probe_data

Physical Architecture Flow Name: toll data

Current toll schedules for different types of vehicles as well as advanced toll payment information.

Logical Architecture Reference Flow(s):
advanced_other_tolls_confirm
advanced_traveler_tolls_confirm

toll_price_data

Traffic Management -> Information Service Provider

Physical Architecture Flow Name: request fare and price information

Requests for current fare and price information from a service provider that can be used to augment the traffic manager's overall view of current transportation network status.

Logical Architecture Reference Flow(s):

transit_fare_request
parking_lot_charge_request
toll_price_request

Physical Architecture Flow Name: road network conditions

Current and forecasted traffic information, road and weather conditions, incident information, and other road network status. Either raw data, processed data, or some combination of both may be provided by this architecture flow.

Logical Architecture Reference Flow(s):

sensor_data_for_distribution
traffic_data_for_distribution
current_road_network_state
current_highway_network_state
planned_events
link_data_for_guidance
prediction_data

Transit Management -> Information Service Provider

Physical Architecture Flow Name: demand responsive transit plan

Plan regarding overall demand responsive transit schedules and deployment.

Logical Architecture Reference Flow(s):

paratransit_personal_schedule

Physical Architecture Flow Name: transit and fare schedules

Specific transit and fare schedule information including schedule adherence.

Logical Architecture Reference Flow(s):

transit_services_for_advisory_data
transit_fare_data
transit_services_for_guidance
transit_vehicle_deviations_details
transit_deviation_data_received

Physical Architecture Flow Name: transit incident information

Information on transit incidents that impact transit services for public dissemination.

Logical Architecture Reference Flow(s):

transit_incident_data

Physical Architecture Flow Name: transit request confirmation

Confirmation of a request for transit information or service.

Logical Architecture Reference Flow(s):
advanced_tolls_and_charges_vehicle_request
advanced_traveler_fares_confirm
advanced_other_fares_confirm

Vehicle -> Information Service Provider

Physical Architecture Flow Name: environmental probe data

Current environmental conditions (e.g., air temperature, wind speed, surface temperature) as measured by vehicle-based environmental sensors. In addition to environmental sensor inputs, this flow may also include vehicle control system information that may indicate adverse road surface conditions (e.g., traction control system activations).

Logical Architecture Reference Flow(s):
env_probe_data_from_vehicle

Physical Architecture Flow Name: traveler profile

Information about a traveler including equipment capabilities, personal preferences and recurring trip characteristics.

Logical Architecture Reference Flow(s):
traveler_profile_from_vehicle

Physical Architecture Flow Name: traveler request

Request by a traveler to summon assistance, request information, make a reservation, or initiate any other traveler service.

Logical Architecture Reference Flow(s):
event_information_advisory_requests
driver_map_update_payment_request
advanced_fares_and_charges_request
advisory_data_request
advanced_tolls_and_fares_request

Physical Architecture Flow Name: trip confirmation

Acknowledgement by the driver/traveler of acceptance of a route.

Logical Architecture Reference Flow(s):
vehicle_guidance_route_accepted

Physical Architecture Flow Name: trip request

Request by a driver/traveler for special routing.

Logical Architecture Reference Flow(s):
vehicle_route_request

Physical Architecture Flow Name: vehicle probe data

Vehicle probe data indicating identity, route segment identity, link time and location.

Logical Architecture Reference Flow(s):
vehicle_guidance_probe_data

Physical Architecture Flow Name: yellow pages request

Request for information through a yellow pages type service.

Logical Architecture Reference Flow(s):
yellow_pages_advisory_requests

Weather Service -> Information Service Provider

Physical Architecture Flow Name: weather information

Accumulated forecasted and current weather data (e.g., temperature, pressure, wind speed, wind direction, humidity, precipitation, visibility, light conditions, etc.).

Logical Architecture Reference Flow(s):
fws_weather_forecasts
fws_current_weather_observations

Yellow Pages Service Providers -> Information Service Provider

Physical Architecture Flow Name: provider profile data

Information supplied by a service provider (e.g., a hotel or restaurant) that identifies the service provider and provides details of the service offering. This flow covers initial registration of a service provider and subsequent submittal of new information and status updates so that data currency is maintained.

Logical Architecture Reference Flow(s):
fypsp_provider_profile_update
fypsp_request_provider_registration

Physical Architecture Flow Name: travel service info

Reservation information or yellow pages data.

Logical Architecture Reference Flow(s):
fypsp_yellow_pages_data
fypsp_transaction_confirmation

2.12.3 Architecture Flow Diagrams for ISP

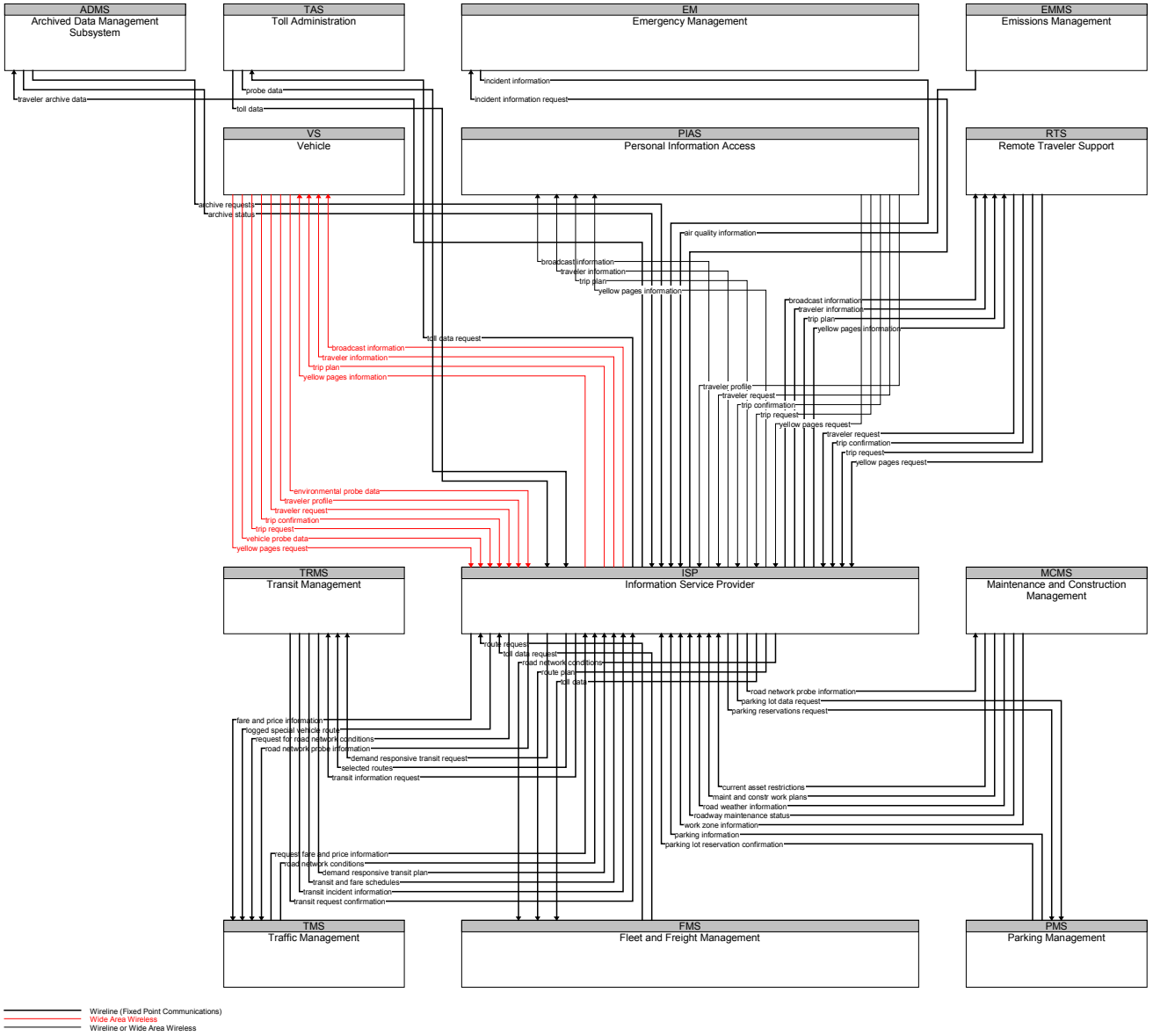


Figure 2-21 Subsystem Architecture Flow Diagram for ISP

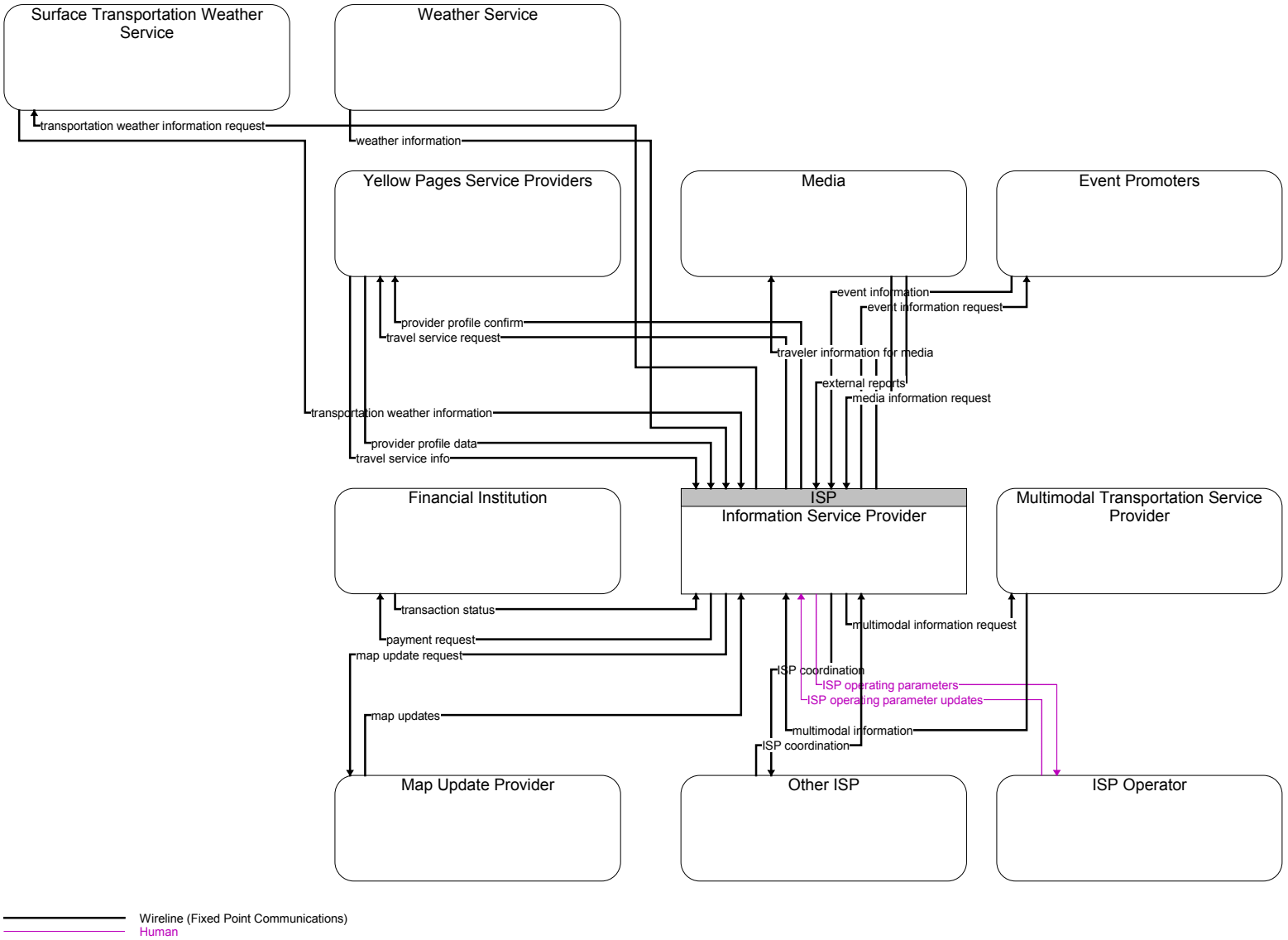


Figure 2-22 Terminator Architecture Flow Diagram for ISP

2.13 Maintenance and Construction Management Subsystem

The Maintenance and Construction Management Subsystem monitors and manages roadway infrastructure construction and maintenance activities. Representing both public agencies and private contractors that provide these functions, this subsystem manages fleets of maintenance, construction, or special service vehicles (e.g., snow and ice control equipment). The subsystem receives a wide range of status information from these vehicles and performs vehicle dispatch, routing, and resource management for the vehicle fleets and associated equipment. The subsystem participates in incident response by deploying maintenance and construction resources to an incident scene, in coordination with other center subsystems. The subsystem manages equipment at the roadside, including environmental sensors and automated systems that monitor and mitigate adverse road and surface weather conditions. The subsystem manages the repair and maintenance of both non-ITS and ITS equipment including the traffic controllers, detectors, dynamic message signs, signals, and other equipment associated with the roadway infrastructure. Additional interfaces to weather information providers (the weather service and surface transportation weather service providers) provide current and forecast weather information that can be fused with other data sources and used to support advanced decision support systems that increase the efficiency and effectiveness of maintenance and construction operations. The subsystem remotely monitors and manages ITS capabilities in work zones, gathering, storing, and disseminating work zone information to other systems. It manages traffic in the vicinity of the work zone and advises drivers of work zone status (either directly at the roadside or through an interface with the Information Service Provider or Traffic Management subsystems.) It schedules and manages the location and usage of maintenance assets (such as portable dynamic message signs).

2.13.1 Subsystem Equipment Packages and Supporting Process Specifications for MCMS

MCM Automated Treatment System Control
This equipment package remotely monitors and manages automated road treatment systems, providing status to the operator.

Process Specifications
9.2.5 Provide M&C Center Personnel Interface for Maint

9.2.6.1 Operate Roadway Automated Treatment System

MCM Data Collection
This equipment package collects and stores maintenance and construction information that is collected in the course of operations by the Maintenance and Construction Management Subsystem. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.

Process Specifications
9.2.7 Manage M&C Archive Data

MCM Environmental Information Collection
This equipment package collects current road and weather conditions using data collected from environmental sensors deployed on and about the roadway. In addition to fixed sensor stations at the roadside, this equipment package also collects environmental information from sensor systems located on Maintenance and Construction Vehicles, and sensor data that is made available by other systems..

Process Specifications
9.2.2 Status Current M&C Activities

9.4.2 Collect Environmental Data

9.4.5 Provide M&C Center Personnel Interface for Environment

MCM Environmental Information Processing
This equipment package processes current and forecast weather data, road condition information, local environmental data, and uses internal models to develop specialized detailed forecasts of local weather and surface conditions. The processed environmental information products are presented to the user.

Process Specifications
9.2.2 Status Current M&C Activities

9.4.2 Collect Environmental Data

9.4.3 Process Environmental Data
9.4.4 Disseminate Environmental Information

9.4.5 Provide M&C Center Personnel Interface for Environment

MCM Incident Management
This equipment package supports coordinated response to highway incidents. Incident notifications are shared, incident response resources are managed, and the overall incident situation and incident response is coordinated among allied response organizations.

Process Specifications
9.1.4 Manage M&C Vehicle Fleet

9.1.7 Process Road Network Information

9.2.2 Status Current M&C Activities

9.2.3.4 Manage M&C Resource Needs

9.2.5 Provide M&C Center Personnel Interface for Maint

MCM Maintenance Decision Support
This equipment package recommends maintenance courses of action based on current and forecast environmental and road conditions and additional application specific information. Decisions are supported through understandable presentation of filtered and fused environmental and road condition information for specific time horizons as well as specific maintenance recommendations that are generated by the system based on this integrated information. The recommended courses of action are supported by information on the anticipated consequences of action or inaction, when available.

Process Specifications
9.2.3.3 Provide Maintenance Decision Support

9.2.5 Provide M&C Center Personnel Interface for Maint

MCM Roadway Maintenance and Construction
This equipment package provides overall management and support for routine maintenance on a roadway system or right-of-way. Services managed are 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, etc.). Environmental conditions information is also received from various weather sources to aid in scheduling routine maintenance activities.

Process Specifications
9.1.4 Manage M&C Vehicle Fleet
9.1.7 Process Road Network Information

9.2.1 Schedule M&C Activities

9.2.2 Status Current M&C Activities

9.2.3.2 Determine Roadway M&C Needs

9.2.3.4 Manage M&C Resource Needs

9.2.3.5 Collect Roadside Equipment Status

9.2.4 Manage M&C Map Data

9.2.5 Provide M&C Center Personnel Interface for Maint

9.2.6.3 Operate Infrastructure Monitoring Devices

9.2.8 Manage M&C Materials

9.4.2 Collect Environmental Data

MCM Speed Monitoring
This equipment package manages remote devices that monitor vehicle speeds and optionally provide safe speed advisories to the motorist. This equipment package can monitor speeds and notify an enforcement agency if excessive speeds are identified.

Process Specifications
9.2.5 Provide M&C Center Personnel Interface for Maint

9.3.3.2 Monitor Vehicle Speed in Work Zone

MCM Vehicle and Equipment Maintenance Management
This equipment package monitors vehicle and equipment condition, tracks maintenance history, and schedules routine and corrective maintenance.

Process Specifications
9.1.5 Schedule M&C Vehicle Maint

9.2.5 Provide M&C Center Personnel Interface for Maint

MCM Vehicle Tracking
This equipment package tracks the location of maintenance and construction vehicles and other equipment. Vehicle location and associated information is presented to the operator.

Process Specifications
9.1.3 Track M&C Vehicles and Equipment

9.2.4 Manage M&C Map Data

9.2.5 Provide M&C Center Personnel Interface for Maint

MCM Winter Maintenance Management
This equipment package manages winter road maintenance, tracking and controlling snow plow operations, roadway treatment (e.g., salt spraying and other material applications) based on weather information.

Process Specifications
9.1.4 Manage M&C Vehicle Fleet

9.1.7 Process Road Network Information

9.2.1 Schedule M&C Activities

9.2.2 Status Current M&C Activities

9.2.3.1 Determine Winter Roadway Treatment Needs

9.2.3.4 Manage M&C Resource Needs

9.2.4 Manage M&C Map Data

9.2.5 Provide M&C Center Personnel Interface for Maint

9.2.8 Manage M&C Materials
9.4.2 Collect Environmental Data

MCM Work Activity Coordination
This equipment package disseminates work activity schedules to other agencies. Work schedules are coordinated, factoring in the needs and activities of other agencies and adjacent jurisdictions.

Process Specifications
9.2.1 Schedule M&C Activities

9.2.2 Status Current M&C Activities

9.2.3.4 Manage M&C Resource Needs

9.2.5 Provide M&C Center Personnel Interface for Maint

MCM Work Zone Management
This equipment package remotely monitors and supports work zone activities, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., ISP, TM, other maintenance and construction centers) for better coordination management. Work zone speeds and delays are provided to the motorist prior to the work zones.

Process Specifications
9.2.1 Schedule M&C Activities

9.2.5 Provide M&C Center Personnel Interface for Maint

9.3.1.1 Operate Work Zone Devices

9.3.2.2 Collect Work Zone Data

9.3.2.3 Generate Work Zone Information for Distribution

MCM Work Zone Safety Management
This equipment package remotely monitors work zone safety systems that detect vehicle intrusions in work zones and warns crew workers and drivers of imminent encroachment. Crew movements are also monitored so that the crew can be warned of movement beyond the designated safe zone.

Process Specifications
9.2.5 Provide M&C Center Personnel Interface for Maint
9.3.1.1 Operate Work Zone Devices

9.3.2.2 Collect Work Zone Data

2.13.2 Subsystem Interfaces for MCMS

Archived Data Management Subsystem -> **Maintenance and Construction Management**

Physical Architecture Flow Name: archive requests

A request to a data source for information on available data (i.e. "catalog") or a request that defines the data to be archived. The request can be a general subscription intended to initiate a continuous or regular data stream or a specific request intended to initiate a one-time response from the recipient.

Logical Architecture Reference Flow(s):
m_and_c_archive_request

Physical Architecture Flow Name: archive status

Notification that data provided to an archive contains erroneous, missing, or suspicious data or verification that the data provided appears valid. If an error has been detected, the offending data and the nature of the potential problem are identified.

Logical Architecture Reference Flow(s):
m_and_c_archive_status

Asset Management -> **Maintenance and Construction Management**

Physical Architecture Flow Name: asset inventory

Information on pavement, bridges, signs and other assets. This includes asset location, installation information, materials information, vendor/contractor information, current maintenance status, and a variety of other information (e.g., video logs) that define the transportation infrastructure.

Logical Architecture Reference Flow(s):
fam_asset_inventory

Physical Architecture Flow Name: asset restrictions

Restrictions levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard height, width, and weight restrictions by facility as well as special restrictions such as spring weight restrictions and temporary bridge weight restrictions.

Logical Architecture Reference Flow(s):
fam_asset_restrictions

Physical Architecture Flow Name: maintenance and repair needs

Recommended strategies and schedules for maintenance of the transportation infrastructure.

Logical Architecture Reference Flow(s):
fam_asset_maint_and_repair_needs

Emergency Management -> **Maintenance and Construction Management**

Physical Architecture Flow Name: incident information

Notification of existence of incident and expected severity, location, time and nature of incident.

Logical Architecture Reference Flow(s):

incident_info_from_emerg

Physical Architecture Flow Name: incident response status

Status of the current incident response including traffic management strategies implemented at the site (e.g., closures, diversions, traffic signal control overrides).

Logical Architecture Reference Flow(s):

incident_response_status_from_emerg

Physical Architecture Flow Name: maint and constr resource request

Request for road maintenance and construction resources that can be used in the diversion of traffic (cones, portable signs), clearance of a road hazard, repair of ancillary damage, or any other incident response.

Logical Architecture Reference Flow(s):

roadway_maint_action_req_from_emerg
m_and_c_resource_request_from_emerg

Physical Architecture Flow Name: road network probe information

Aggregated route usage, travel times, environmental conditions, and other aggregated data collected from probe vehicles.

Logical Architecture Reference Flow(s):

env_probe_info_from_emergency

Physical Architecture Flow Name: work plan feedback

Comments and suggested changes to proposed construction and maintenance work schedules and activities. This information influences work plan schedules so that they minimize impact to other system operations and the overall transportation system.

Logical Architecture Reference Flow(s):

m_and_c_plan_feedback_from_emerg

Equipment Repair Facility -> Maintenance and Construction Management

Physical Architecture Flow Name: maint and constr equipment repair status

Current maintenance and repair status of the maintenance and construction vehicle fleet and other support equipment. This information includes a record of all maintenance and repair activities performed.

Logical Architecture Reference Flow(s):

ferf_equipment_repair_status
ferf_equipment_status_for_tracking
ferf_fleet_maintenance_record
ferf_current_fleet_maintenance_status

Information Service Provider -> Maintenance and Construction Management

Physical Architecture Flow Name: road network probe information

Aggregated route usage, travel times, environmental conditions, and other aggregated data collected from probe vehicles.

Logical Architecture Reference Flow(s):

traffic_probe_info_from_info_provider
env_probe_info_from_isp

Maintenance and Construction Administrative Systems -> **Maintenance and Construction Management**

Physical Architecture Flow Name: maint and constr administrative information

Administrative information that is provided to support maintenance and construction operations. This information includes: equipment and consumables resupply purchase request status, personnel qualifications including training and special certifications, environmental regulations and rules that may impact maintenance activities, and requests and project requirements from contract administration.

Logical Architecture Reference Flow(s):

fmcas_m_and_c_regulations
fmcas_resupply_response
fmcas_m_and_c_administrative_information
fmcas_m_and_c_personnel_information

Maintenance and Construction Center Personnel -> **Maintenance and Construction Management**

Physical Architecture Flow Name: maint and constr center personnel inputs

Maintenance and construction related information (e.g., routing information, scheduling data, dispatch instructions, resource allocations, incident coordination) entered by maintenance and construction center personnel.

Logical Architecture Reference Flow(s):

fmccp_env_sensor_control_inputs
fmccp_dispatch_and_routing_info
fmccp_env_data_processing_inputs
fmccp_env_data_collection_inputs
fmccp_resource_response
fmccp_archive_commands
fmccp_wz_device_control
fmccp_request_for_schedule
fmccp_mdss_parameter_input
fmccp_env_info_dissemination_inputs

Maintenance and Construction Management -> **Archived Data Management Subsystem**

Physical Architecture Flow Name: maint and constr archive data

Information describing road construction and maintenance activities identifying the type of activity, the work performed, and work zone information including work zone configuration and safety (e.g., a record of intrusions and vehicle speeds) information.. For construction activities, this information also includes a description of the completed infrastructure, including as-built plans as applicable. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.

Logical Architecture Reference Flow(s):
m_and_c_archive_data

Maintenance and Construction Management -> Asset Management

Physical Architecture Flow Name: asset status update

Changes to status of pavement, bridges, signs and other assets resulting from maintenance or construction activities or infrastructure monitoring. The updates may include changes in installation information, materials information, vendor/contractor information, condition, and current maintenance status. In addition to infrastructure asset updates, the information provided may also include status of the maintenance and construction support assets, including vehicle and equipment utilization and repair records.

Logical Architecture Reference Flow(s):
tam_infrastructure_data_for_analysis
tam_asset_status_update_for_asset_mgmt

Maintenance and Construction Management -> Commercial Vehicle Administration

Physical Architecture Flow Name: current asset restrictions

Restrictions levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.

Logical Architecture Reference Flow(s):
asset_restrictions_for_com_veh

Maintenance and Construction Management -> Emergency Management

Physical Architecture Flow Name: current asset restrictions

Restrictions levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.

Logical Architecture Reference Flow(s):
asset_restrictions_for_emerg

Physical Architecture Flow Name: incident information

Notification of existence of incident and expected severity, location, time and nature of incident.

Logical Architecture Reference Flow(s):
incident_info_for_emerg

Physical Architecture Flow Name: maint and constr resource response

Current status of maintenance and construction resources including availability and deployment status.

Logical Architecture Reference Flow(s):
m_and_c_resource_response_to_emerg

Physical Architecture Flow Name: maint and constr work plans

Future construction and maintenance work schedules and activities including anticipated closures with anticipated impact to the roadway, alternate routes, anticipated delays, closure times, and durations.

Logical Architecture Reference Flow(s):
m_and_c_work_plans_for_emerg

Physical Architecture Flow Name: road weather information

Road conditions and weather information that are made available by road maintenance operations to other transportation system operators.

Logical Architecture Reference Flow(s):
road_weather_info_for_emergency

Physical Architecture Flow Name: roadway maintenance status

Summary of maintenance fleet operations affecting the road network. This includes the status of winter maintenance (snow plow schedule and current status).

Logical Architecture Reference Flow(s):
roadway_maint_status_for_emerg

Physical Architecture Flow Name: work zone information

Summary of maintenance and construction work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

Logical Architecture Reference Flow(s):
work_zone_info_for_emergency

Maintenance and Construction Management -> Enforcement Agency

Physical Architecture Flow Name: request for enforcement

Request for traffic enforcement to address safety issues in a work zone or other special situations.

Logical Architecture Reference Flow(s):
tea_enforcement_request_from_m_and_c

Maintenance and Construction Management -> Equipment Repair Facility

Physical Architecture Flow Name: maint and constr fleet information

Information supporting maintenance of the maintenance and construction vehicle fleet and other support equipment. This information includes vehicle status and diagnostic information, vehicle utilization, and coordination of when vehicles will be available for preventative and corrective maintenance.

Logical Architecture Reference Flow(s):
terf_mdss_recommended_actions
terf_vehicle_utilization_information

terf_fleet_maintenance_availability

Maintenance and Construction Management -> **Information Service Provider**

Physical Architecture Flow Name: current asset restrictions

Restrictions levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.

Logical Architecture Reference Flow(s):

asset_restrictions_for_info_provider

Physical Architecture Flow Name: maint and constr work plans

Future construction and maintenance work schedules and activities including anticipated closures with anticipated impact to the roadway, alternate routes, anticipated delays, closure times, and durations.

Logical Architecture Reference Flow(s):

m_and_c_work_plans_for_info_provider

Physical Architecture Flow Name: road weather information

Road conditions and weather information that are made available by road maintenance operations to other transportation system operators.

Logical Architecture Reference Flow(s):

road_weather_info_for_isp

Physical Architecture Flow Name: roadway maintenance status

Summary of maintenance fleet operations affecting the road network. This includes the status of winter maintenance (snow plow schedule and current status).

Logical Architecture Reference Flow(s):

roadway_maint_status_for_info_provider

Physical Architecture Flow Name: work zone information

Summary of maintenance and construction work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

Logical Architecture Reference Flow(s):

work_zone_images_for_isp
work_zone_info_for_isp

Maintenance and Construction Management -> **Maintenance and Construction Administrative Systems**

Physical Architecture Flow Name: maint and constr administrative request

Requests for maintenance and construction administrative information or services. Requests include: requests to purchasing for equipment and consumables resupply and requests to human resources that manage training and special certification for field crews and other

personnel.

Logical Architecture Reference Flow(s):

tmcas_m_and_c_administrative_request
tmcas_resupply_request

Physical Architecture Flow Name: maint and constr work performance

Overall project status and work performance information provided to support contract administration.

Logical Architecture Reference Flow(s):

tmcas_m_and_c_work_performance
tmcas_work_zone_info

Maintenance and Construction Management -> Maintenance and Construction Center Personnel

Physical Architecture Flow Name: maint and constr operations information presentation

Presentation of maintenance and construction operations information to center personnel. This information includes maintenance resource status (vehicles, equipment, and personnel), work schedule information, work status, road and weather conditions, traffic information, incident information and associated resource requests, and a range of other information that supports efficient maintenance and construction operations and planning.

Logical Architecture Reference Flow(s):

tmccp_vehicle_fleet_status
tmccp_auto_treat_status
tmccp_work_zone_images_for_display
tmccp_env_and_weather_data
tmccp_env_info_for_dissemination
tmccp_work_zone_info
tmccp_archive_status
tmccp_resource_request
tmccp_m_and_c_activity_status
tmccp_view_of_road_network
tmccp_scheduled_work_plan
tmccp_processed_env_info
tmccp_mdss_recommended_actions

Maintenance and Construction Management -> Maintenance and Construction Vehicle

Physical Architecture Flow Name: environmental sensors control

Data used to configure and control environmental sensors.

Logical Architecture Reference Flow(s):

environmental_sensor_control_for_mcv

Physical Architecture Flow Name: maint and constr dispatch information

Information used to dispatch maintenance and construction vehicles, equipment, and crews. This information includes routing information, traffic information, road restrictions, incident information, environmental information, decision support information, maintenance schedule data, dispatch instructions, personnel assignments, and corrective actions.

Logical Architecture Reference Flow(s):

status_of_other_work_zones
suggested_route_to_mcv
road_network_info_to_mcv
dispatch_orders_to_mcv
winter_dispatch_orders_to_mcv
mdss_recommended_actions_for_operator

Physical Architecture Flow Name: maint and constr vehicle system control

Configure and control data that supports remote control of on-board maintenance and construction vehicle systems and field equipment that is remotely controlled by the vehicle. For example, the data can be used to adjust material application rates and spread patterns.

Logical Architecture Reference Flow(s):

mcv_infrastructure_sensor_control
mcv_vehicle_systems_control_by_fleet_manager
center_control_of_on_board_work_zone_devices

Maintenance and Construction Management -> Map Update Provider

Physical Architecture Flow Name: map update request

Request for a map update which could include a new underlying map or map layer updates.

Logical Architecture Reference Flow(s):

tmup_request_m_and_c_route_map
tmup_request_m_and_c_display_update

Maintenance and Construction Management -> Media

Physical Architecture Flow Name: maint and constr work plans

Future construction and maintenance work schedules and activities including anticipated closures with anticipated impact to the roadway, alternate routes, anticipated delays, closure times, and durations.

Logical Architecture Reference Flow(s):

tm_m_and_c_work_plans_for_media

Physical Architecture Flow Name: road weather information

Road conditions and weather information that are made available by road maintenance operations to other transportation system operators.

Logical Architecture Reference Flow(s):

tm_road_weather_info

Physical Architecture Flow Name: roadway maintenance status

Summary of maintenance fleet operations affecting the road network. This includes the status of winter maintenance (snow plow schedule and current status).

Logical Architecture Reference Flow(s):

tm_roadway_maint_status_for_media

Physical Architecture Flow Name: work zone information

Summary of maintenance and construction work zone activities affecting the road network

including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

Logical Architecture Reference Flow(s):

tm_work_zone_images
tm_work_zone_info

Maintenance and Construction Management -> Multimodal Transportation Service Provider

Physical Architecture Flow Name: maint and constr work plans

Future construction and maintenance work schedules and activities including anticipated closures with anticipated impact to the roadway, alternate routes, anticipated delays, closure times, and durations.

Logical Architecture Reference Flow(s):

tmtsp_m_and_c_work_plans_for_mtsp

Maintenance and Construction Management -> Other MCM

Physical Architecture Flow Name: maint and constr resource coordination

Request for road maintenance and construction resources that can be used in the diversion of traffic (cones, portable signs), clearance of a road hazard, repair of ancillary damage, or any other incident response.

Logical Architecture Reference Flow(s):

tomcm_resource_coordination_data

Physical Architecture Flow Name: road weather information

Road conditions and weather information that are made available by road maintenance operations to other transportation system operators.

Logical Architecture Reference Flow(s):

tomcm_env_sensor_data
tomcm_road_weather_info

Physical Architecture Flow Name: roadway maintenance status

Summary of maintenance fleet operations affecting the road network. This includes the status of winter maintenance (snow plow schedule and current status).

Logical Architecture Reference Flow(s):

tomcm_roadway_maint_status

Physical Architecture Flow Name: work plan coordination

Coordination of work plan schedules and activities between maintenance and construction organizations or systems. This information includes the work plan schedules and comments and suggested changes that are exchanged as work plans are coordinated and finalized.

Logical Architecture Reference Flow(s):

tomcm_m_and_c_plan_feedback
tomcm_m_and_c_work_plans

Physical Architecture Flow Name: work zone information

Summary of maintenance and construction work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

Logical Architecture Reference Flow(s):

tomcm_work_zone_images
tomcm_work_zone_info

Maintenance and Construction Management -> Rail Operations

Physical Architecture Flow Name: maint and constr work plans

Future construction and maintenance work schedules and activities including anticipated closures with anticipated impact to the roadway, alternate routes, anticipated delays, closure times, and durations.

Logical Architecture Reference Flow(s):

tro_m_and_c_work_plans_for_rail

Physical Architecture Flow Name: road weather information

Road conditions and weather information that are made available by road maintenance operations to other transportation system operators.

Logical Architecture Reference Flow(s):

tro_road_weather_info

Physical Architecture Flow Name: work plan feedback

Comments and suggested changes to proposed construction and maintenance work schedules and activities. This information influences work plan schedules so that they minimize impact to other system operations and the overall transportation system.

Logical Architecture Reference Flow(s):

tro_railroad_schedule_feedback

Maintenance and Construction Management -> Roadway Subsystem

Physical Architecture Flow Name: environmental sensors control

Data used to configure and control environmental sensors.

Logical Architecture Reference Flow(s):

environmental_sensor_control_for_roadway_sensors

Physical Architecture Flow Name: infrastructure monitoring sensor control

Data used to configure and control infrastructure monitoring sensors.

Logical Architecture Reference Flow(s):

infrastructure_sensor_control_from_m_and_c

Physical Architecture Flow Name: roadway information system data

Information used to initialize, configure, and control roadside systems that provide driver

information (e.g., dynamic message signs, highway advisory radio, beacon systems). This flow can provide message content and delivery attributes, local message store maintenance requests, control mode commands, status queries, and all other commands and associated parameters that support remote management of these systems.

Logical Architecture Reference Flow(s):

har_data_from_m_and_c
dms_data_from_m_and_c
dms_auto_treat_data_from_maint
work_zone_info_for_display

Physical Architecture Flow Name: roadway treatment system control

Control data for remotely located, automated devices, that affect the roadway surface (e.g. de-icing applications).

Logical Architecture Reference Flow(s):

roadway_treatment_system_control

Physical Architecture Flow Name: speed monitoring control

Information used to configure and control automated speed monitoring, speed warning, and speed enforcement systems.

Logical Architecture Reference Flow(s):

speed_sensor_control_from_m_and_c

Physical Architecture Flow Name: video surveillance control

Information used to configure and control video surveillance systems.

Logical Architecture Reference Flow(s):

video_control_from_m_and_c

Physical Architecture Flow Name: work zone warning device control

Data used to configure and control work zone safety monitoring and warning devices.

Logical Architecture Reference Flow(s):

intrusion_alert_device_control
intrusion_detection_device_control

Maintenance and Construction Management -> Storage Facility

Physical Architecture Flow Name: storage facility request

Request for information about the equipment and/or materials available at a maintenance storage facility.

Logical Architecture Reference Flow(s):

tsf_materials_status_request
tsf_equipment_availability_request

Maintenance and Construction Management -> Surface Transportation Weather Service

Physical Architecture Flow Name: environmental conditions data

Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing,

treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) as measured and reported by environmental sensors.

Logical Architecture Reference Flow(s):
tstws_env_sensor_data

Physical Architecture Flow Name: road data

Basic road facility and treatment information that supports road conditions forecasts.

Logical Architecture Reference Flow(s):
tstws_asset_treatment_info

Physical Architecture Flow Name: road weather information

Road conditions and weather information that are made available by road maintenance operations to other transportation system operators.

Logical Architecture Reference Flow(s):
tstws_env_info

Physical Architecture Flow Name: transportation weather information request

A request for transportation weather information that may specify the area of interest (a geographic region, particular routes within a region, specific road segments), the type of information that is required, the desired spatial resolution of the information, and time horizon.

Logical Architecture Reference Flow(s):
tstws_trans_weather_info_request

Maintenance and Construction Management -> Traffic Management

Physical Architecture Flow Name: current asset restrictions

Restrictions levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.

Logical Architecture Reference Flow(s):
asset_restrictions_for_traffic

Physical Architecture Flow Name: equipment maintenance status

Current status of field equipment maintenance actions.

Logical Architecture Reference Flow(s):
field_equip_maint_status

Physical Architecture Flow Name: incident information

Notification of existence of incident and expected severity, location, time and nature of incident.

Logical Architecture Reference Flow(s):
incident_info_for_traffic

Physical Architecture Flow Name: maint and constr resource response

Current status of maintenance and construction resources including availability and deployment status.

Logical Architecture Reference Flow(s):
m_and_c_resource_response_to_traffic

Physical Architecture Flow Name: maint and constr work plans

Future construction and maintenance work schedules and activities including anticipated closures with anticipated impact to the roadway, alternate routes, anticipated delays, closure times, and durations.

Logical Architecture Reference Flow(s):
m_and_c_work_plans_for_traffic

Physical Architecture Flow Name: road weather information

Road conditions and weather information that are made available by road maintenance operations to other transportation system operators.

Logical Architecture Reference Flow(s):
road_weather_info_for_traffic

Physical Architecture Flow Name: roadway maintenance status

Summary of maintenance fleet operations affecting the road network. This includes the status of winter maintenance (snow plow schedule and current status).

Logical Architecture Reference Flow(s):
roadway_maint_status_for_traffic

Physical Architecture Flow Name: work zone information

Summary of maintenance and construction work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

Logical Architecture Reference Flow(s):
work_zone_images_for_traffic
work_zone_info_for_traffic

Maintenance and Construction Management -> Transit Management

Physical Architecture Flow Name: current asset restrictions

Restrictions levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.

Logical Architecture Reference Flow(s):
asset_restrictions_for_transit

Physical Architecture Flow Name: maint and constr work plans

Future construction and maintenance work schedules and activities including anticipated closures with anticipated impact to the roadway, alternate routes, anticipated delays, closure times, and durations.

Logical Architecture Reference Flow(s):
m_and_c_work_plans_for_transit

Physical Architecture Flow Name: road weather information

Road conditions and weather information that are made available by road maintenance operations to other transportation system operators.

Logical Architecture Reference Flow(s):
road_weather_info_for_transit

Physical Architecture Flow Name: roadway maintenance status

Summary of maintenance fleet operations affecting the road network. This includes the status of winter maintenance (snow plow schedule and current status).

Logical Architecture Reference Flow(s):
roadway_maint_status_for_transit

Physical Architecture Flow Name: work zone information

Summary of maintenance and construction work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

Logical Architecture Reference Flow(s):
work_zone_info_for_transit

Maintenance and Construction Management -> Weather Service

Physical Architecture Flow Name: environmental conditions data

Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) as measured and reported by environmental sensors.

Logical Architecture Reference Flow(s):
tws_env_sensor_data

Physical Architecture Flow Name: road weather information

Road conditions and weather information that are made available by road maintenance operations to other transportation system operators.

Logical Architecture Reference Flow(s):
tws_env_info

Maintenance and Construction Vehicle -> Maintenance and Construction Management

Physical Architecture Flow Name: environmental probe data

Current environmental conditions (e.g., air temperature, wind speed, surface temperature) as measured by vehicle-based environmental sensors. In addition to environmental sensor inputs, this flow may also include vehicle control system information that may indicate adverse road surface conditions (e.g., traction control system activations).

Logical Architecture Reference Flow(s):
environmental_sensor_data_from_mcv
environmental_sensor_status_from_mcv

environmental_sensor_fault_data_from_mcv

Physical Architecture Flow Name: infrastructure conditions data

Current condition of pavement, bridges, culverts, signs, and other roadway infrastructure as measured by on-board sensors or read from infrastructure-based sensors. The data may include raw data or images (e.g., photo logs) that indicate the current status of the infrastructure.

Logical Architecture Reference Flow(s):

mcv_infrastructure_sensor_data
mcv_infrastructure_sensor_status

Physical Architecture Flow Name: maint and constr dispatch status

Current maintenance and construction status including work data, operator status, crew status, and equipment status.

Logical Architecture Reference Flow(s):

dispatch_response_from_mcv
field_equip_status_from_mcv_operator
m_and_c_status_from_mcv_operator

Physical Architecture Flow Name: maint and constr vehicle conditions

Vehicle diagnostics information that is collected, filtered, and selectively reported by a maintenance and construction vehicle. The information includes engine temperature, mileage, tire wear, brake wear, belt wear, and any warnings or alarms concerning the operational condition of the vehicle and ancillary equipment.

Logical Architecture Reference Flow(s):

safety_data_for_fleet_mgmt
basic_mcv_measures_for_maint_sched

Physical Architecture Flow Name: maint and constr vehicle location data

The current location and related status (e.g., direction and speed) of the maintenance/construction vehicle.

Logical Architecture Reference Flow(s):

vehicle_location_for_mcv_tracking

Physical Architecture Flow Name: maint and constr vehicle operational data

Data that describes the maintenance and construction activity performed by the vehicle. Operational data includes materials usage (amount stored and current application rate), operational state of the maintenance equipment (e.g., blade up/down, spreader pattern), vehicle safety status, and other measures associated with the operation of a maintenance, construction, or other special purpose vehicle. Operational data may include basic operational status of the vehicle equipment or a more precise record of the work performed (e.g., application of crack sealant with precise locations and application characteristics).

Logical Architecture Reference Flow(s):

mcv_materials_status
mcv_operational_data
on_board_work_zone_device_status

Physical Architecture Flow Name: work zone status

Current work zone status including current location (and future locations for moving work zones), impact to the roadway, required lane shifts, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits.

Logical Architecture Reference Flow(s):
work_zone_status_from_mcv

Physical Architecture Flow Name: work zone warning status

Status of a work zone safety monitoring and warning devices. This flow documents system activations and includes additional supporting information (e.g., an image) that allows verification of the alarm.

Logical Architecture Reference Flow(s):
work_zone_intrusion_warning_notification

Map Update Provider -> **Maintenance and Construction Management**

Physical Architecture Flow Name: map updates

Map update which could include a new underlying static or real-time map or map layer(s) update.

Logical Architecture Reference Flow(s):
fmup_m_and_c_display_update
fmup_m_and_c_route_map_update

Other MCM -> **Maintenance and Construction Management**

Physical Architecture Flow Name: maint and constr resource coordination

Request for road maintenance and construction resources that can be used in the diversion of traffic (cones, portable signs), clearance of a road hazard, repair of ancillary damage, or any other incident response.

Logical Architecture Reference Flow(s):
fomcm_resource_coordination_data

Physical Architecture Flow Name: road weather information

Road conditions and weather information that are made available by road maintenance operations to other transportation system operators.

Logical Architecture Reference Flow(s):
fomcm_env_sensor_data
fomcm_road_weather_info

Physical Architecture Flow Name: roadway maintenance status

Summary of maintenance fleet operations affecting the road network. This includes the status of winter maintenance (snow plow schedule and current status).

Logical Architecture Reference Flow(s):
fomcm_roadway_maint_status

Physical Architecture Flow Name: work plan coordination

Coordination of work plan schedules and activities between maintenance and construction organizations or systems. This information includes the work plan schedules and comments and suggested changes that are exchanged as work plans are coordinated and finalized.

Logical Architecture Reference Flow(s):
fomcm_m_and_c_plan_feedback

fomcm_m_and_c_work_plans

Physical Architecture Flow Name: work zone information

Summary of maintenance and construction work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

Logical Architecture Reference Flow(s):

fomcm_work_zone_images
fomcm_work_zone_info

Rail Operations -> Maintenance and Construction Management

Physical Architecture Flow Name: railroad schedules

Train schedules, maintenance schedules, and other information from the railroad that supports forecast of HRI closures.

Logical Architecture Reference Flow(s):

fro_railroad_schedules

Physical Architecture Flow Name: work plan feedback

Comments and suggested changes to proposed construction and maintenance work schedules and activities. This information influences work plan schedules so that they minimize impact to other system operations and the overall transportation system.

Logical Architecture Reference Flow(s):

fro_m_and_c_plan_feedback_from_rail

Roadway Subsystem -> Maintenance and Construction Management

Physical Architecture Flow Name: environmental conditions data

Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) as measured and reported by environmental sensors.

Logical Architecture Reference Flow(s):

environmental_sensor_data_from_roadway_sensors
environmental_sensor_fault_data_from_roadway_sensors
environmental_sensor_status_from_roadway_sensors

Physical Architecture Flow Name: field device status

Reports from field equipment (sensors, signals, signs, controllers, etc.) which indicate current operational status.

Logical Architecture Reference Flow(s):

video_device_equip_status_for_m_and_c
traffic_sensor_equip_status_for_m_and_c
signal_override_equip_status_for_m_and_c
vehicle_sign_equip_status_for_m_and_c
smart_probe_equip_status_for_m_and_c
indicator_equip_status_from_highways_for_m_and_c

hov_sensor_equip_status_for_m_and_c
indicator_equip_status_from_roads_for_m_and_c

Physical Architecture Flow Name: infrastructure monitoring sensor data

Data read from infrastructure-based sensors that monitor the condition of pavement, bridges, culverts, signs, and other roadway infrastructure.

Logical Architecture Reference Flow(s):

infrastructure_sensor_status_for_m_and_c
infrastructure_sensor_data_for_m_and_c

Physical Architecture Flow Name: roadway information system status

Current operating status of dynamic message signs, highway advisory radios, beacon systems, or other configurable field equipment that provides dynamic information to the driver.

Logical Architecture Reference Flow(s):

dms_auto_treat_status_to_maint
dms_equip_status_for_m_and_c
dms_status_for_m_and_c
har_equip_status_for_m_and_c
har_status_for_m_and_c

Physical Architecture Flow Name: roadway treatment system status

Current operational status of automated roadway treatment devices (e.g., anti-icing systems).

Logical Architecture Reference Flow(s):

roadway_treatment_system_status

Physical Architecture Flow Name: speed monitoring information

System status including current operational state and logged information including measured speeds, warning messages displayed, and violation records.

Logical Architecture Reference Flow(s):

speed_sensor_status_for_m_and_c
speed_violation_notification_for_m_and_c
speed_data_for_m_and_c_speed_monitoring
speed_sensor_log_for_m_and_c

Physical Architecture Flow Name: traffic images

High fidelity, real-time traffic images suitable for surveillance monitoring by the operator or for use in machine vision applications. This flow includes the images and the operational status of the surveillance system.

Logical Architecture Reference Flow(s):

work_zone_images

Physical Architecture Flow Name: work zone warning status

Status of a work zone safety monitoring and warning devices. This flow documents system activations and includes additional supporting information (e.g., an image) that allows verification of the alarm.

Logical Architecture Reference Flow(s):

intrusion_alert_device_status
work_zone_intrusion_detected
roadside_crew_warning_given
intrusion_detection_device_status

work_zone_intrusion_alert
work_zone_intrusion_video_image

Storage Facility -> **Maintenance and Construction Management**

Physical Architecture Flow Name: equipment availability

An inventory of the maintenance and construction equipment available at the storage facility. This flow includes the type of equipment, enough descriptive information to indicate its suitability for use, and its current status. This flow may contain information for a specific type of equipment or include all equipment available at the facility.

Logical Architecture Reference Flow(s):
fsf_equipment_availability_for_fleet_manager
fsf_equipment_availability
fsf_equipment_status_for_tracking

Physical Architecture Flow Name: maintenance materials storage status

The amount and availability of maintenance materials in storage facilities.

Logical Architecture Reference Flow(s):
fsf_materials_status

Surface Transportation Weather Service -> **Maintenance and Construction Management**

Physical Architecture Flow Name: environmental conditions data

Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) as measured and reported by environmental sensors.

Logical Architecture Reference Flow(s):
fstws_env_sensor_data
fstws_surface_trans_weather_observations

Physical Architecture Flow Name: transportation weather information

Current and forecast road conditions and weather information (e.g., surface condition, flooding, wind advisories, visibility, etc.) associated with the transportation network. This information is of a resolution, timeliness, and accuracy to be useful in transportation decision making.

Logical Architecture Reference Flow(s):
fstws_surface_trans_weather_forecasts

Traffic Management -> **Maintenance and Construction Management**

Physical Architecture Flow Name: field equipment status

Identification of field equipment requiring repair and known information about the associated faults.

Logical Architecture Reference Flow(s):
field_equipment_status_from_traffic

Physical Architecture Flow Name: incident information

Notification of existence of incident and expected severity, location, time and nature of incident.

Logical Architecture Reference Flow(s):
incident_info_from_traffic

Physical Architecture Flow Name: maint and constr resource request

Request for road maintenance and construction resources that can be used in the diversion of traffic (cones, portable signs), clearance of a road hazard, repair of ancillary damage, or any other incident response.

Logical Architecture Reference Flow(s):
m_and_c_resource_request_from_traffic
roadway_maint_action_req_from_traffic
winter_maint_action_req_from_traffic

Physical Architecture Flow Name: road network conditions

Current and forecasted traffic information, road and weather conditions, incident information, and other road network status. Either raw data, processed data, or some combination of both may be provided by this architecture flow.

Logical Architecture Reference Flow(s):
road_network_info_from_traffic
environmental_sensor_data_from_traffic_management

Physical Architecture Flow Name: work plan feedback

Comments and suggested changes to proposed construction and maintenance work schedules and activities. This information influences work plan schedules so that they minimize impact to other system operations and the overall transportation system.

Logical Architecture Reference Flow(s):
m_and_c_plan_feedback_from_traffic

Transit Management -> Maintenance and Construction Management

Physical Architecture Flow Name: road network probe information

Aggregated route usage, travel times, environmental conditions, and other aggregated data collected from probe vehicles.

Logical Architecture Reference Flow(s):
env_probe_info_from_transit

Physical Architecture Flow Name: work plan feedback

Comments and suggested changes to proposed construction and maintenance work schedules and activities. This information influences work plan schedules so that they minimize impact to other system operations and the overall transportation system.

Logical Architecture Reference Flow(s):
m_and_c_plan_feedback_from_transit

Weather Service -> Maintenance and Construction Management

Physical Architecture Flow Name: environmental conditions data

Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) as measured and reported by environmental sensors.

Logical Architecture Reference Flow(s):
fws_env_sensor_data

Physical Architecture Flow Name: weather information

Accumulated forecasted and current weather data (e.g., temperature, pressure, wind speed, wind direction, humidity, precipitation, visibility, light conditions, etc.).

Logical Architecture Reference Flow(s):
fws_current_weather_observations
fws_weather_forecasts

2.13.3 Architecture Flow Diagrams for MCMS

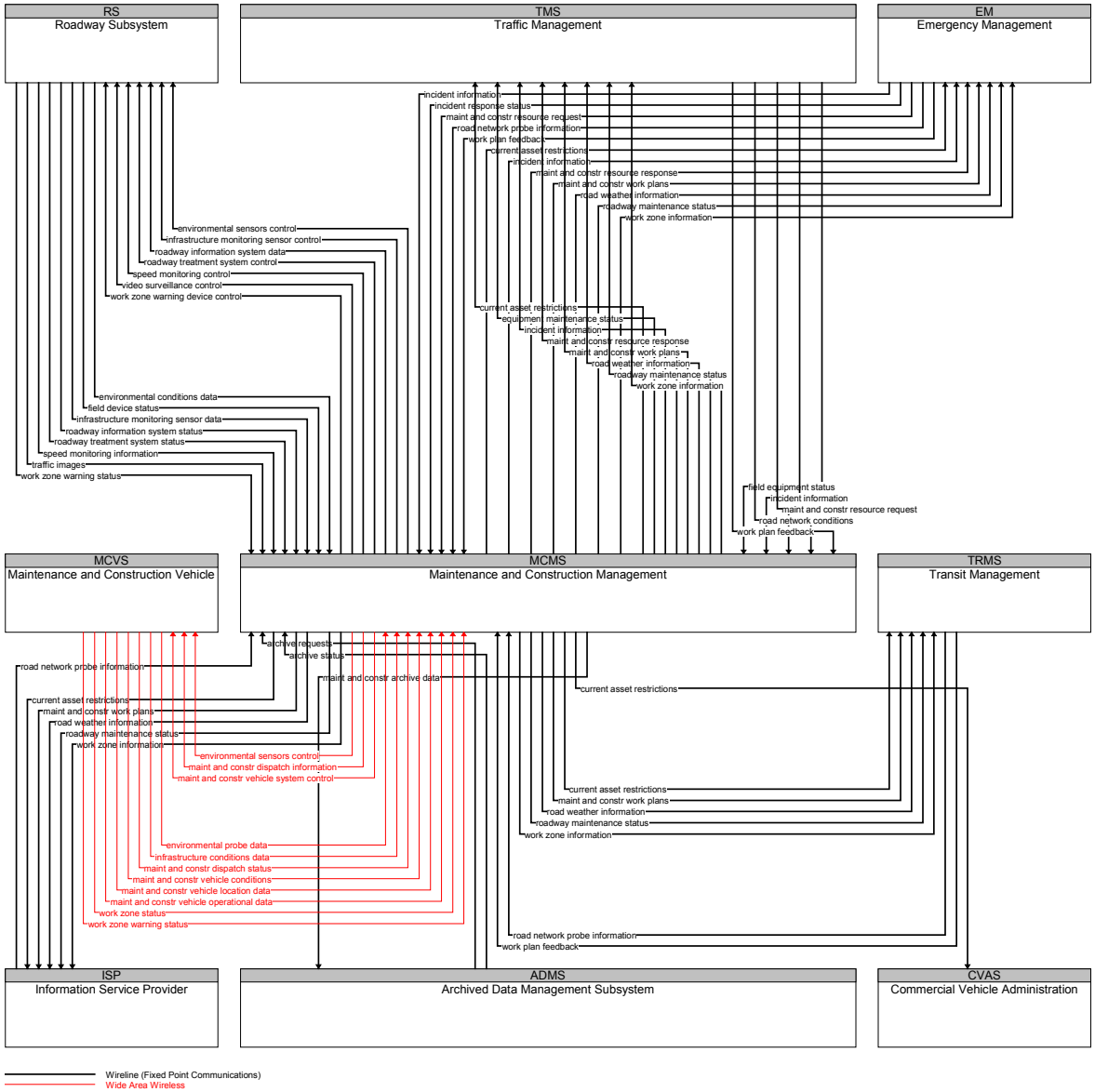


Figure 2-23 Subsystem Architecture Flow Diagram for MCMS

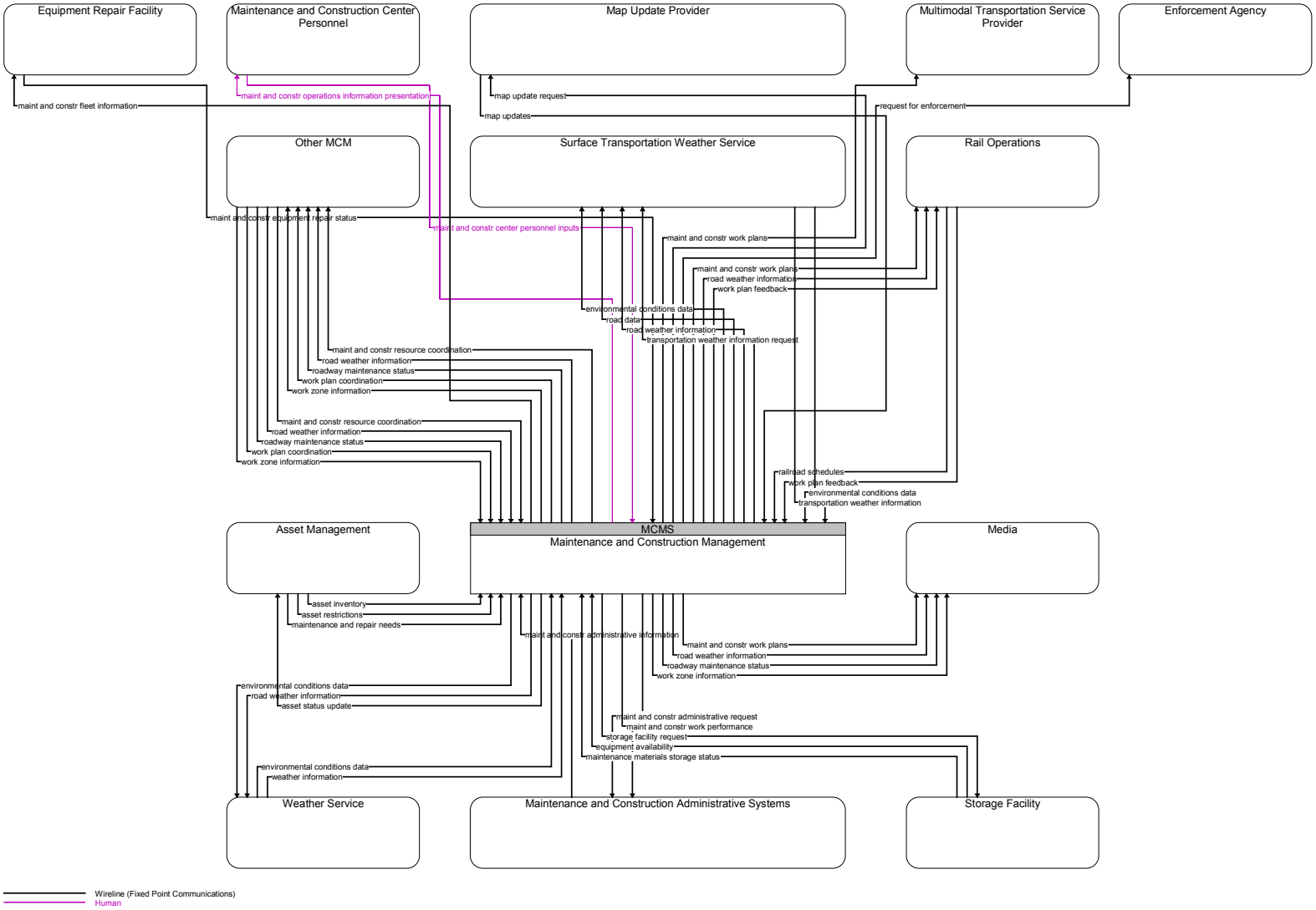


Figure 2-24 Terminator Architecture Flow Diagram for MCMS

2.14 Maintenance and Construction Vehicle Subsystem

This subsystem resides in a maintenance, construction, or other specialized service vehicles or equipment and provides the sensory, processing, storage, and communications functions necessary to support highway maintenance and construction. All types of maintenance and construction vehicles are covered, including heavy equipment and supervisory vehicles. The subsystem provides two-way communications between drivers/operators and dispatchers and maintains and communicates current location and status information. A wide range of operational status is monitored, measured, and made available, depending on the specific type of vehicle or equipment. For example, for a snow plow, the information would include whether the plow is up or down and material usage information. The subsystem may also contain capabilities to monitor vehicle systems to support maintenance of the vehicle itself and other sensors that monitor environmental conditions including the road condition and surface weather information. This subsystem can represent a diverse set of mobile environmental sensing platforms, including wheeled vehicles and any other vehicle that collects and reports environmental information.

2.14.1 Subsytem Equipment Packages and Supporting Process Specifications for MCVS

MCV Environmental Monitoring
This equipment package collects current road and weather conditions using sensor systems. Environmental information including road surface temperature and air temperature is measured and spatially located and time stamped. Individual measures can be combined to generate a "thermal trace".

Process Specifications
9.4.1 Collect Environmental Data On-Board

MCV Infrastructure Monitoring
This on-board equipment package monitors the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts). It includes vehicle-based sensors that directly monitor the infrastructure, communications that allow roadway-based infrastructure monitoring sensors to be controlled and read, and data communications that allows collected infrastructure condition information to be reported back to a center.

Process Specifications
9.1.1 Manage M&C Systems On-Board

MCV Roadway Maintenance and Construction
This equipment package includes the on-board systems that support routine non-winter maintenance on a roadway system or right-of-way. Routine maintenance includes 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, etc.).

Process Specifications
9.1.1 Manage M&C Systems On-Board

9.1.2 Collect M&C Vehicle Data On-Board

9.1.6 Provide M&C Vehicle Operator Interface for Maint

MCV Vehicle Location Tracking
This equipment package tracks vehicle location and reports this location to a dispatch center.

Process Specifications
9.1.2 Collect M&C Vehicle Data On-Board

MCV Vehicle Safety Monitoring
This equipment package detects vehicle intrusions in the vicinity of the vehicle and warns crew workers and drivers of imminent encroachment. Crew movements are also monitored so that the crew can be warned of movement beyond the designated safe zone. This equipment package can be used for stationary work zones or in mobile applications where a safe zone is maintained around the moving vehicle.

Process Specifications
9.1.6 Provide M&C Vehicle Operator Interface for Maint
9.3.1.4 Monitor Crew Movement On-Board

9.3.2.1 Status Work Zone Activity

9.3.2.4 Provide M&C Field Personnel Interface for Work Zones

9.3.4.3 Detect Work Zone Intrusion On-Board

9.3.4.4 Provide On-Board Work Zone Intrusion Alert

MCV Vehicle System Monitoring and Diagnostics
This equipment package includes on-board sensors capable of monitoring the condition of each of the vehicle systems and diagnostics that can be used to support vehicle maintenance.

Process Specifications
9.1.2 Collect M&C Vehicle Data On-Board

9.1.6 Provide M&C Vehicle Operator Interface for Maint

MCV Winter Maintenance
This equipment package supports snow plow operations and other roadway treatments (e.g., salt spraying and other material applications).

Process Specifications
9.1.1 Manage M&C Systems On-Board

9.1.2 Collect M&C Vehicle Data On-Board

9.1.6 Provide M&C Vehicle Operator Interface for Maint

MCV Work Zone Support

This equipment package provides communications and support for local management of a work zone.

Process Specifications
9.3.1.2 Operate WZ Devices On-Board

9.3.2.1 Status Work Zone Activity
9.3.2.4 Provide M&C Field Personnel Interface for Work Zones

2.14.2 Subsytem Interfaces for MCVS

Basic Maintenance and Construction Vehicle -> **Maintenance and Construction Vehicle**

Physical Architecture Flow Name: maint and constr material information

Information on materials stored on the vehicle including quantity and current application rate.

Logical Architecture Reference Flow(s):
fbmcv_materials_status

Physical Architecture Flow Name: maint and constr vehicle measures

Raw vehicle diagnostics and operating status data reported by the maintenance vehicle platform including engine temperature, mileage, tire wear, brake wear, belt wear, and other operational status measures. In addition to this general vehicle status, this flow also includes the status of maintenance and construction-specific systems on the vehicle.

Logical Architecture Reference Flow(s):
fbmcv_basic_mcv_measures

Maintenance and Construction Field Personnel -> **Maintenance and Construction Vehicle**

Physical Architecture Flow Name: crew movements

Field crew location within a work zone that is monitored to enhance work zone safety.

Logical Architecture Reference Flow(s):
fmcfp_crew_movements

Physical Architecture Flow Name: maint and constr field personnel inputs

Current maintenance and construction status information provided by field personnel including work data, operator status, crew status, vehicle status, and equipment status.

Logical Architecture Reference Flow(s):
fmcfp_m_and_c_activity_status
fmcfp_field_equip_repair_status
fmcfp_work_zone_status_inputs
fmcfp_dispatch_response

Maintenance and Construction Management -> **Maintenance and Construction Vehicle**

Physical Architecture Flow Name: environmental sensors control

Data used to configure and control environmental sensors.

Logical Architecture Reference Flow(s):

environmental_sensor_control_for_mcv

Physical Architecture Flow Name: maint and constr dispatch information

Information used to dispatch maintenance and construction vehicles, equipment, and crews. This information includes routing information, traffic information, road restrictions, incident information, environmental information, decision support information, maintenance schedule data, dispatch instructions, personnel assignments, and corrective actions.

Logical Architecture Reference Flow(s):

status_of_other_work_zones
suggested_route_to_mcv
dispatch_orders_to_mcv
winter_dispatch_orders_to_mcv
road_network_info_to_mcv
mdss_recommended_actions_for_operator

Physical Architecture Flow Name: maint and constr vehicle system control

Configure and control data that supports remote control of on-board maintenance and construction vehicle systems and field equipment that is remotely controlled by the vehicle. For example, the data can be used to adjust material application rates and spread patterns.

Logical Architecture Reference Flow(s):

center_control_of_on_board_work_zone_devices
mcv_vehicle_systems_control_by_fleet_manager
mcv_infrastructure_sensor_control

Maintenance and Construction Vehicle -> Basic Maintenance and Construction Vehicle

Physical Architecture Flow Name: maint and constr vehicle control

Control data sent from on-board ITS systems to control maintenance and construction vehicle equipment, including control of materials dispersion rate and other control functions that will vary with vehicle type and application.

Logical Architecture Reference Flow(s):

tbmcv_vehicle_system_control

Maintenance and Construction Vehicle -> Driver

Physical Architecture Flow Name: driver information

General advisory and traffic control information provided to the driver while en route.

Logical Architecture Reference Flow(s):

td_work_zone_intrusion_alert_from_mcv
td_mcv_on_board_display
td_traffic_advisory_from_mcv

Maintenance and Construction Vehicle -> Equipment Repair Facility

Physical Architecture Flow Name: maint and constr vehicle conditions

Vehicle diagnostics information that is collected, filtered, and selectively reported by a maintenance and construction vehicle. The information includes engine temperature, mileage, tire wear, brake wear, belt wear, and any warnings or alarms concerning the operational condition of the vehicle and ancillary equipment.

Logical Architecture Reference Flow(s):

terf_basic_mcv_measures_for_equip_repair

Maintenance and Construction Vehicle -> Maintenance and Construction Field Personnel

Physical Architecture Flow Name: maint and constr field personnel information presentation

Information presented to maintenance and construction field personnel including vehicle routing and traffic information, road restrictions, environmental information, decision support information, maintenance schedules, dispatch instructions, maintenance personnel assignments, vehicle maintenance information, work zone status information, and corrective actions.

Logical Architecture Reference Flow(s):

tmcfp_environmental_info
tmcfp_suggested_route
tmcfp_work_zone_status_presentation
tmcfp_dispatch_info
tmcfp_mcv_operational_data
tmcfp_road_network_info

Physical Architecture Flow Name: maint and constr vehicle condition presentation

Presentation of vehicle diagnostics and operating status including speed, engine temperature, mileage, tire wear, brake wear, belt wear, maintenance and construction system status, environmental sensor information, and other measures associated with the operation of a maintenance vehicle.

Logical Architecture Reference Flow(s):

tmcfp_vehicle_condition_status

Physical Architecture Flow Name: work zone warning

Warning of a work zone emergency or safety issue such as the intrusion of a vehicle into the work zone area or movement of field crew into the travel lanes.

Logical Architecture Reference Flow(s):

tmcfp_work_zone_intrusion_alert_from_mcv
tmcfp_work_zone_on_board_intrusion_warning

Maintenance and Construction Vehicle -> Maintenance and Construction Management

Physical Architecture Flow Name: environmental probe data

Current environmental conditions (e.g., air temperature, wind speed, surface temperature) as measured by vehicle-based environmental sensors. In addition to environmental sensor inputs, this flow may also include vehicle control system information that may indicate adverse road surface conditions (e.g., traction control system activations).

Logical Architecture Reference Flow(s):

environmental_sensor_data_from_mcv
environmental_sensor_fault_data_from_mcv
environmental_sensor_status_from_mcv

Physical Architecture Flow Name: infrastructure conditions data

Current condition of pavement, bridges, culverts, signs, and other roadway infrastructure as measured by on-board sensors or read from infrastructure-based sensors. The data may include raw data or images (e.g., photo logs) that indicate the current status of the infrastructure.

Logical Architecture Reference Flow(s):

mcv_infrastructure_sensor_status
mcv_infrastructure_sensor_data

Physical Architecture Flow Name: maint and constr dispatch status

Current maintenance and construction status including work data, operator status, crew status, and equipment status.

Logical Architecture Reference Flow(s):

m_and_c_status_from_mcv_operator
dispatch_response_from_mcv
field_equip_status_from_mcv_operator

Physical Architecture Flow Name: maint and constr vehicle conditions

Vehicle diagnostics information that is collected, filtered, and selectively reported by a maintenance and construction vehicle. The information includes engine temperature, mileage, tire wear, brake wear, belt wear, and any warnings or alarms concerning the operational condition of the vehicle and ancillary equipment.

Logical Architecture Reference Flow(s):

basic_mcv_measures_for_maint_sched
safety_data_for_fleet_mgmt

Physical Architecture Flow Name: maint and constr vehicle location data

The current location and related status (e.g., direction and speed) of the maintenance/construction vehicle.

Logical Architecture Reference Flow(s):

vehicle_location_for_mcv_tracking

Physical Architecture Flow Name: maint and constr vehicle operational data

Data that describes the maintenance and construction activity performed by the vehicle. Operational data includes materials usage (amount stored and current application rate), operational state of the maintenance equipment (e.g., blade up/down, spreader pattern), vehicle safety status, and other measures associated with the operation of a maintenance, construction, or other special purpose vehicle. Operational data may include basic operational status of the vehicle equipment or a more precise record of the work performed (e.g., application of crack sealant with precise locations and application characteristics).

Logical Architecture Reference Flow(s):

mcv_materials_status
mcv_operational_data
on_board_work_zone_device_status

Physical Architecture Flow Name: work zone status

Current work zone status including current location (and future locations for moving work zones), impact to the roadway, required lane shifts, expected time(s) and duration of impact, anticipated

delays, alternate routes, and suggested speed limits.

Logical Architecture Reference Flow(s):
work_zone_status_from_mcv

Physical Architecture Flow Name: work zone warning status

Status of a work zone safety monitoring and warning devices. This flow documents system activations and includes additional supporting information (e.g., an image) that allows verification of the alarm.

Logical Architecture Reference Flow(s):
work_zone_intrusion_warning_notification

Maintenance and Construction Vehicle -> Other MCV

Physical Architecture Flow Name: maint and constr vehicle status coordination

Maintenance and construction vehicle status information that is shared between vehicles. This includes environmental conditions and the operational status of the vehicles.

Logical Architecture Reference Flow(s):
tomcv_env_conditions
tomcv_vehicle_operational_data

Physical Architecture Flow Name: work zone warning notification

Notification of a work zone emergency or safety issue. This flow identifies that a work zone emergency or safety issue has occurred so that warnings may be generated by more than one system in the work zone.

Logical Architecture Reference Flow(s):
tomcv_work_zone_intrusion_detection_on_board
tomcv_work_zone_intrusion_warning_to_crew
tomcv_crew_movements
tomcv_work_zone_intrusion_alert_on_board

Maintenance and Construction Vehicle -> Roadway Subsystem

Physical Architecture Flow Name: environmental conditions data

Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) as measured and reported by environmental sensors.

Logical Architecture Reference Flow(s):
environmental_sensor_data_for_roadway

Physical Architecture Flow Name: environmental sensors control

Data used to configure and control environmental sensors.

Logical Architecture Reference Flow(s):
environmental_sensor_control_for_roadway

Physical Architecture Flow Name: infrastructure monitoring sensor control

Data used to configure and control infrastructure monitoring sensors.

Logical Architecture Reference Flow(s):
infrastructure_sensor_control_from_mcv

Physical Architecture Flow Name: roadway information system data

Information used to initialize, configure, and control roadside systems that provide driver information (e.g., dynamic message signs, highway advisory radio, beacon systems). This flow can provide message content and delivery attributes, local message store maintenance requests, control mode commands, status queries, and all other commands and associated parameters that support remote management of these systems.

Logical Architecture Reference Flow(s):
dms_data_from_mcv

Maintenance and Construction Vehicle -> **Vehicle**

Physical Architecture Flow Name: vehicle signage data

In-vehicle signage data generated by the roadway infrastructure indicating either road conditions, street names, or special information.

Logical Architecture Reference Flow(s):
work_zone_intrusion_alert_on_board_for_in_vehicle_signing

Other MCV -> **Maintenance and Construction Vehicle**

Physical Architecture Flow Name: maint and constr vehicle status coordination

Maintenance and construction vehicle status information that is shared between vehicles. This includes environmental conditions and the operational status of the vehicles.

Logical Architecture Reference Flow(s):
fomcv_env_conditions
fomcv_vehicle_operational_data

Physical Architecture Flow Name: work zone warning notification

Notification of a work zone emergency or safety issue. This flow identifies that a work zone emergency or safety issue has occurred so that warnings may be generated by more than one system in the work zone.

Logical Architecture Reference Flow(s):
fomcv_work_zone_intrusion_warning_to_crew
fomcv_crew_movements
fomcv_work_zone_intrusion_detection_on_board
fomcv_work_zone_intrusion_alert_on_board

Roadway Environment -> **Maintenance and Construction Vehicle**

Physical Architecture Flow Name: environmental conditions

Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) that are measured by environmental sensors.

Logical Architecture Reference Flow(s):

fre_environmental_conditions_at_roadway

Physical Architecture Flow Name: roadway characteristics

Detectable or measurable road characteristics such as friction coefficient and general surface conditions, road geometry and markings, etc. These characteristics are monitored or measured by ITS sensors and used to support advanced vehicle safety and control and road maintenance capabilities.

Logical Architecture Reference Flow(s):

fre_roadway_infrastructure_characteristics
fre_roadway_characteristics_for_mcv

Roadway Subsystem -> Maintenance and Construction Vehicle

Physical Architecture Flow Name: environmental conditions data

Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) as measured and reported by environmental sensors.

Logical Architecture Reference Flow(s):

environmental_sensor_data_from_roadway
environmental_sensor_status_from_roadway
environmental_sensor_fault_data_from_roadway

Physical Architecture Flow Name: infrastructure monitoring sensor data

Data read from infrastructure-based sensors that monitor the condition of pavement, bridges, culverts, signs, and other roadway infrastructure.

Logical Architecture Reference Flow(s):

infrastructure_sensor_status_for_mcv
infrastructure_sensor_data_for_mcv

Physical Architecture Flow Name: roadway information system status

Current operating status of dynamic message signs, highway advisory radios, beacon systems, or other configurable field equipment that provides dynamic information to the driver.

Logical Architecture Reference Flow(s):

dms_status_for_mcv

Physical Architecture Flow Name: work zone warning notification

Notification of a work zone emergency or safety issue. This flow identifies that a work zone emergency or safety issue has occurred so that warnings may be generated by more than one system in the work zone.

Logical Architecture Reference Flow(s):

work_zone_intrusion_detection_for_on_board

Traffic -> Maintenance and Construction Vehicle

Physical Architecture Flow Name: traffic characteristics

Physical traffic characteristics which are monitored and translated into macroscopic measures like occupancy, volume, density, and average speed. Point measures support presence detection and individual vehicle measures like speed.

Logical Architecture Reference Flow(s):
ftrf_vehicle_presence

Vehicle -> **Maintenance and Construction Vehicle**

Physical Architecture Flow Name: safety system status

Current vehicle safety system status indicating the operating condition of these systems and the safety status of the vehicle and driver.

Logical Architecture Reference Flow(s):
safety_data_for_mcv

Physical Architecture Flow Name: vehicle location

Location of vehicle and other vehicle characteristics which are exchanged between vehicle subsystems.

Logical Architecture Reference Flow(s):
vehicle_location_for_mcv

2.14.3 Architecture Flow Diagrams for MCVS

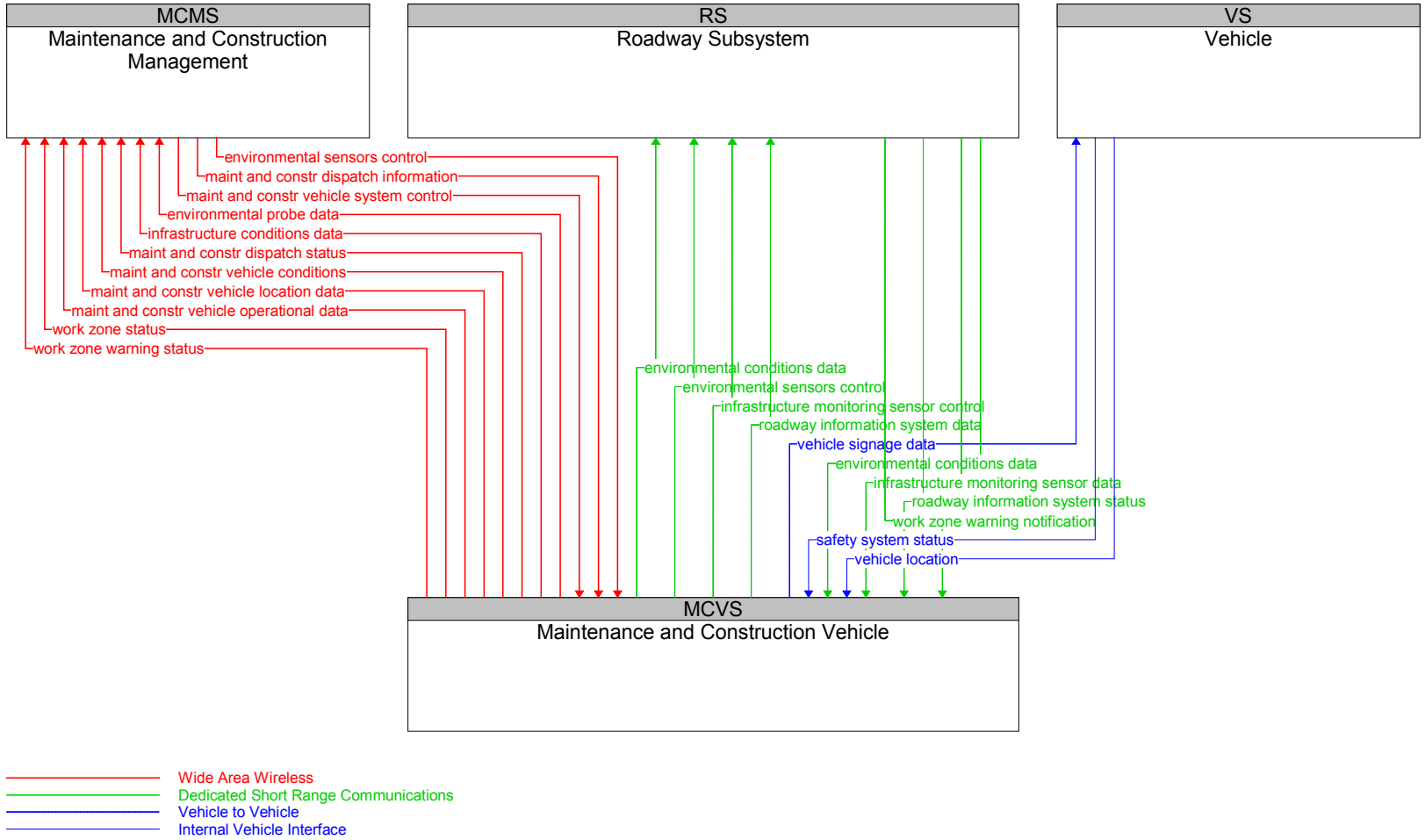


Figure 2-25 Subsystem Architecture Flow Diagram for MCVS

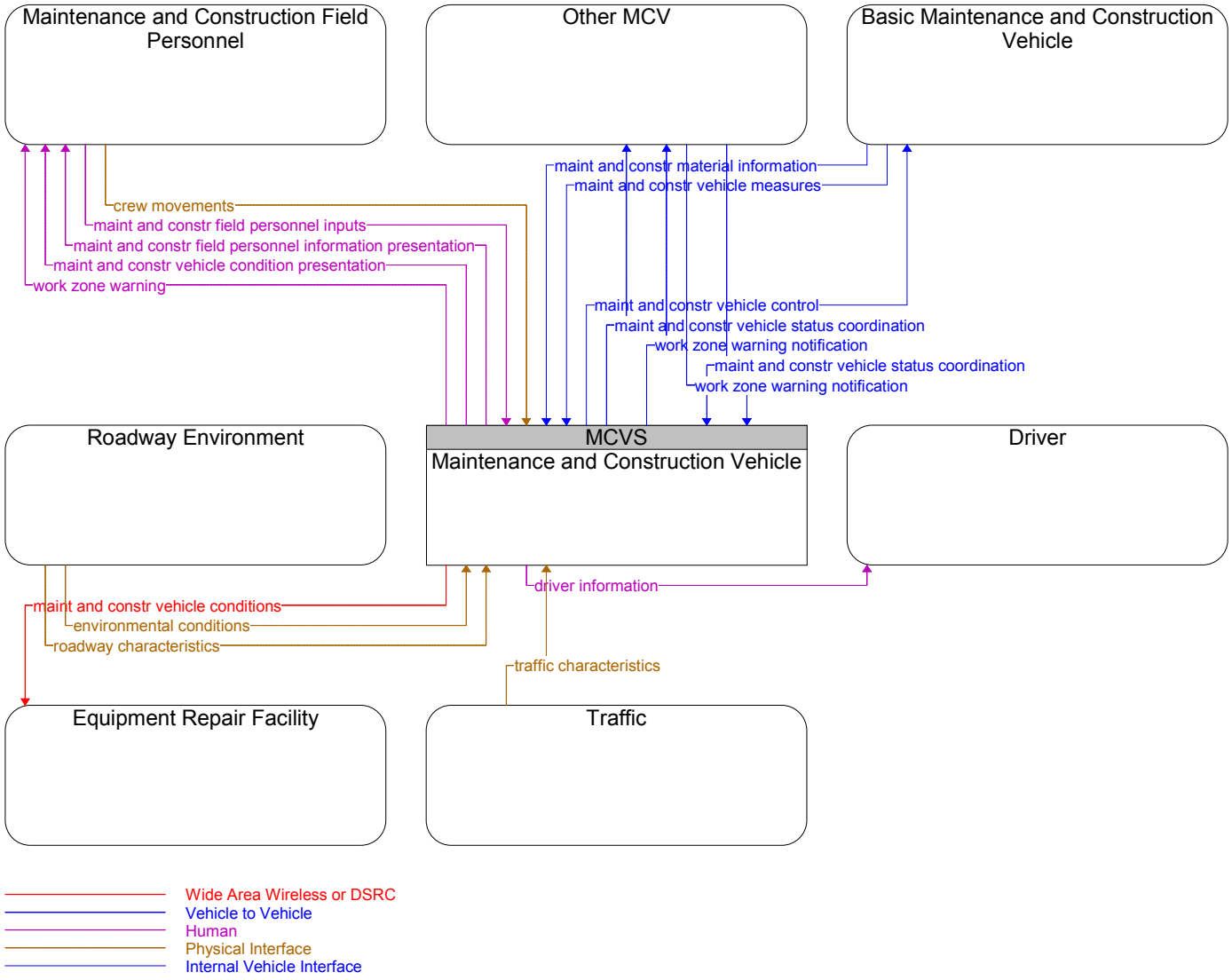


Figure 2-26 Terminator Architecture Flow Diagram for MCVS

2.15 Personal Information Access

This subsystem provides the capability for travelers to receive formatted traffic advisories from their homes, place of work, major trip generation sites, personal portable devices, and over multiple types of electronic media. These capabilities shall also provide basic routing information and allow users to select those transportation modes that allow them to avoid congestion, or more advanced capabilities to allow users to specify those transportation parameters that are unique to their individual needs and receive travel information. This subsystem shall provide capabilities to receive route planning from the infrastructure at fixed locations such as in their homes, their place of work, and at mobile locations such as from personal portable devices and in the vehicle or perform the route planning process at a mobile information access location. In addition to end user devices, this subsystem may also represent a device that is used by a merchant or other service provider to receive traveler information and relay important information to their customers. This subsystem shall also provide the capability to initiate a distress signal and cancel a prior issued manual request for help.

2.15.1 Subsystem Equipment Packages and Supporting Process Specifications for PIAS

Personal Autonomous Route Guidance
This Equipment package provides multi-modal route planning and transition by transition route guidance. It provides autonomous route guidance in the absence of real-time information or factors information provided by the infrastructure into its route selection and guidance algorithms. The equipment package also includes those truly autonomous systems that are not configured to receive or process any external data.

Process Specifications
6.8.1.1.3 Provide Personal Portable Device Autonomous Guidance

6.8.1.2 Provide Personal Portable Device Guidance Interface

6.8.1.4 Update Traveler Navigable Map Database

6.8.3.4 Update Traveler Personal Display Map Data

Personal Basic Information Reception
This Equipment package shall provide the capability for travelers to interface with the ISP Subsystem Basic Information Broadcast Equipment package and receive formatted traffic advisories including accurate traveling information concerning available travel options and their availability, and congestion information from their Personal Information Access Subsystem to include their homes, place of work, major trip generation sites, personal portable devices, and over multiple types of electronic media such as facsimile machines, portable AM/FM radios, and a pager processor.

Process Specifications
6.8.3.2 Provide Traveler with Personal Travel Information

6.8.3.3 Provide Traveler Personal Interface

Personal Interactive Information Reception
This Equipment package shall provide the capability for travelers to interface with the ISP Subsystem Infrastructure Equipment packages including the Interactive Infrastructure Information Equipment package, and the Infrastructure

Provided Route Selection, Yellow Pages and Reservation, and Dynamic Ridesharing Equipment packages. These capabilities shall be provided using the Personal Information Access Subsystem equipment such as cellular telephone, interactive TV, Personal Computer, and pager with alpha display using communication medium and equipment such as two-way radio, CATV, and wireless data transceivers.

Process Specifications
6.8.3.1 Get Traveler Personal Request

6.8.3.2 Provide Traveler with Personal Travel Information

6.8.3.3 Provide Traveler Personal Interface
7.5.3 Provide Personal Traveler Card Interface

Personal Location Determination
This equipment package determines current location information and provides this information to other equipment packages that use the location information to provide various ITS services.

Process Specifications
6.8.1.3 Process Personal Portable Device Location Data

Personal Mayday I/F
This Equipment package shall provide the capability to initiate a distress signal and cancel a prior issued manual request for help using the Personal Information Access Subsystem. This capability shall be provided using equipment such as a processor to automatically dial the Emergency Management Subsystem and provide location.

Process Specifications
6.8.1.5 Provide Traveler Emergency Message Interface

6.8.2.1 Build Traveler Personal Security Message

6.8.2.2 Provide Traveler Emergency Communications Function

Personal Provider-Based Route Guidance
This Equipment package coordinates with an ISP-Based route planning service to select a suggested route plan that is tailored to the traveler's preferences. Coordination may continue during the trip so that the route plan can be modified to account for new information. Many equipment configurations are possible including systems that provide a basic route plan to the traveler as well as more sophisticated systems that can provide transition by transition guidance to the traveler along a multi-modal route plan.

Process Specifications
6.8.1.1.1 Determine Personal Portable Device Guidance Method

6.8.1.1.2 Provide Personal Portable Device Dynamic Guidance

6.8.1.2 Provide Personal Portable Device Guidance Interface

6.8.1.4 Update Traveler Navigable Map Database

6.8.3.3 Provide Traveler Personal Interface

2.15.2 Subsystem Interfaces for PIAS

Emergency Management -> Personal Information Access

Physical Architecture Flow Name: emergency acknowledge

Acknowledge request for emergency assistance and provide additional details regarding actions and verification requirements.

Logical Architecture Reference Flow(s):

emergency_request_personal_traveler_acknowledge

Information Service Provider -> Personal Information Access

Physical Architecture Flow Name: broadcast information

General broadcast information that contains link travel times, incidents, advisories, transit services and a myriad of other traveler information.

Logical Architecture Reference Flow(s):

transit_deviations_for_broadcast_to_personal_devices
traffic_data_for_broadcast_to_personal_devices

Physical Architecture Flow Name: traveler information

Traveler information comprised of traffic status, advisories, incidents, payment information and many other travel-related data updates and confirmations.

Logical Architecture Reference Flow(s):

traveler_map_update_payment_response
transit_deviations_for_personal_devices
traveler_personal_payment_confirmation
traveler_personal_transaction_confirmation
traffic_data_for_personal_devices
traveler_personal_event_information
traveler_personal_display_update_payment_response

Physical Architecture Flow Name: trip plan

A sequence of links and special instructions comprising of a trip plan indicating efficient routes for navigating the links. Normally coordinated with traffic conditions, other incidents, preemption and prioritization plans.

Logical Architecture Reference Flow(s):

traveler_personal_trip_information
traveler_guidance_route

Physical Architecture Flow Name: yellow pages information

Travel service information covering tourist attractions, lodging, restaurants, service stations, emergency services, and other services and businesses of interest to the traveler.

Logical Architecture Reference Flow(s):

traveler_personal_yellow_pages_data

Location Data Source -> Personal Information Access

Physical Architecture Flow Name: position fix

Information which provides a traveler's or vehicle's geographical position.

Logical Architecture Reference Flow(s):

From_Location_Data_Source

Map Update Provider -> Personal Information Access

Physical Architecture Flow Name: map updates

Map update which could include a new underlying static or real-time map or map layer(s) update.

Logical Architecture Reference Flow(s):

fmup_traveler_personal_display_update_cost
fmup_traveler_personal_display_update
fmup_traveler_map_update
fmup_traveler_map_update_cost

Personal Information Access -> Emergency Management

Physical Architecture Flow Name: emergency notification

An emergency request for assistance originated by a traveler using an in-vehicle, public access, or personal device.

Logical Architecture Reference Flow(s):

emergency_request_personal_traveler_details

Personal Information Access -> Information Service Provider

Physical Architecture Flow Name: traveler profile

Information about a traveler including equipment capabilities, personal preferences and recurring trip characteristics.

Logical Architecture Reference Flow(s):

traveler_traffic_profile
traveler_transit_profile

Physical Architecture Flow Name: traveler request

Request by a traveler to summon assistance, request information, make a reservation, or initiate any other traveler service.

Logical Architecture Reference Flow(s):

traveler_map_update_payment_request
transit_deviations_personal_request
traveler_personal_display_update_payment_request
traveler_personal_current_condition_request
traveler_personal_event_information_request
traffic_data_personal_request

Physical Architecture Flow Name: trip confirmation

Acknowledgement by the driver/traveler of acceptance of a route.

Logical Architecture Reference Flow(s):

traveler_route_accepted

traveler_personal_trip_confirmation
traveler_personal_payment_information

Physical Architecture Flow Name: trip request

Request by a driver/traveler for special routing.

Logical Architecture Reference Flow(s):
traveler_route_request
traveler_personal_trip_request

Physical Architecture Flow Name: yellow pages request

Request for information through a yellow pages type service.

Logical Architecture Reference Flow(s):
traveler_personal_transaction_request
traveler_personal_yellow_pages_information_request

Personal Information Access -> Map Update Provider

Physical Architecture Flow Name: map update request

Request for a map update which could include a new underlying map or map layer updates.

Logical Architecture Reference Flow(s):
tmup_request_traveler_personal_display_update_cost
tmup_traveler_map_update_cost_request
tmup_request_traveler_personal_display_update
tmup_traveler_map_update_request

Personal Information Access -> Transit Management

Physical Architecture Flow Name: transit information user request

Request for special transit routing, real-time schedule information, and availability information.

Logical Architecture Reference Flow(s):
transit_services_personal_request

Personal Information Access -> Traveler

Physical Architecture Flow Name: traveler interface updates

Visual or audio information (e.g., routes, messages, guidance) to the traveler.

Logical Architecture Reference Flow(s):
tt_personal_trip_planning_responses
tt_guidance
tt_personal_extra_trip_data_request
tt_emergency_message
tt_guidance_input_request
tt_guidance_route_details
tt_guidance_map_update_response

Personal Information Access -> Traveler Card

Physical Architecture Flow Name: request for payment

Request to deduct cost of service from user's payment account.

Logical Architecture Reference Flow(s):
ttc_debited_payment_at_personal_device

Physical Architecture Flow Name: traveler card update

Information updated concerning traveler's personal data including items such as address, trip records, and profile data.

Logical Architecture Reference Flow(s):
ttc_traveler_personal_information_update

Transit Management -> Personal Information Access

Physical Architecture Flow Name: personal transit information

General and personalized transit information for a particular fixed route, flexible route, or paratransit system.

Logical Architecture Reference Flow(s):
transit_vehicle_arrival_time
transit_services_for_personal_devices

Traveler -> Personal Information Access

Physical Architecture Flow Name: traveler inputs

Request by a traveler to summon assistance, request travel information, make a reservation, or request any other traveler service.

Logical Architecture Reference Flow(s):
ft_personal_trip_planning_requests
ft_personal_map_display_update_request
ft_personal_extra_trip_data
ft_personal_emergency_request
ft_guidance_route_accepted
ft_guidance_request
ft_guidance_data
ft_guidance_map_update_request

Traveler Card -> Personal Information Access

Physical Architecture Flow Name: payment

Payment of some kind (e.g., toll, parking, fare) by traveler which, in most cases, can be related to a credit account.

Logical Architecture Reference Flow(s):
ftc_traveler_personal_input_credit_identity

Physical Architecture Flow Name: traveler card information

The traveler personal information such as name, address, license number, and trip records and profile data.

Logical Architecture Reference Flow(s):
ftc_traveler_personal_information

2.15.3 Architecture Flow Diagrams for PIAS

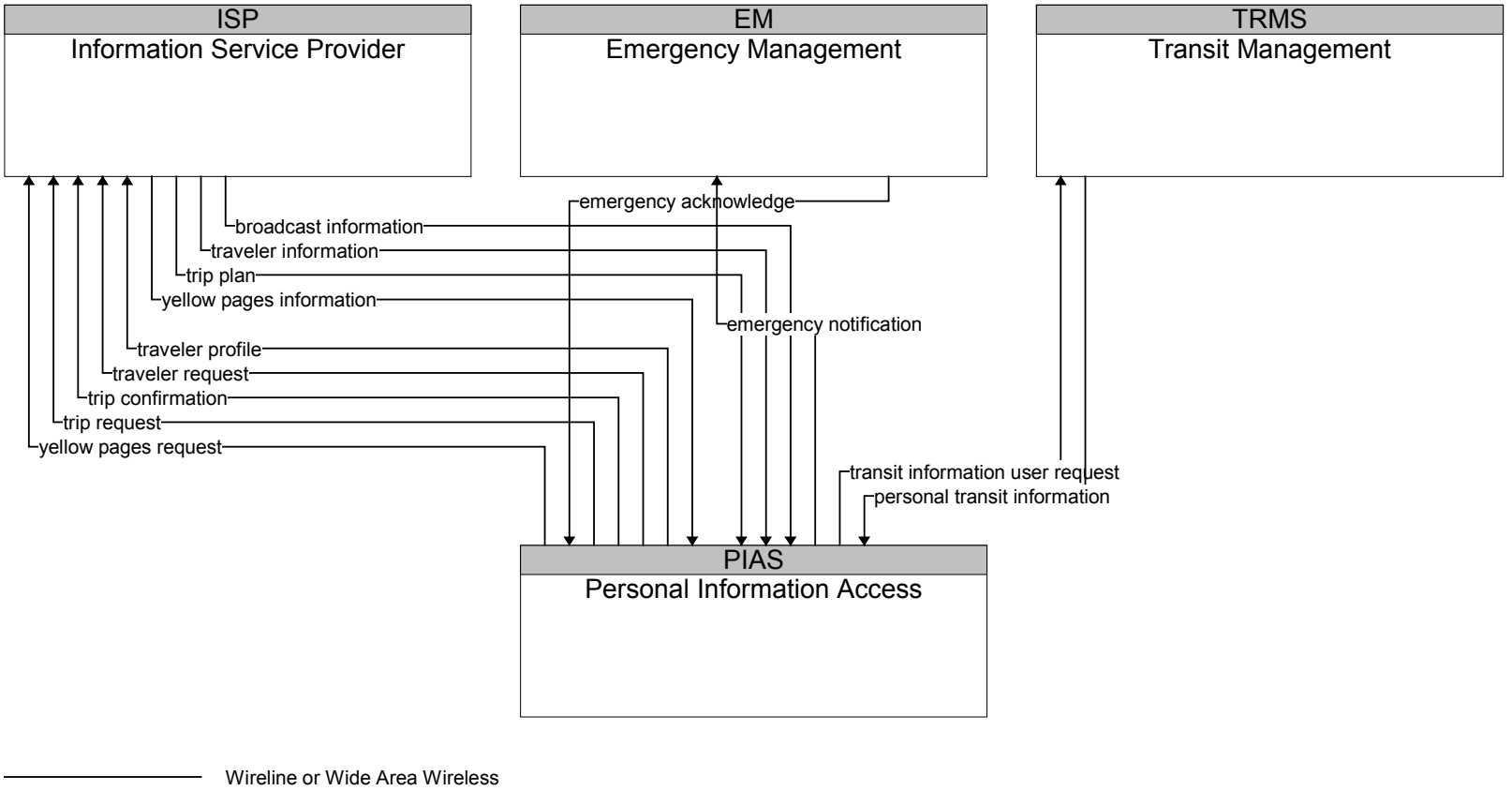


Figure 2-27 Subsystem Architecture Flow Diagram for PIAS

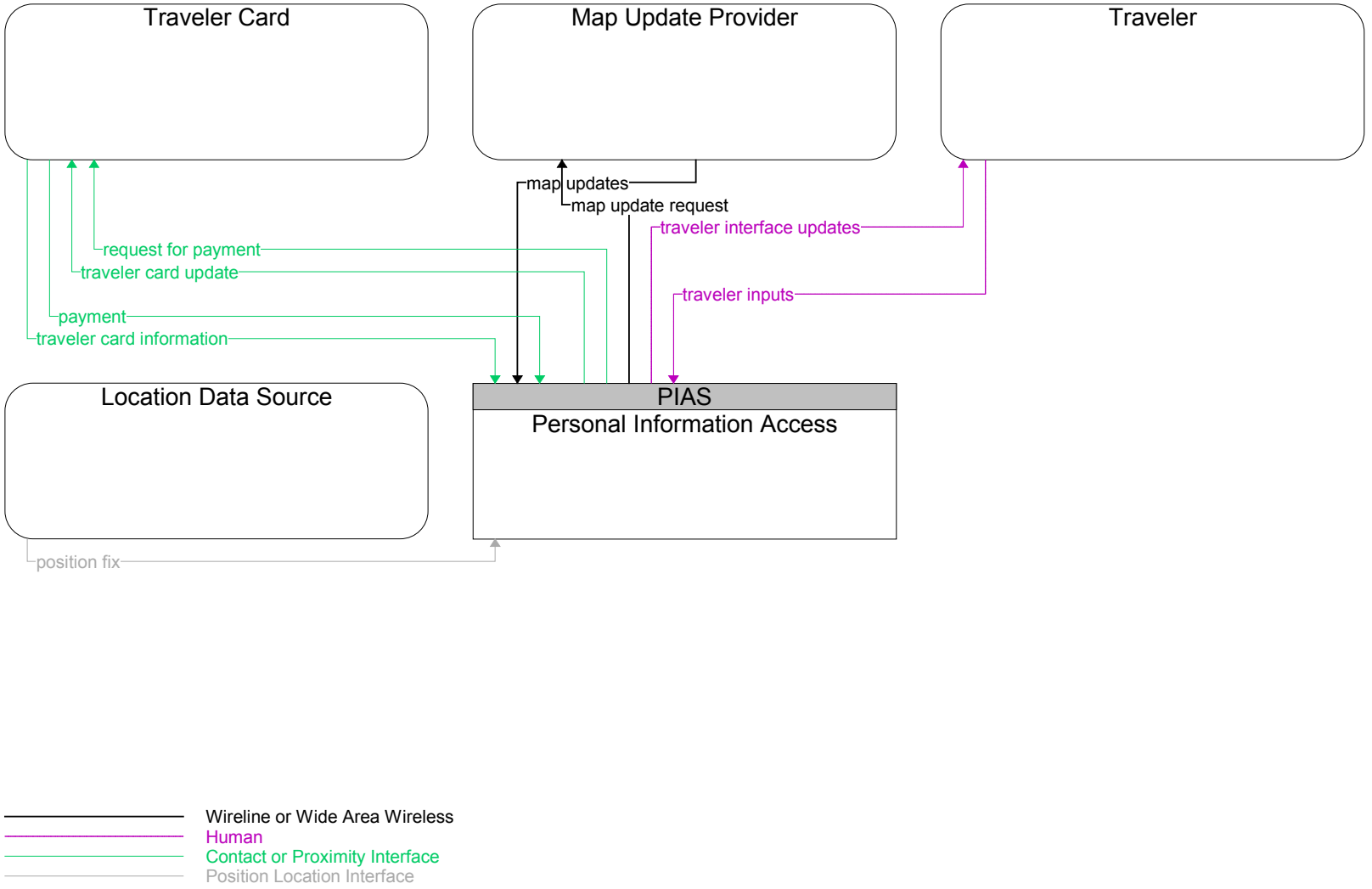


Figure 2-28 Terminator Architecture Flow Diagram for PIAS

2.16 Parking Management

The Parking Management Subsystem provides electronic monitoring and management of parking facilities. It supports a DSRC communications link to the Vehicle Subsystem that allows electronic collection of parking fees. It also includes the instrumentation, signs, and other infrastructure that monitors parking lot usage and provides local information about parking availability and other general parking information. This portion of the subsystem functionality must be located in the parking facility where it can monitor, classify, and share information with customers and their vehicles. The subsystem also interfaces with the financial infrastructure and broadly disseminates parking information to other operational centers in the region. Note that the latter functionality may be located in a back office, remote from the parking facility.

2.16.1 Subsystem Equipment Packages and Supporting Process Specifications for PMS

Parking Coordination
This equipment package supports communication and coordination between equipped parking facilities and also supports regional coordination between parking facilities and traffic and transit management systems. Information including current parking availability, system status, and operating strategies are shared through this equipment package to enable local parking facility management that supports regional transportation strategies.

Process Specifications
1.2.5.2 Coordinate Other Parking Data

1.2.5.4 Determine P+R needs for Transit Management

7.2.1.7 Update Parking Lot Data

Parking Data Collection
This equipment package collects and stores parking information that is collected in the course of parking system operations performed by the Parking Management Subsystem. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.

Process Specifications
1.2.5.5 Manage Parking Archive Data

Parking Electronic Payment
This Equipment package supports electronic payment of parking fees.

Process Specifications
5.4.3 Process Parking Lot Violations

7.2.1.1 Read Parking Lot Tag Data

7.2.1.10 Determine Advanced Charges

7.2.1.2 Calculate Vehicle Parking Lot Charges

7.2.1.3 Collect Bad Charge Payment Data

7.2.1.4 Check for Advanced Parking Lot Payment

7.2.1.5 Bill Driver for Parking Lot Charges
7.2.1.6 Manage Parking Lot Financial Processing

7.2.1.7 Update Parking Lot Data

7.2.1.8 Register for Advanced Parking Lot Payment

7.2.2 Produce Parking Lot Displays

7.2.3 Obtain Parking Lot Violator Image

7.2.5 Detect Vehicle for Parking Lot Payment

Parking Management
This Equipment package provides the capability to detect and classify properly equipped vehicles entering and exiting the parking facility, and to maintain database information with parking availability and pricing structure information. This capability shall be provided through the utilization of active/passive tag readers and database software containing parking pricing structure and current availability. Wireline communications with clearinghouse operators (the Financial Institution terminator) enable processing of financial transactions.

Process Specifications
1.2.5.1 Determine Parking Lot State

1.2.5.3 Provide Parking Lot Operator Interface

7.2.1.9 Manage Parking Lot Reservations

Parking Surveillance
This Equipment package provides the capability to detect and classify vehicles entering and exiting the parking facility and measures parking facility occupancy to support parking operations and traveler information services.

Process Specifications
1.2.5.6 Calculate Parking Lot Occupancy

7.2.5 Detect Vehicle for Parking Lot Payment

2.16.2 Subsystem Interfaces for PMS

Archived Data Management Subsystem -> Parking Management

Physical Architecture Flow Name: archive requests

A request to a data source for information on available data (i.e. "catalog") or a request that defines the data to be archived. The request can be a general subscription intended to initiate a continuous or regular data stream or a specific request intended to initiate a one-time response from the recipient.

Logical Architecture Reference Flow(s):

parking_archive_request

Physical Architecture Flow Name: archive status

Notification that data provided to an archive contains erroneous, missing, or suspicious data or verification that the data provided appears valid. If an error has been detected, the offending data and the nature of the potential problem are identified.

Logical Architecture Reference Flow(s):

parking_archive_status

DMV -> Parking Management

Physical Architecture Flow Name: registration

Registered owner of vehicle and associated vehicle information.

Logical Architecture Reference Flow(s):

fdmv_parking_lot_violation_state_identity
fdmv_parking_lot_violation_vehicle_registration

Financial Institution -> Parking Management

Physical Architecture Flow Name: transaction status

Response to transaction request. Normally dealing with a request for payment.

Logical Architecture Reference Flow(s):

ffi_confirm_charges_payment
ffi_bad_charges_payment_updates

Information Service Provider -> Parking Management

Physical Architecture Flow Name: parking lot data request

Request for parking lot occupancy, fares, and availability. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.

Logical Architecture Reference Flow(s):

advanced_traveler_charges_request
parking_lot_data_request
parking_lot_price_data_request
advanced_other_charges_request

Physical Architecture Flow Name: parking reservations request

Reservation request for parking lot.

Logical Architecture Reference Flow(s):
parking_lot_reservation_request

Other Parking -> Parking Management

Physical Architecture Flow Name: parking coordination

Information that enables parking management activities to be coordinated between different parking operators or systems in a region.

Logical Architecture Reference Flow(s):
fop_parking_coordination_data

Parking Management -> Archived Data Management Subsystem

Physical Architecture Flow Name: parking archive data

Data used to analyze and monitor trends in parking demand, pricing, and operational actions. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.

Logical Architecture Reference Flow(s):
parking_archive_data

Parking Management -> DMV

Physical Architecture Flow Name: license request

Request supporting registration data based on license plate read during violation.

Logical Architecture Reference Flow(s):
tdmv_parking_lot_violation_identity_code
tdmv_parking_lot_violation_vehicle_license

Parking Management -> Driver

Physical Architecture Flow Name: roadside transaction status

The status of an electronic payment transaction provided directly to the driver via sign or other roadside infrastructure.

Logical Architecture Reference Flow(s):
td_parking_lot_payment_confirmed
td_parking_lot_payment_invalid

Parking Management -> Enforcement Agency

Physical Architecture Flow Name: payment violation notification

Notification to enforcement agency of a toll, parking, or transit fare payment violation.

Logical Architecture Reference Flow(s):
tea_parking_violation_data

Parking Management -> Financial Institution

Physical Architecture Flow Name: payment request

Request for payment from financial institution.

Logical Architecture Reference Flow(s):
tfi_parking_lot_payment_violator_data
tfi_request_charges_payment

Parking Management -> Information Service Provider

Physical Architecture Flow Name: parking information

General parking information and current parking availability.

Logical Architecture Reference Flow(s):
parking_lot_price_data
parking_lot_availability

Physical Architecture Flow Name: parking lot reservation confirmation

Confirmation for parking lot reservation.

Logical Architecture Reference Flow(s):
advanced_traveler_charges_confirm
advanced_other_charges_confirm
parking_lot_reservation_confirm

Parking Management -> Other Parking

Physical Architecture Flow Name: parking coordination

Information that enables parking management activities to be coordinated between different parking operators or systems in a region.

Logical Architecture Reference Flow(s):
top_parking_coordination_data

Parking Management -> Parking Operator

Physical Architecture Flow Name: parking status

Parking lot operational status.

Logical Architecture Reference Flow(s):
tpo_change_lot_state
tpo_request_advanced_parking_payment
tpo_parking_lot_charge_change_request
tpo_archive_status
tpo_transaction_reports

Parking Management -> Traffic Management

Physical Architecture Flow Name: parking availability

Current parking lot occupancy, parking availability, and cost information.

Logical Architecture Reference Flow(s):
parking_guidance_for_dms
parking_lot_current_state

Physical Architecture Flow Name: parking demand management response

Response to parking demand management change requests indicating level of compliance with request.

Logical Architecture Reference Flow(s):
parking_lot_charge_direct_details
parking_lot_charge_change_response

Parking Management -> Transit Management

Physical Architecture Flow Name: transit parking coordination

Request for coordinated fare payment and parking lot price data.

Logical Architecture Reference Flow(s):
parking_lot_transit_request

Parking Management -> Traveler Card

Physical Architecture Flow Name: request for payment

Request to deduct cost of service from user's payment account.

Logical Architecture Reference Flow(s):
ttc_request_traveler_parking_payment
ttc_debited_traveler_parking_payment

Parking Management -> Vehicle

Physical Architecture Flow Name: request tag data

Request for tag information including credit identity, stored value card cash, etc.

Logical Architecture Reference Flow(s):
parking_lot_tag_data_request
parking_lot_payment_request

Physical Architecture Flow Name: tag update

Update data held in tag which can be read by another roadside device (Commercial Vehicle Check Subsystem, Toll Collection Subsystem, etc.).

Logical Architecture Reference Flow(s):
parking_lot_tag_data_update
parking_lot_tag_data_clear
parking_lot_payment_debited

Parking Operator -> Parking Management

Physical Architecture Flow Name: parking operator inputs

Local parking operator inputs that query current status and control the operation of the parking management system.

Logical Architecture Reference Flow(s):
fpo_parking_lot_hours_of_operation
fpo_confirm_advanced_parking_payment

fpo_archive_commands
fpo_parking_lot_data
fpo_parking_lot_charge_change_response
fpo_current_lot_state
fpo_lot_occupancy

Physical Architecture Flow Name: request for performance data

Request issued by a service provider for current parking service performance data.

Logical Architecture Reference Flow(s):
fpo_transaction_reports_request

Traffic Management -> Parking Management

Physical Architecture Flow Name: parking demand management request

Request to change the demand for parking facility use through pricing or other mechanisms.

Logical Architecture Reference Flow(s):
parking_lot_charge_direct_request
parking_lot_charge_change_request

Physical Architecture Flow Name: parking instructions

Information that allows local parking facilities to be managed to support regional traffic management objectives.

Logical Architecture Reference Flow(s):
parking_lot_input_data
selected_parking_lot_control_strategy
static_data_for_parking_lots

Transit Management -> Parking Management

Physical Architecture Flow Name: transit parking lot response

Response to transit occupancy inquiries and coordination with parking lots.

Logical Architecture Reference Flow(s):
parking_lot_transit_response

Traveler Card -> Parking Management

Physical Architecture Flow Name: payment

Payment of some kind (e.g., toll, parking, fare) by traveler which, in most cases, can be related to a credit account.

Logical Architecture Reference Flow(s):
ftc_traveler_parking_input_credit_identity
ftc_confirm_traveler_parking_payment

Vehicle -> Parking Management

Physical Architecture Flow Name: tag data

Unique tag ID and related vehicle information.

Logical Architecture Reference Flow(s):
parking_lot_payment_confirmation
parking_lot_tag_data_collect

Vehicle Characteristics -> Parking Management

Physical Architecture Flow Name: vehicle characteristics

The physical or visible characteristics of an individual vehicle that can be measured to classify a vehicle and imaged to uniquely identify a vehicle.

Logical Architecture Reference Flow(s):
From_Vehicle_Characteristics

2.16.3 Architecture Flow Diagrams for PMS

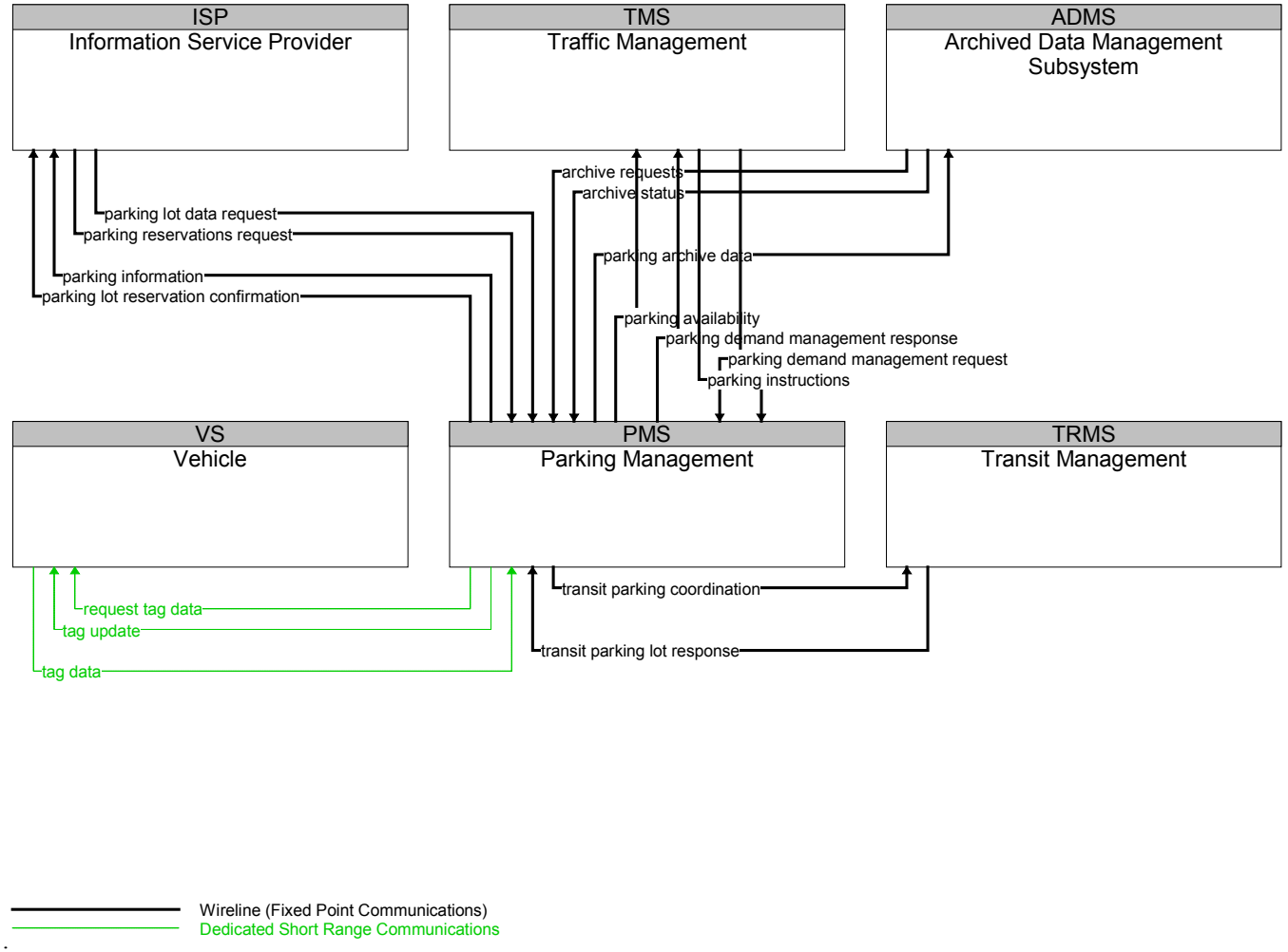


Figure 2-29 Subsystem Architecture Flow Diagram for PMS

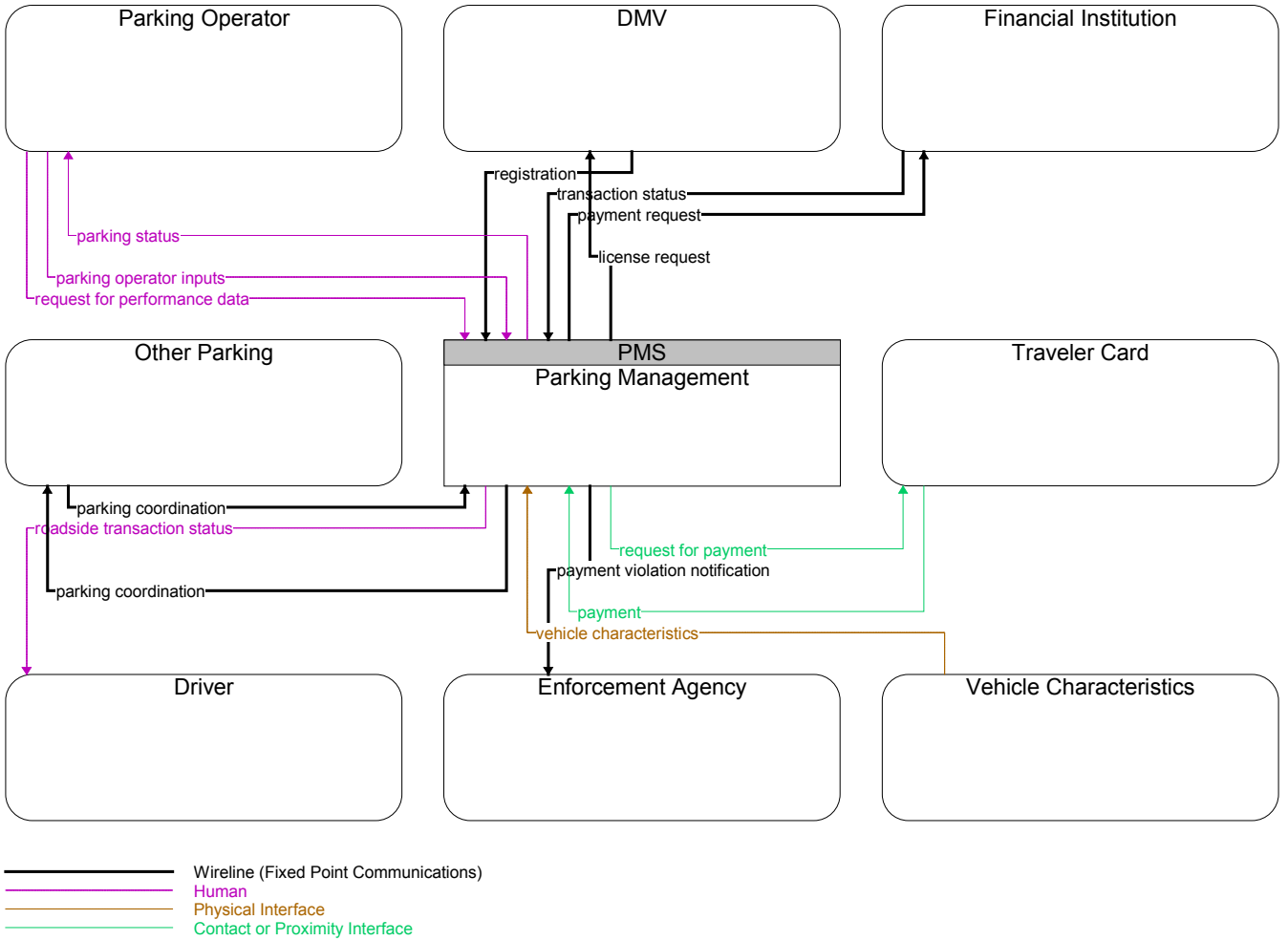


Figure 2-30 Terminator Architecture Flow Diagram for PMS

2.17 Remote Traveler Support

This subsystem provides access to traveler information at transit stations, transit stops, other fixed sites along travel routes (e.g., rest stops, merchant locations), and at major trip generation locations such as special event centers, hotels, office complexes, amusement parks, and theaters. Traveler information access points include kiosks and informational displays supporting varied levels of interaction and information access. At transit stops, simple displays providing schedule information and imminent arrival signals can be provided. This basic information may be extended to include multi-modal information including traffic conditions and transit schedules along with yellow pages information to support mode and route selection at major trip generation sites. Personalized route planning and route guidance information can also be provided based on criteria supplied by the traveler. In addition to traveler information provision, this subsystem also supports public safety monitoring using CCTV cameras or other surveillance equipment and emergency notification within these public areas. Fare card maintenance, and other features which enhance traveler convenience may also be provided at the discretion of the deploying agency.

2.17.1 Subsystem Equipment Packages and Supporting Process Specifications for RTS

Remote Basic Information Reception
This Equipment package shall provide the capability for travelers to interface with the ISP Subsystem Basic Information Broadcast Equipment package and receive formatted traffic advisories including accurate traveling information concerning available travel options and their availability, and congestion information at the Remote Traveler Support Subsystem.

Process Specifications
6.3.2 Inform Traveler

6.3.3 Provide Traveler Kiosk Interface

Remote Interactive Information Reception
This Equipment package shall provide the capability for travelers to interface with the ISP Subsystem Infrastructure Equipment packages including the Interactive Infrastructure Information Equipment package, the Infrastructure Provided Route Selection, Yellow Pages and Reservation, and Dynamic Ridesharing Equipment packages. These capabilities shall be provided using the Remote Traveler Support Subsystem equipment such as interactive TV and kiosk using communication medium and equipment such as CATV and wireline and wireless data transceivers.

Process Specifications
6.3.1 Get Traveler Request

6.3.2 Inform Traveler

6.3.3 Provide Traveler Kiosk Interface

6.3.4 Update Traveler Display Map Data at Kiosk

7.3.4 Provide Remote Terminal Traveler Card Interface

7.5.2 Provide Transit User Roadside Traveler Card Interface

7.5.4 Provide Traveler Kiosk Traveler Card Interface

Remote Mayday I/F
This Equipment package provides the capability to report an emergency and summons assistance. The equipment includes a traveler interface that facilitates generation of a distress signal under duress and wireline communications that carries this distress signal and allows follow-up verification and determination of the nature of the emergency and the required response. This equipment package notifies either the Emergency Management or Transit Management Subsystem depending on the implementation.

Process Specifications
5.1.7.3 Report Traveler Emergencies

6.3.3 Provide Traveler Kiosk Interface

Remote Transit Fare Management
This Equipment package provides the capability for the traveler to use a common fare medium for all applicable surface transportation services, to pay without stopping, have payment media automatically identified as void and/or invalid and eligibility verified. This may be implemented as a payment instrument reader at a kiosk. In addition, capability to provide expansion into other uses for payment medium such as retail and telephone and for off-line billing for fares paid by agencies shall be supported.

Process Specifications
4.7.2.1 Detect Transit User at Roadside

4.7.2.2 Determine Transit User Needs at Roadside

4.7.2.3 Determine Transit Fare at Roadside

4.7.2.4 Manage Transit Fare Billing at Roadside

4.7.2.5 Provide Transit User Roadside Fare Interface

4.7.2.6 Update Roadside Transit Fare Data

4.7.2.7 Provide Transit Roadside Passenger Data

7.3.4 Provide Remote Terminal Traveler Card Interface

7.5.2 Provide Transit User Roadside Traveler Card Interface

Remote Transit Information Services
The Equipment package furnishes transit users with real-time travel-related information at transit stops, multi-modal transfer points, and other public transportation areas. It provides transit users with the latest available information on transit routes, schedules, transfer options, bicycle accessibility, fares, real-time schedule adherence, current incidents, weather conditions, and special events. In addition to tailored information for individual transit users, this equipment package supports general annunciation and/or display of imminent arrival information and other information of general interest to transit users.

Process Specifications
4.7.1 Provide Transit User Roadside & Vehicle Data Interface

Secure Area Monitoring
This Equipment package provides the capability to monitor the safety of travelers at Remote Traveler Subsystem locations such as transit stations, rest areas, tourist centers, park and ride lots, and other locations frequented by travelers. It collects surveillance images and data and relays this information back to the Transit Management and Emergency Management Subsystems.

Process Specifications
5.1.7.1 Monitor Secure Area

5.1.7.2 Manage Secure Area Security

2.17.2 Subsystem Interfaces for RTS

Emergency Management -> Remote Traveler Support

Physical Architecture Flow Name: emergency acknowledge

Acknowledge request for emergency assistance and provide additional details regarding actions and verification requirements.

Logical Architecture Reference Flow(s):
operator_monitoring_action_command
emergency_request_traveler_acknowledge

Physical Architecture Flow Name: secure area monitoring support

Commands that control surveillance equipment and security sensors that monitor secure public transportation areas. Also includes information for general advisories and alerts intended for general dissemination in these same public areas.

Logical Architecture Reference Flow(s):
secure_area_broadcast_message

Information Service Provider -> Remote Traveler Support

Physical Architecture Flow Name: broadcast information

General broadcast information that contains link travel times, incidents, advisories, transit services and a myriad of other traveler information.

Logical Architecture Reference Flow(s):
transit_deviations_for_broadcast_to_kiosks
traffic_data_for_broadcast_to_kiosks

Physical Architecture Flow Name: traveler information

Traveler information comprised of traffic status, advisories, incidents, payment information and

many other travel-related data updates and confirmations.

Logical Architecture Reference Flow(s):
traffic_data_for_kiosks
traveler_transaction_confirmation
advanced_tolls_and_charges_roadside_confirm
transit_deviations_for_kiosks
traveler_event_information
traveler_payment_confirmation

Physical Architecture Flow Name: trip plan

A sequence of links and special instructions comprising of a trip plan indicating efficient routes for navigating the links. Normally coordinated with traffic conditions, other incidents, preemption and prioritization plans.

Logical Architecture Reference Flow(s):
traveler_trip_information

Physical Architecture Flow Name: yellow pages information

Travel service information covering tourist attractions, lodging, restaurants, service stations, emergency services, and other services and businesses of interest to the traveler.

Logical Architecture Reference Flow(s):
traveler_yellow_pages_data

Map Update Provider -> Remote Traveler Support

Physical Architecture Flow Name: map updates

Map update which could include a new underlying static or real-time map or map layer(s) update.

Logical Architecture Reference Flow(s):
fmup_traveler_display_update

Remote Traveler Support -> Emergency Management

Physical Architecture Flow Name: emergency notification

An emergency request for assistance originated by a traveler using an in-vehicle, public access, or personal device.

Logical Architecture Reference Flow(s):
emergency_request_traveler_details
secure_area_emergency_data_request

Physical Architecture Flow Name: secure area surveillance data

Data collected from surveillance systems used to monitor secure areas. Includes video, audio, and other security sensor outputs.

Logical Architecture Reference Flow(s):
secure_area_incident_data

Remote Traveler Support -> Information Service Provider

Physical Architecture Flow Name: traveler request

Request by a traveler to summon assistance, request information, make a reservation, or initiate any other traveler service.

Logical Architecture Reference Flow(s):
traveler_current_condition_request
traveler_payment_information
traveler_transaction_request
traveler_yellow_pages_information_request
traffic_data_kiosk_request
traveler_event_information_request
advanced_tolls_and_charges_roadside_request
transit_deviation_kiosk_request

Physical Architecture Flow Name: trip confirmation

Acknowledgement by the driver/traveler of acceptance of a route.

Logical Architecture Reference Flow(s):
traveler_trip_confirmation

Physical Architecture Flow Name: trip request

Request by a driver/traveler for special routing.

Logical Architecture Reference Flow(s):
traveler_trip_request

Physical Architecture Flow Name: yellow pages request

Request for information through a yellow pages type service.

Logical Architecture Reference Flow(s):
traveler_yellow_pages_information_request

Remote Traveler Support -> Map Update Provider

Physical Architecture Flow Name: map update request

Request for a map update which could include a new underlying map or map layer updates.

Logical Architecture Reference Flow(s):
tmup_request_traveler_display_update

Remote Traveler Support -> Transit Management

Physical Architecture Flow Name: emergency notification

An emergency request for assistance originated by a traveler using an in-vehicle, public access, or personal device.

Logical Architecture Reference Flow(s):
transit_user_roadside_image
emergency_request_transit_details

Physical Architecture Flow Name: secure area surveillance data

Data collected from surveillance systems used to monitor secure areas. Includes video, audio, and other security sensor outputs.

Logical Architecture Reference Flow(s):
transit_area_surveillance_information

Physical Architecture Flow Name: transit fare payment requests

Information provided from the transit user location that supports fare payments and associated

record-keeping.

Logical Architecture Reference Flow(s):
request_roadside_fare_payment
transit_roadside_passenger_data
transit_roadside_fare_payment_confirmation
fare_collection_roadside_violation_information

Physical Architecture Flow Name: transit information user request

Request for special transit routing, real-time schedule information, and availability information.

Logical Architecture Reference Flow(s):
other_services_roadside_request
transit_services_kiosk_request
transit_services_travelers_request

Remote Traveler Support -> Transit User

Physical Architecture Flow Name: transit user fare status

Status of fare transaction for transit user.

Logical Architecture Reference Flow(s):
ttu_roadside_access_message
ttu_roadside_payment_confirmed

Physical Architecture Flow Name: transit user outputs

Information for traveler from either an on-board or fixed location traveler information station.

Logical Architecture Reference Flow(s):
ttu_transit_vehicle_information
ttu_other_services_roadside_confirmed
ttu_transit_information

Remote Traveler Support -> Traveler

Physical Architecture Flow Name: traveler interface updates

Visual or audio information (e.g., routes, messages, guidance) to the traveler.

Logical Architecture Reference Flow(s):
tt_extra_trip_data_request
tt_emergency_response
tt_trip_planning_responses

Remote Traveler Support -> Traveler Card

Physical Architecture Flow Name: request for payment

Request to deduct cost of service from user's payment account.

Logical Architecture Reference Flow(s):
ttc_debited_fare_payment_at_roadside
ttc_debited_transit_user_payment_at_roadside
ttc_debited_traveler_payment_at_roadside
ttc_request_fare_payment_at_roadside

Physical Architecture Flow Name: traveler card update

Information updated concerning traveler's personal data including items such as address, trip records, and profile data.

Logical Architecture Reference Flow(s):

ttc_traveler_remote_personal_information_update

Secure Area Environment -> Remote Traveler Support

Physical Architecture Flow Name: secure area characteristics

Characteristics (visual, audible, other) that are monitored by surveillance security systems via sensors.

Logical Architecture Reference Flow(s):

fsa_area_image

Transit Management -> Remote Traveler Support

Physical Architecture Flow Name: emergency acknowledge

Acknowledge request for emergency assistance and provide additional details regarding actions and verification requirements.

Logical Architecture Reference Flow(s):

emergency_acknowledge_transit_details
request_transit_user_roadside_image

Physical Architecture Flow Name: secure area monitoring support

Commands that control surveillance equipment and security sensors that monitor secure public transportation areas. Also includes information for general advisories and alerts intended for general dissemination in these same public areas.

Logical Architecture Reference Flow(s):

transit_area_monitoring_control

Physical Architecture Flow Name: transit fare payment responses

Information provided by transit management that supports a fare payment transaction.

Logical Architecture Reference Flow(s):

transit_roadside_fare_data
confirm_roadside_fare_payment
transit_roadside_fare_payment_debited
transit_services_for_roadside_fares
transit_roadside_fare_payment_request

Physical Architecture Flow Name: transit traveler information

Transit information prepared to support transit users and other travelers. It contains transit schedules, real-time arrival information, fare schedules, and general transit service information.

Logical Architecture Reference Flow(s):

transit_services_for_kiosks
transit_services_for_travelers
other_services_roadside_response
transit_area_broadcast_message
transit_vehicle_user_data

transit_vehicle_arrival_time

Transit User -> Remote Traveler Support

Physical Architecture Flow Name: transit user inputs

Requests from transit user through either an on-board or fixed location traveler information station.

Logical Architecture Reference Flow(s):

ftu_destination_at_roadside
ftu_other_services_roadside_request
ftu_transit_information_request
ftu_transit_user_roadside_image

Traveler -> Remote Traveler Support

Physical Architecture Flow Name: traveler inputs

Request by a traveler to summon assistance, request travel information, make a reservation, or request any other traveler service.

Logical Architecture Reference Flow(s):

ft_trip_planning_requests
ft_remote_emergency_request
ft_extra_trip_data

Traveler Card -> Remote Traveler Support

Physical Architecture Flow Name: payment

Payment of some kind (e.g., toll, parking, fare) by traveler which, in most cases, can be related to a credit account.

Logical Architecture Reference Flow(s):

ftc_transit_user_roadside_input_credit_identity
ftc_traveler_roadside_input_credit_identity
ftc_confirm_fare_payment_at_roadside
ftc_transit_roadside_tag_data

Physical Architecture Flow Name: traveler card information

The traveler personal information such as name, address, license number, and trip records and profile data.

Logical Architecture Reference Flow(s):

ftc_traveler_remote_personal_information

2.17.3 Architecture Flow Diagrams for RTS

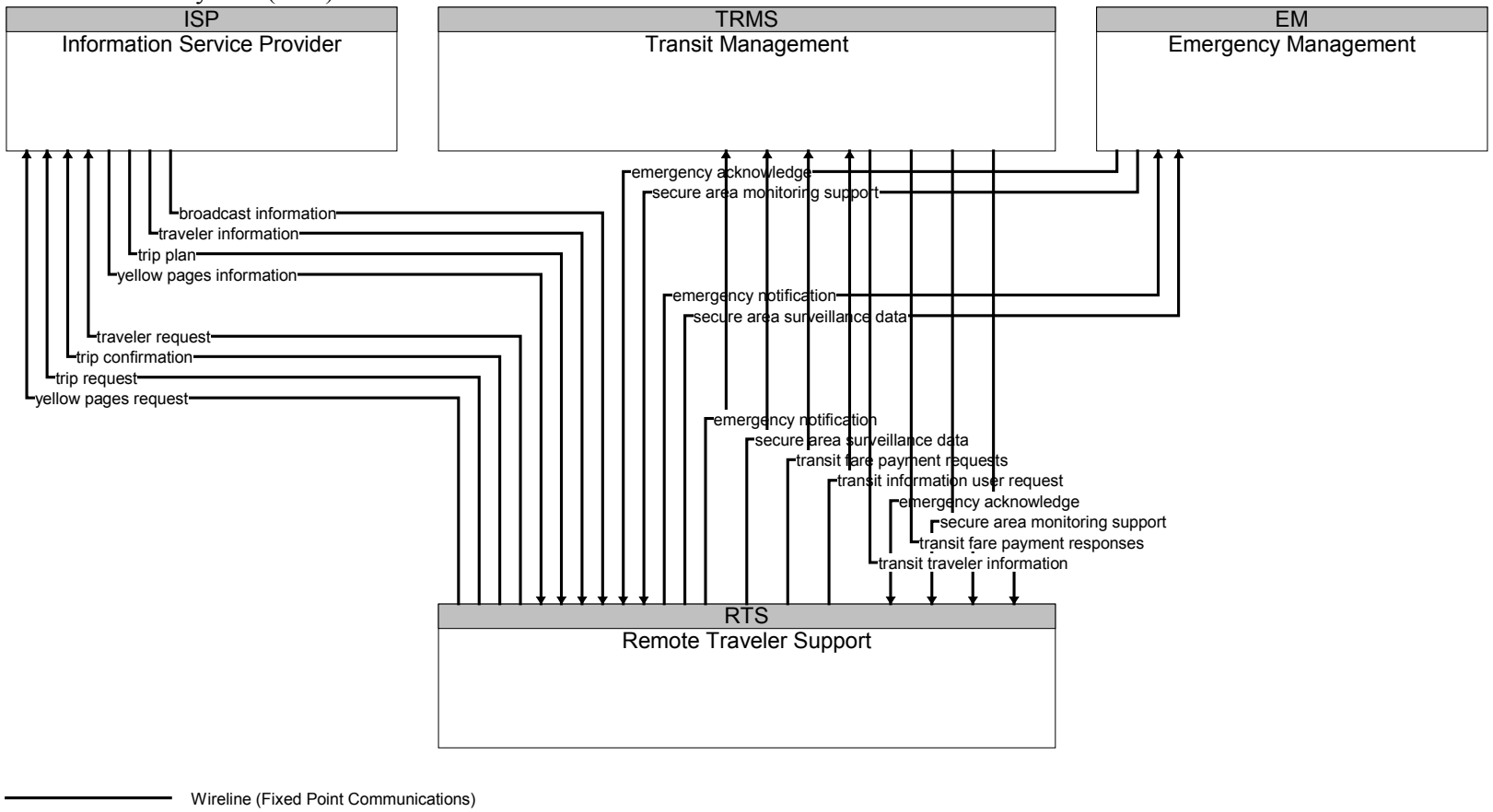


Figure 2-31 Subsystem Architecture Flow Diagram for RTS

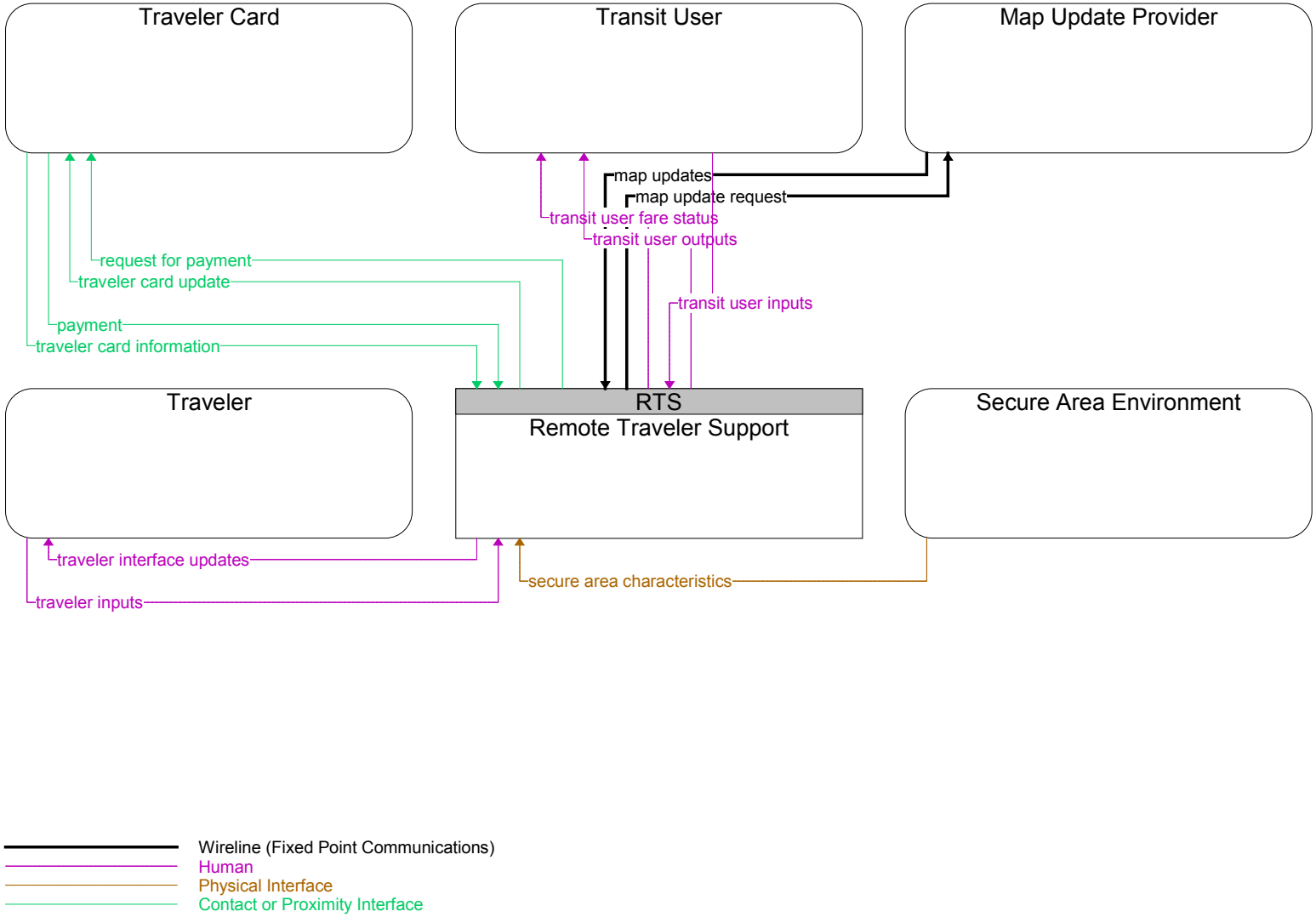


Figure 2-32 Terminator Architecture Flow Diagram for RTS

2.18 Roadway Subsystem

This subsystem includes the equipment distributed on and along the roadway which monitors and controls traffic and monitors and manages the roadway itself. Equipment includes traffic detectors, environmental sensors, traffic signals, highway advisory radios, dynamic message signs, CCTV cameras and video image processing systems, grade crossing warning systems, and freeway ramp metering systems. HOV lane management and reversible lane management functions are also available. This subsystem also provides the capability for environmental monitoring including sensors that measure road conditions, surface weather, and vehicle emissions. In adverse conditions, automated systems can be used to apply anti-icing materials, disperse fog, etc. Work zone systems including work zone surveillance, traffic control, driver warning, and work crew safety systems are also included. In advanced implementations, this subsystem supports automated vehicle safety systems by safely controlling access to and egress from an Automated Highway System through monitoring of, and communications with, AHS vehicles. Intersection collision avoidance functions are provided by determining the probability of a collision in the intersection and sending appropriate warnings and/or control actions to the approaching vehicles.

2.18.1 Subsystem Equipment Packages and Process Specifications for RS

Advanced Rail Crossing
This equipment package manages highway traffic at highway-rail intersections (HRIs) where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). It includes all capabilities from the Standard Rail Crossing equipment package and augments these with additional safety features. The active warning systems supported by this market package includes positive barrier systems which preclude entrance into the intersection when the barriers are activated. Like the Standard package, the HRI equipment is activated on notification by wayside interface equipment which detects, or communicates with the approaching train. In this equipment package, additional information about the arriving train is also provided by the wayside interface equipment so that the train's direction of travel, its estimated time of arrival, and the estimated duration of closure may be derived. This enhanced information may be conveyed to the driver prior to, or in context with, warning system activation. This equipment package also includes detection capabilities which enable it to detect an entrapped or otherwise immobilized vehicle within the HRI and provide an immediate notification to the wayside interface equipment and traffic management.

Process Specifications

1.1.1.1 Process Traffic Sensor Data

1.6.1.1 Detect Roadway Events

1.6.1.2.4 Provide HSR Device Controls

1.6.1.4.1 Generate Alerts and Advisories

1.6.1.4.3 Report Alerts and Advisories

1.6.1.5 Detect HRI Hazards

1.6.1.6.1 Close HRI on Detection

1.6.1.6.2 Detect Imminent Vehicle/Train Collision

1.6.3.1 Interact with Wayside Systems

1.6.3.2 Advise and Protect Train Crews

1.6.3.3 Provide ATS Alerts

1.6.5.1 Provide Interactive Interface

Automated Road Signing
Roadside beacons which may be locally and autonomously controlled at the roadside or remotely monitored and controlled by equipment packages in the Traffic Management Subsystem.

Process Specifications

1.1.2.6 Process Collected Vehicle Smart Probe Data

1.1.7 Collect Vehicle Smart Probe Data

1.2.7.4 Process In-vehicle Signage Data

1.2.7.7 Process Vehicle Smart Probe Data for Output

Multimodal Crossing Control
This Equipment package monitors multimodal crossings and monitors and controls traffic control equipment in the vicinity. Equipment controlled includes warning lights, gates, dynamic message signs, and other systems associated with multimodal crossings. This equipment package manages draw bridges and miscellaneous other interference crossings between highway traffic and other modes. Railroad grade crossings are covered by the Standard Rail Crossing equipment package.

Process Specifications

1.1.1.1 Process Traffic Sensor Data

1.2.7.1 Process Indicator Output Data for Roads

1.2.7.5 Process Indicator Output Data for Freeways

1.2.7.9 Process Roadway Information Data

Roadside Data Collection
This equipment package collects traffic, road, and environmental conditions information for use in transportation planning, research, and other off-line applications where data quality and completeness take precedence over real-time performance. This equipment package includes the sensors, supporting roadside infrastructure, and communications equipment that collects and transfers information to a center for archival.

Process Specifications
1.1.1.4 Manage Data Collection and Monitoring

Roadside Signal Priority
This Equipment package shall provide the capability to receive vehicle signal priority requests and control roadside signals accordingly.

Process Specifications
1.2.7.1 Process Indicator Output Data for Roads

1.2.7.3 Manage Indicator Preemptions

Roadway Automated Treatment
This equipment package automatically treats a roadway section based on environmental or atmospheric conditions. Treatments can be in the form of fog dispersion, anti-icing chemicals, etc

Process Specifications
9.2.6.2 Control Roadway Automated Treatment System

Roadway Basic Surveillance
This Equipment package provides the capabilities to monitor traffic flow in major intersections and on main highways for urban areas and to monitor road conditions using fixed equipment such as loop detectors and wireline communication.

Process Specifications
1.1.1.1 Process Traffic Sensor Data

1.3.1.3 Process Traffic Images

Roadway Emissions Monitoring
This Equipment package monitors emissions and general air quality and communicates the collected information back to the emissions management subsystem where it can be monitored, analyzed, and used. This equipment package supports point monitoring of individual vehicle emissions as well as general monitoring of standard air quality measures.

Process Specifications
1.5.5 Process Vehicle Pollution Data

1.5.6 Detect Roadside Pollution Levels

Roadway Environmental Monitoring
This Equipment package measures environmental conditions and communicates the collected information back to a center where it can be monitored and analyzed. A broad array of general weather and road surface information may be collected. Weather conditions that may be measured include temperature, wind, humidity, precipitation, and visibility. Surface and sub-surface sensors can measure road surface temperature, moisture, icing, salinity, and other measures.

Process Specifications
1.1.1.3 Process Environmental Sensor Data

Roadway Equipment Coordination
This equipment package coordinates field equipment that is distributed along the roadway by supporting direct communications between field equipment. This includes coordination between remote sensors and field devices (e.g., Dynamic Message Signs) and coordination between the field devices themselves (e.g., coordination between traffic controllers that are controlling adjacent intersections.).

Process Specifications
1.1.1.5 Provide Sensor Interface to Other Roadway Devices

1.2.7.8 Provide Device Interface to Other Roadway Devices

Roadway Freeway Control
Ramp meters, CMS and other freeway control effects which will control traffic on freeways.

Process Specifications
1.1.1.1 Process Traffic Sensor Data

1.2.7.2 Monitor Roadside Equipment Operation for Faults

1.2.7.5 Process Indicator Output Data for Freeways

Roadway HOV Control
This Equipment package provides the capability to detect the HOV lane usage using sensor equipment. For lanes that become HOV or High Occupancy Toll (HOT) lanes during certain time of the day, it provides display equipment to notify users of their status.

Process Specifications
1.1.1.1 Process Traffic Sensor Data

1.2.7.5 Process Indicator Output Data for Freeways

Roadway Incident Detection
This Equipment package provides incident detection capability to reside at the roadside. For example, advanced CCTV's with built-in incident detection algorithms would allow the actual detection function to be roadside rather than transmitting images to a center for visual or automated detection.

Process Specifications
1.1.1.1 Process Traffic Sensor Data

Roadway Infrastructure Monitoring
This equipment package monitors the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts). It includes sensors that monitor the infrastructure and the communications necessary to report this data to a center or vehicle-based maintenance system.

Process Specifications

1.1.1.6 Collect Infrastructure Sensor Data

Roadway Intersection Collision Warning
This Equipment package provides the capability to determine the probability of a collision in the intersection and send appropriate warnings and/or control actions to the approaching vehicles using a short-range interface. This Equipment package also provides the capability that the traffic control signals provide signal indication information to the vehicles using a short-range interface and the vehicle performs the determination of the probability of collision in the intersection. This package covers intersections between vehicles and railroad at grade crossings.

Process Specifications
1.2.7.6 Provide Intersection Collision Avoidance Data

Roadway In-Vehicle Signing
This Equipment package provides the capability to detect local traffic flow conditions, corroborate them with a traffic management subsystem, and distribute them to the user over a short-range interface such as a radio beacon.

Process Specifications
1.2.7.4 Process In-vehicle Signage Data

Roadway Probe Beacons
This Equipment package monitors traffic and road conditions by collecting information from passing vehicles that are equipped with a transponder or other short range communications device. The probe data collected by this equipment package may include link travel times, average speeds, road conditions, and any other data that can be measured and communicated by passing vehicles. This equipment package consists of roadside equipment that communicates with passing vehicles using dedicated short range communications, collects the information provided by the vehicles, and forwards this information back to the Traffic Management Subsystem.

Process Specifications
1.1.6 Collect Vehicle Probe Data

Roadway Reversible Lanes
This Equipment package provides the capability for control of reversible lanes using sensor and actuator type equipment. This Equipment package also provides the capability to notify users the direction of the reversible lanes using electronic lane signs.

Process Specifications
1.1.1.1 Process Traffic Sensor Data

1.2.7.1 Process Indicator Output Data for Roads

1.2.7.5 Process Indicator Output Data for Freeways

Roadway Signal Controls
This Equipment package provides the capabilities to control traffic signals at major intersections and on main highways for urban areas. This Equipment package is generally constrained to a single jurisdiction.

Process Specifications

1.1.1.1 Process Traffic Sensor Data

1.2.7.1 Process Indicator Output Data for Roads

1.2.7.2 Monitor Roadside Equipment Operation for Faults

Roadway Speed Monitoring
This equipment package monitors vehicle speeds. If the speed is determine to be excessive, then roadside equipment can suggest a safe driving speed. Environmental conditions may be monitored and factored into the safe speed advisories that are provided to the motorist. This equipment package can also provide an enforcement function, reporting speed violations to an enforcement agency.

Process Specifications
9.3.3.1 Collect Vehicle Speed

9.3.3.4 Support Vehicle Speed Enforcement

Roadway Systems for AHS
This Equipment package provides the capability of safely controlling access to and egress from an Automated Highway System. This Equipment package also provides the capability for roadside to vehicle communication. These capabilities shall be provided using equipment such as a lane check-in or check-out beacon and special purpose vehicle signing beacons.

Process Specifications
3.2.5 Check Vehicle for AHS eligibility

3.2.6 Manage AHS Check-in and Check-out

3.2.8 Provide Automated Lane Changing

Roadway Traffic Information Dissemination
This Equipment package provides the roadside elements of traffic information dissemination including DMS, HAR, and talking pedestrian signs.

Process Specifications
1.2.7.1 Process Indicator Output Data for Roads

1.2.7.5 Process Indicator Output Data for Freeways

1.2.7.9 Process Roadway Information Data

Roadway Work Zone Safety
This equipment package detects vehicle intrusions in work zones and warns crew workers and drivers of imminent encroachment. Crew movements are also monitored so that the crew can be warned of movement beyond the designated safe zone.

Process Specifications

9.3.1.3 Monitor Crew Movement

9.3.4.1 Detect Work Zone Intrusion

9.3.4.2 Provide Work Zone Intrusion Alert

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

Process Specifications
1.2.7.9 Process Roadway Information Data

1.3.1.3 Process Traffic Images

Standard Rail Crossing
This Equipment Package manages highway traffic at highway-rail intersections (HRIs) where operational requirements do not dictate advanced features (e.g., where rail operational speeds are less than 80 miles per hour). Either passive (e.g., the crossbuck sign) or active warning systems (e.g., flashing lights and gates) are supported depending on the specific requirements for each intersection. These traditional HRI warning systems may also be augmented with other standard traffic management devices. The warning systems are activated on notification by interfaced wayside equipment of an approaching train. The equipment at the HRI may also be interconnected with adjacent signalized intersections so that local control can be adapted to highway-rail intersection activities. Health monitoring of the HRI equipment and interfaces is performed; detected abnormalities are reported through interfaces to the wayside interface equipment and the traffic management subsystem.

Process Specifications
1.1.1.1 Process Traffic Sensor Data

1.2.7.1 Process Indicator Output Data for Roads

1.6.1.2.1 Control HRI Traffic Signals

1.6.1.2.2 Control HRI Warnings and Barriers

1.6.1.2.3 Provide SSR Device Controls
1.6.1.2.5 Manage Device Control

1.6.1.2.6 Maintain Device State

1.6.1.3 Perform Equipment Self-Test

1.6.1.4.2 Provide Closure Parameters

1.6.1.4.4 Report HRI Status on Approach

1.6.1.7.1 Control Traffic Volume at Active HRI

1.6.1.7.2 Close HRI on Command

1.6.3.1 Interact with Wayside Systems

1.6.5.2 Determine HRI Status
1.6.5.3 Maintain HRI Closure Data

2.18.2 Subsystem Interfaces for RS

Archived Data Management Subsystem -> Roadway Subsystem

Physical Architecture Flow Name: data collection and monitoring control

Information used to configure and control data collection and monitoring systems.

Logical Architecture Reference Flow(s):
roadside_archive_control

Emergency Vehicle Subsystem -> Roadway Subsystem

Physical Architecture Flow Name: local signal preemption request

Direct control signal or message to a signalized intersection that results in preemption of the current control plan and grants right-of-way to the requesting vehicle.

Logical Architecture Reference Flow(s):
emergency_vehicle_preemptions

Emissions Management -> Roadway Subsystem

Physical Architecture Flow Name: vehicle pollution criteria

Vehicular pollution acceptance criteria.

Logical Architecture Reference Flow(s):
pollution_state_vehicle_acceptance_criteria

Enforcement Agency -> Roadway Subsystem

Physical Architecture Flow Name: speed monitoring control

Information used to configure and control automated speed monitoring, speed warning, and speed enforcement systems.

Logical Architecture Reference Flow(s):
fea_enforcement_parameters
fea_speed_sensor_control

Environment -> Roadway Subsystem

Physical Architecture Flow Name: pollutant levels

Atmospheric pollutant levels as monitored by air quality sensors.

Logical Architecture Reference Flow(s):
fe_roadside_pollutant_levels

Maintenance and Construction Field Personnel -> Roadway Subsystem

Physical Architecture Flow Name: crew movements

Field crew location within a work zone that is monitored to enhance work zone safety.

Logical Architecture Reference Flow(s):
fmcfp_crew_movements

Maintenance and Construction Management -> Roadway Subsystem

Physical Architecture Flow Name: environmental sensors control

Data used to configure and control environmental sensors.

Logical Architecture Reference Flow(s):
environmental_sensor_control_for_roadway_sensors

Physical Architecture Flow Name: infrastructure monitoring sensor control

Data used to configure and control infrastructure monitoring sensors.

Logical Architecture Reference Flow(s):
infrastructure_sensor_control_from_m_and_c

Physical Architecture Flow Name: roadway information system data

Information used to initialize, configure, and control roadside systems that provide driver information (e.g., dynamic message signs, highway advisory radio, beacon systems). This flow can provide message content and delivery attributes, local message store maintenance requests, control mode commands, status queries, and all other commands and associated parameters that support remote management of these systems.

Logical Architecture Reference Flow(s):
work_zone_info_for_display
dms_data_from_m_and_c
dms_auto_treat_data_from_maint
har_data_from_m_and_c

Physical Architecture Flow Name: roadway treatment system control

Control data for remotely located, automated devices, that affect the roadway surface (e.g. de-icing applications).

Logical Architecture Reference Flow(s):
roadway_treatment_system_control

Physical Architecture Flow Name: speed monitoring control

Information used to configure and control automated speed monitoring, speed warning, and speed enforcement systems.

Logical Architecture Reference Flow(s):
speed_sensor_control_from_m_and_c

Physical Architecture Flow Name: video surveillance control

Information used to configure and control video surveillance systems.

Logical Architecture Reference Flow(s):
video_control_from_m_and_c

Physical Architecture Flow Name: work zone warning device control

Data used to configure and control work zone safety monitoring and warning devices.

Logical Architecture Reference Flow(s):
intrusion_detection_device_control
intrusion_alert_device_control

Maintenance and Construction Vehicle -> Roadway Subsystem

Physical Architecture Flow Name: environmental conditions data

Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) as measured and reported by environmental sensors.

Logical Architecture Reference Flow(s):
environmental_sensor_data_for_roadway

Physical Architecture Flow Name: environmental sensors control

Data used to configure and control environmental sensors.

Logical Architecture Reference Flow(s):
environmental_sensor_control_for_roadway

Physical Architecture Flow Name: infrastructure monitoring sensor control

Data used to configure and control infrastructure monitoring sensors.

Logical Architecture Reference Flow(s):
infrastructure_sensor_control_from_mcv

Physical Architecture Flow Name: roadway information system data

Information used to initialize, configure, and control roadside systems that provide driver information (e.g., dynamic message signs, highway advisory radio, beacon systems). This flow can provide message content and delivery attributes, local message store maintenance requests, control mode commands, status queries, and all other commands and associated parameters that support remote management of these systems.

Logical Architecture Reference Flow(s):

dms_data_from_mcv

Multimodal Crossings -> Roadway Subsystem

Physical Architecture Flow Name: multimodal crossing status

Indication of operational status and pending requests for right-of-way from equipment supporting the non-highway mode at multimodal crossings.

Logical Architecture Reference Flow(s):

fmmc_crossing_status_for_highways
fmmc_crossing_status_for_roads
fmmc_crossing_close_time
fmmc_crossing_close_duration

Other Roadway -> Roadway Subsystem

Physical Architecture Flow Name: roadway equipment coordination

The direct flow of information between field equipment. This includes transfer of information between sensors and driver information systems or control devices (traffic signals, ramp meters, etc.), direct coordination between adjacent control devices, interfaces between detection and warning or alarm systems, and any other direct communications between field equipment. Both peer-to-peer and master-slave communications between field devices are covered by this flow.

Logical Architecture Reference Flow(s):

fors_sensor_data
fors_device_status
fors_device_control
fors_roadway_info_data_from_sensors
fors_roadway_info_data_from_devices
fors_sensor_control
fors_sensor_status

Pedestrians -> Roadway Subsystem

Physical Architecture Flow Name: crossing call

Request for pedestrian crossing.

Logical Architecture Reference Flow(s):

fp_pedestrian_images
fp_pedestrian_data

Roadway Environment -> Roadway Subsystem

Physical Architecture Flow Name: environmental conditions

Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) that are measured by environmental sensors.

Logical Architecture Reference Flow(s):

fre_physical_conditions
fre_environmental_conditions
fre_roadway_infrastructure_characteristics

Roadway Subsystem -> Archived Data Management Subsystem

Physical Architecture Flow Name: roadside archive data

A broad set of data derived from roadside sensors that includes current traffic conditions, environmental conditions, and any other data that can be directly collected by roadside sensors. This data also indicates the status of the sensors and reports of any identified sensor faults.

Logical Architecture Reference Flow(s):

roadside_archive_data

Roadway Subsystem -> Basic Vehicle

Physical Architecture Flow Name: broadcast advisories

General broadcast advisories that are provided over wide-area wireless communications direct to the vehicle radio. These analog advisory messages may provide similar content to ITS broadcast information flows, but include no digital data component. Existing Highway-Advisory Radio (HAR) advisory messages are a prime example of this flow.

Logical Architecture Reference Flow(s):

tbv_har_broadcast

Roadway Subsystem -> Driver

Physical Architecture Flow Name: driver information

General advisory and traffic control information provided to the driver while en route.

Logical Architecture Reference Flow(s):

td_work_zone_intrusion_alert
td_dms_indication
td_lane_use_indication_for_roads
td_signal_indication
td_lane_use_indication_for_highways
td_ramp_state_indication

Roadway Subsystem -> Emissions Management

Physical Architecture Flow Name: pollution data

Measured emissions data comprised of various atmospheric pollutants.

Logical Architecture Reference Flow(s):

pollution_state_roadside_collection
pollution_state_vehicle_log_data
pollution_state_vehicle_collection

Roadway Subsystem -> Enforcement Agency

Physical Architecture Flow Name: speed monitoring information

System status including current operational state and logged information including measured speeds, warning messages displayed, and violation records.

Logical Architecture Reference Flow(s):

tea_speed_sensor_status

Physical Architecture Flow Name: traffic violation notification

Notification to enforcement agency of a detected traffic violation including speed violations, HOV passenger occupancy violations, and vehicle emissions violations.

Logical Architecture Reference Flow(s):

tea_speed_violation_notification

Roadway Subsystem -> Maintenance and Construction Field Personnel

Physical Architecture Flow Name: work zone warning

Warning of a work zone emergency or safety issue such as the intrusion of a vehicle into the work zone area or movement of field crew into the travel lanes.

Logical Architecture Reference Flow(s):

tmcfp_work_zone_intrusion_warning
tmcfp_work_zone_intrusion_alert

Roadway Subsystem -> Maintenance and Construction Management

Physical Architecture Flow Name: environmental conditions data

Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) as measured and reported by environmental sensors.

Logical Architecture Reference Flow(s):

environmental_sensor_fault_data_from_roadway_sensors
environmental_sensor_data_from_roadway_sensors
environmental_sensor_status_from_roadway_sensors

Physical Architecture Flow Name: field device status

Reports from field equipment (sensors, signals, signs, controllers, etc.) which indicate current operational status.

Logical Architecture Reference Flow(s):

video_device_equip_status_for_m_and_c
smart_probe_equip_status_for_m_and_c
traffic_sensor_equip_status_for_m_and_c
indicator_equip_status_from_roads_for_m_and_c
indicator_equip_status_from_highways_for_m_and_c
hov_sensor_equip_status_for_m_and_c
vehicle_sign_equip_status_for_m_and_c
signal_override_equip_status_for_m_and_c

Physical Architecture Flow Name: infrastructure monitoring sensor data

Data read from infrastructure-based sensors that monitor the condition of pavement, bridges, culverts, signs, and other roadway infrastructure.

Logical Architecture Reference Flow(s):

infrastructure_sensor_status_for_m_and_c
infrastructure_sensor_data_for_m_and_c

Physical Architecture Flow Name: roadway information system status

Current operating status of dynamic message signs, highway advisory radios, beacon systems,

or other configurable field equipment that provides dynamic information to the driver.

Logical Architecture Reference Flow(s):

dms_auto_treat_status_to_maint
har_status_for_m_and_c
har_equip_status_for_m_and_c
dms_equip_status_for_m_and_c
dms_status_for_m_and_c

Physical Architecture Flow Name: roadway treatment system status

Current operational status of automated roadway treatment devices (e.g., anti-icing systems).

Logical Architecture Reference Flow(s):

roadway_treatment_system_status

Physical Architecture Flow Name: speed monitoring information

System status including current operational state and logged information including measured speeds, warning messages displayed, and violation records.

Logical Architecture Reference Flow(s):

speed_violation_notification_for_m_and_c
speed_data_for_m_and_c_speed_monitoring
speed_sensor_log_for_m_and_c
speed_sensor_status_for_m_and_c

Physical Architecture Flow Name: traffic images

High fidelity, real-time traffic images suitable for surveillance monitoring by the operator or for use in machine vision applications. This flow includes the images and the operational status of the surveillance system.

Logical Architecture Reference Flow(s):

work_zone_images

Physical Architecture Flow Name: work zone warning status

Status of a work zone safety monitoring and warning devices. This flow documents system activations and includes additional supporting information (e.g., an image) that allows verification of the alarm.

Logical Architecture Reference Flow(s):

work_zone_intrusion_detected
roadside_crew_warning_given
work_zone_intrusion_video_image
work_zone_intrusion_alert
intrusion_detection_device_status
intrusion_alert_device_status

Roadway Subsystem -> Maintenance and Construction Vehicle

Physical Architecture Flow Name: environmental conditions data

Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) as measured and reported by environmental sensors.

Logical Architecture Reference Flow(s):

environmental_sensor_status_from_roadway
environmental_sensor_fault_data_from_roadway
environmental_sensor_data_from_roadway

Physical Architecture Flow Name: infrastructure monitoring sensor data

Data read from infrastructure-based sensors that monitor the condition of pavement, bridges, culverts, signs, and other roadway infrastructure.

Logical Architecture Reference Flow(s):

infrastructure_sensor_data_for_mcv
infrastructure_sensor_status_for_mcv

Physical Architecture Flow Name: roadway information system status

Current operating status of dynamic message signs, highway advisory radios, beacon systems, or other configurable field equipment that provides dynamic information to the driver.

Logical Architecture Reference Flow(s):

dms_status_for_mcv

Physical Architecture Flow Name: work zone warning notification

Notification of a work zone emergency or safety issue. This flow identifies that a work zone emergency or safety issue has occurred so that warnings may be generated by more than one system in the work zone.

Logical Architecture Reference Flow(s):

work_zone_intrusion_detection_for_on_board

Roadway Subsystem -> Multimodal Crossings

Physical Architecture Flow Name: highway control status

Current traffic control equipment status that indicates operational status and right-of-way availability to the non-highway transportation mode at a multimodal crossing.

Logical Architecture Reference Flow(s):

tmmc_road_equipment_status
tmmc_stop_alternate_mode_at_highways
tmmc_stop_alternate_mode_at_roads
tmmc_crossing_clear_at_highways
tmmc_crossing_clear_at_roads
tmmc_highway_equipment_status

Roadway Subsystem -> Other Roadway

Physical Architecture Flow Name: roadway equipment coordination

The direct flow of information between field equipment. This includes transfer of information between sensors and driver information systems or control devices (traffic signals, ramp meters, etc.), direct coordination between adjacent control devices, interfaces between detection and warning or alarm systems, and any other direct communications between field equipment. Both peer-to-peer and master-slave communications between field devices are covered by this flow.

Logical Architecture Reference Flow(s):

tors_device_control
tors_sensor_data
tors_roadway_info_data_from_sensors
tors_device_status
tors_sensor_control
tors_sensor_status
tors_roadway_info_data_from_devices

Roadway Subsystem -> Pedestrians

Physical Architecture Flow Name: crossing permission

Signal to pedestrians indicating permission to cross roadway.

Logical Architecture Reference Flow(s):

tp_dms_indication
tp_cross_road
tp_cross_request_received

Roadway Subsystem -> Surface Transportation Weather Service

Physical Architecture Flow Name: environmental conditions data

Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) as measured and reported by environmental sensors.

Logical Architecture Reference Flow(s):

tstws_roadway_env_sensor_status
tstws_roadway_env_sensor_data

Roadway Subsystem -> Traffic Management

Physical Architecture Flow Name: AHS status

Status of AHS equipment, lane controls etc.

Logical Architecture Reference Flow(s):

ahs_checking_details

Physical Architecture Flow Name: emissions data

Emissions data and associated imagery collected by roadside equipment.

Logical Architecture Reference Flow(s):

vehicle_pollution_message
vehicle_pollution_alert

Physical Architecture Flow Name: environmental conditions data

Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) as measured and reported by environmental sensors.

Logical Architecture Reference Flow(s):

environmental_sensor_status
environment_sensor_data

Physical Architecture Flow Name: environmental probe data

Current environmental conditions (e.g., air temperature, wind speed, surface temperature) as measured by vehicle-based environmental sensors. In addition to environmental sensor inputs, this flow may also include vehicle control system information that may indicate adverse road surface conditions (e.g., traction control system activations).

Logical Architecture Reference Flow(s):

vehicle_smart_probe_data_for_storage
smart_probe_reader_status

Physical Architecture Flow Name: freeway control status

Current operational status and operating parameters for ramp meters, mainline metering/lane controls and other control equipment associated with freeway operations.

Logical Architecture Reference Flow(s):

indicator_input_data_from_highways

Physical Architecture Flow Name: hov data

Current HOV lane information including both standard traffic flow measures and information regarding vehicle occupancy in HOV lanes.

Logical Architecture Reference Flow(s):

hov_lane_data_input
hov_sensor_data

Physical Architecture Flow Name: hri status

Status of the highway-rail intersection equipment including both the current state or mode of operation and the current equipment condition.

Logical Architecture Reference Flow(s):

hri_guidance_for_dms
rail_operations_message
traffic_management_request
hri_traffic_data
hri_guidance_for_beacon_message
hri_status

Physical Architecture Flow Name: intersection blockage notification

Notification that a highway-rail intersection is obstructed and supporting information.

Logical Architecture Reference Flow(s):

intersection_blocked
hri_blockage

Physical Architecture Flow Name: request for right-of-way

Forwarded request from signal prioritization, signal preemption, pedestrian call, multi-modal crossing activation, or other source for right-of-way.

Logical Architecture Reference Flow(s):

signal_override_status
indicator_input_data_from_roads
multimodal_crossing_sensor_data
pedestrian_sensor_data

Physical Architecture Flow Name: reversible lane status

Current reversible lane status including traffic sensor and surveillance data and the operational

status and mode of the reversible lane control equipment.

Logical Architecture Reference Flow(s):

reversible_lane_video_images
sensor_data_for_reversible_lanes

Physical Architecture Flow Name: roadway information system status

Current operating status of dynamic message signs, highway advisory radios, beacon systems, or other configurable field equipment that provides dynamic information to the driver.

Logical Architecture Reference Flow(s):

vehicle_sign_data_status
dms_status
har_status

Physical Architecture Flow Name: signal control status

Status of surface street signal controls.

Logical Architecture Reference Flow(s):

indicator_input_data_from_roads
traffic_control_device_status

Physical Architecture Flow Name: speed monitoring information

System status including current operational state and logged information including measured speeds, warning messages displayed, and violation records.

Logical Architecture Reference Flow(s):

speed_data_for_traffic_speed_monitoring
speed_violation_notification_for_traffic
speed_sensor_log_for_traffic
speed_sensor_status_for_traffic

Physical Architecture Flow Name: traffic flow

Raw and/or processed traffic detector data which allows derivation of traffic flow variables (e.g., speed, volume, and density measures) and associated information (e.g., congestion, potential incidents).

Logical Architecture Reference Flow(s):

traffic_sensor_fault_data
traffic_sensor_data
traffic_image_data
traffic_sensor_status
incident_analysis_data

Physical Architecture Flow Name: traffic images

High fidelity, real-time traffic images suitable for surveillance monitoring by the operator or for use in machine vision applications. This flow includes the images and the operational status of the surveillance system.

Logical Architecture Reference Flow(s):

traffic_video_image
video_device_status
incident_video_image
traffic_video_image_for_display

Physical Architecture Flow Name: vehicle probe data

Vehicle probe data indicating identity, route segment identity, link time and location.

Logical Architecture Reference Flow(s):
vehicle_tag_data

Roadway Subsystem -> Vehicle

Physical Architecture Flow Name: AHS control data

Information required for vehicles to operate on AHS lanes.

Logical Architecture Reference Flow(s):
lane_change_details
lane_change_strategy
ahs_check_response

Physical Architecture Flow Name: intersection status

Status of intersection congestion, approaching vehicles, etc.

Logical Architecture Reference Flow(s):
intersection_collision_avoidance_data

Physical Architecture Flow Name: request tag data

Request for tag information including credit identity, stored value card cash, etc.

Logical Architecture Reference Flow(s):
toll_tag_data_needed
parking_lot_tag_data_needed

Physical Architecture Flow Name: vehicle signage data

In-vehicle signage data generated by the roadway infrastructure indicating either road conditions, street names, or special information.

Logical Architecture Reference Flow(s):
intrusion_alert_for_in_vehicle_signing
vehicle_signage_data
vehicle_smart_probe_data_output

Roadway Subsystem -> Wayside Equipment

Physical Architecture Flow Name: hri operational status

Status of the highway-rail grade crossing equipment including both the current state or mode of operation and the current equipment condition.

Logical Architecture Reference Flow(s):
twe_hri_status

Physical Architecture Flow Name: intersection blockage notification

Notification that a highway-rail intersection is obstructed and supporting information.

Logical Architecture Reference Flow(s):
twe_stop_train_indication
twe_stop_highway_indication

Roadway Subsystem -> Weather Service

Physical Architecture Flow Name: environmental conditions data

Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) as measured and reported by environmental sensors.

Logical Architecture Reference Flow(s):

tws_roadway_env_sensor_data
tws_roadway_env_sensor_status

Surface Transportation Weather Service -> Roadway Subsystem

Physical Architecture Flow Name: environmental sensors control

Data used to configure and control environmental sensors.

Logical Architecture Reference Flow(s):

fstws_roadway_env_sensor_control

Traffic -> Roadway Subsystem

Physical Architecture Flow Name: traffic characteristics

Physical traffic characteristics which are monitored and translated into macroscopic measures like occupancy, volume, density, and average speed. Point measures support presence detection and individual vehicle measures like speed.

Logical Architecture Reference Flow(s):

ftrf_vehicle_pollutant_levels
ftrf_traffic_data
ftrf_traffic_images
ftrf_vehicle_presence

Traffic Management -> Roadway Subsystem

Physical Architecture Flow Name: AHS control information

Control data to AHS roadway equipment.

Logical Architecture Reference Flow(s):

ahs_control_data_changes
automated_lane_changing_control_data

Physical Architecture Flow Name: environmental sensors control

Data used to configure and control environmental sensors.

Logical Architecture Reference Flow(s):

environment_sensor_configuration_data

Physical Architecture Flow Name: freeway control data

Control commands and operating parameters for ramp meters, mainline metering/lane controls and other systems associated with freeway operations.

Logical Architecture Reference Flow(s):

indicator_control_monitoring_data_for_highways
indicator_control_data_for_highways

Physical Architecture Flow Name: hri control data

Data required for HRI information transmitted at railroad grade crossings and within railroad operations.

Logical Architecture Reference Flow(s):

indicator_sign_control_data_for_hri
hri_traffic_surveillance
rail_operations_device_command
rail_operations_advisories

Physical Architecture Flow Name: hri request

A request for highway-rail intersection status or a specific control request intended to modify HRI operation.

Logical Architecture Reference Flow(s):

ro_requests
tms_requests

Physical Architecture Flow Name: roadway information system data

Information used to initialize, configure, and control roadside systems that provide driver information (e.g., dynamic message signs, highway advisory radio, beacon systems). This flow can provide message content and delivery attributes, local message store maintenance requests, control mode commands, status queries, and all other commands and associated parameters that support remote management of these systems.

Logical Architecture Reference Flow(s):

vehicle_sign_data
har_data
dms_data

Physical Architecture Flow Name: signal control data

Information used to configure and control traffic signal systems.

Logical Architecture Reference Flow(s):

indicator_control_monitoring_data_for_roads
indicator_control_data_for_roads

Physical Architecture Flow Name: speed monitoring control

Information used to configure and control automated speed monitoring, speed warning, and speed enforcement systems.

Logical Architecture Reference Flow(s):

speed_sensor_control_from_traffic

Physical Architecture Flow Name: traffic sensor control

Information used to configure and control traffic sensor systems.

Logical Architecture Reference Flow(s):

sensor_configuration_data

Physical Architecture Flow Name: video surveillance control

Information used to configure and control video surveillance systems.

Logical Architecture Reference Flow(s):

incident_video_image_control

Transit Vehicle Subsystem -> Roadway Subsystem

Physical Architecture Flow Name: local signal priority request

Request from a vehicle to a signalized intersection for priority at that intersection.

Logical Architecture Reference Flow(s):
transit_vehicle_roadway_priorities

Vehicle -> Roadway Subsystem

Physical Architecture Flow Name: AHS vehicle data

AHS route and vehicle condition data.

Logical Architecture Reference Flow(s):
ahs_vehicle_condition
ahs_route_data

Physical Architecture Flow Name: environmental probe data

Current environmental conditions (e.g., air temperature, wind speed, surface temperature) as measured by vehicle-based environmental sensors. In addition to environmental sensor inputs, this flow may also include vehicle control system information that may indicate adverse road surface conditions (e.g., traction control system activations).

Logical Architecture Reference Flow(s):
vehicle_status_details_for_emissions
vehicle_smart_probe_data

Physical Architecture Flow Name: vehicle probe data

Vehicle probe data indicating identity, route segment identity, link time and location.

Logical Architecture Reference Flow(s):
toll_tag_data_input
parking_lot_tag_data_input

Vehicle Characteristics -> Roadway Subsystem

Physical Architecture Flow Name: vehicle characteristics

The physical or visible characteristics of an individual vehicle that can be measured to classify a vehicle and imaged to uniquely identify a vehicle.

Logical Architecture Reference Flow(s):
From_Vehicle_Characteristics

Wayside Equipment -> Roadway Subsystem

Physical Architecture Flow Name: arriving train information

Information for a train approaching a highway-rail intersection that may include direction and allow calculation of approximate arrival time and closure duration.

Logical Architecture Reference Flow(s):
fwe_train_data

Physical Architecture Flow Name: track status

Current status of the wayside equipment and notification of an arriving train.

Logical Architecture Reference Flow(s):
fwe_approaching_train_announcement
fwe_wayside_equipment_status

Weather Service -> Roadway Subsystem

Physical Architecture Flow Name: environmental sensors control

Data used to configure and control environmental sensors.

Logical Architecture Reference Flow(s):
fws_roadway_env_sensor_control

2.18.3 Architecture Flow Diagrams for RS

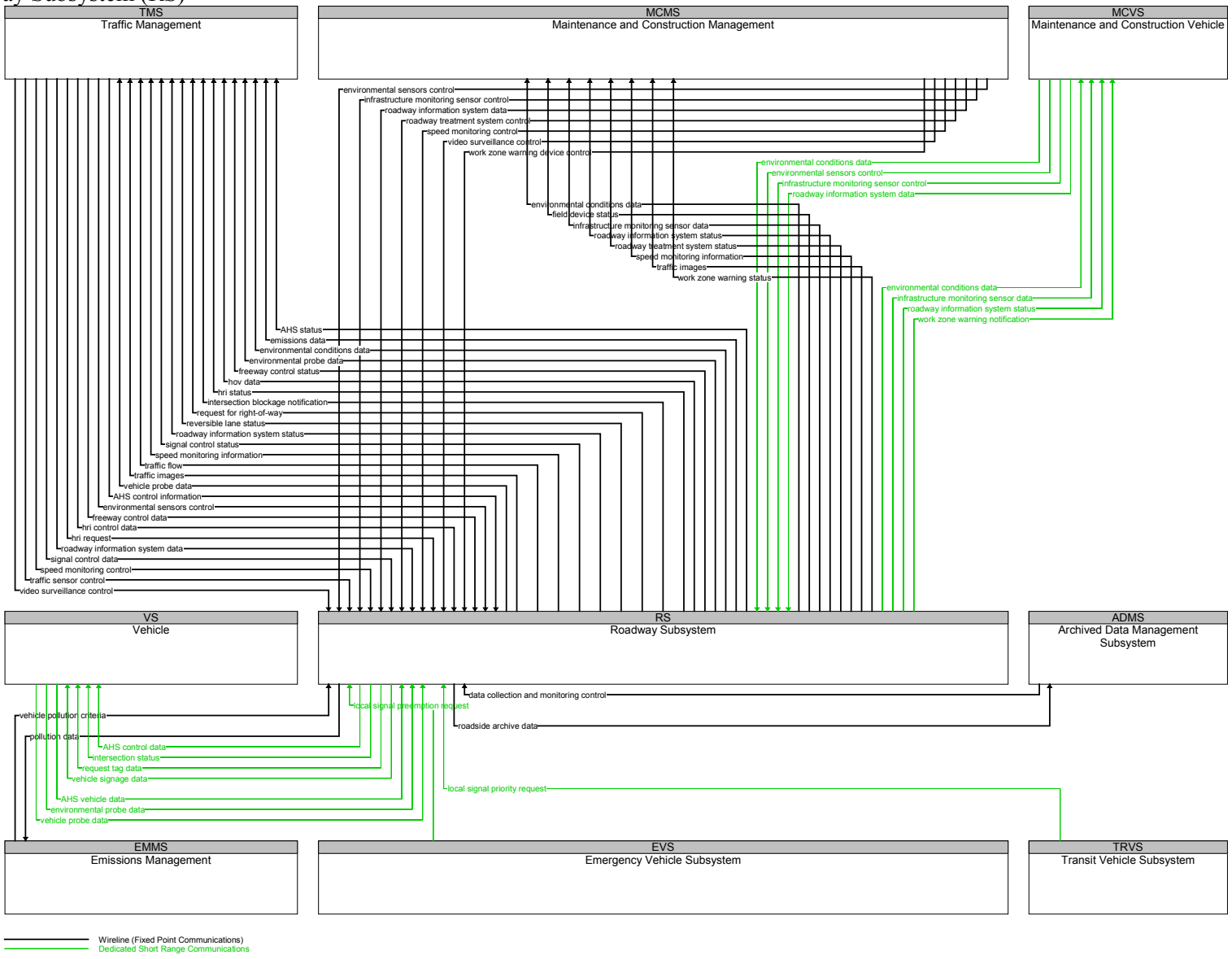


Figure 2-33 Subsystem Architecture Flow Diagram for RS

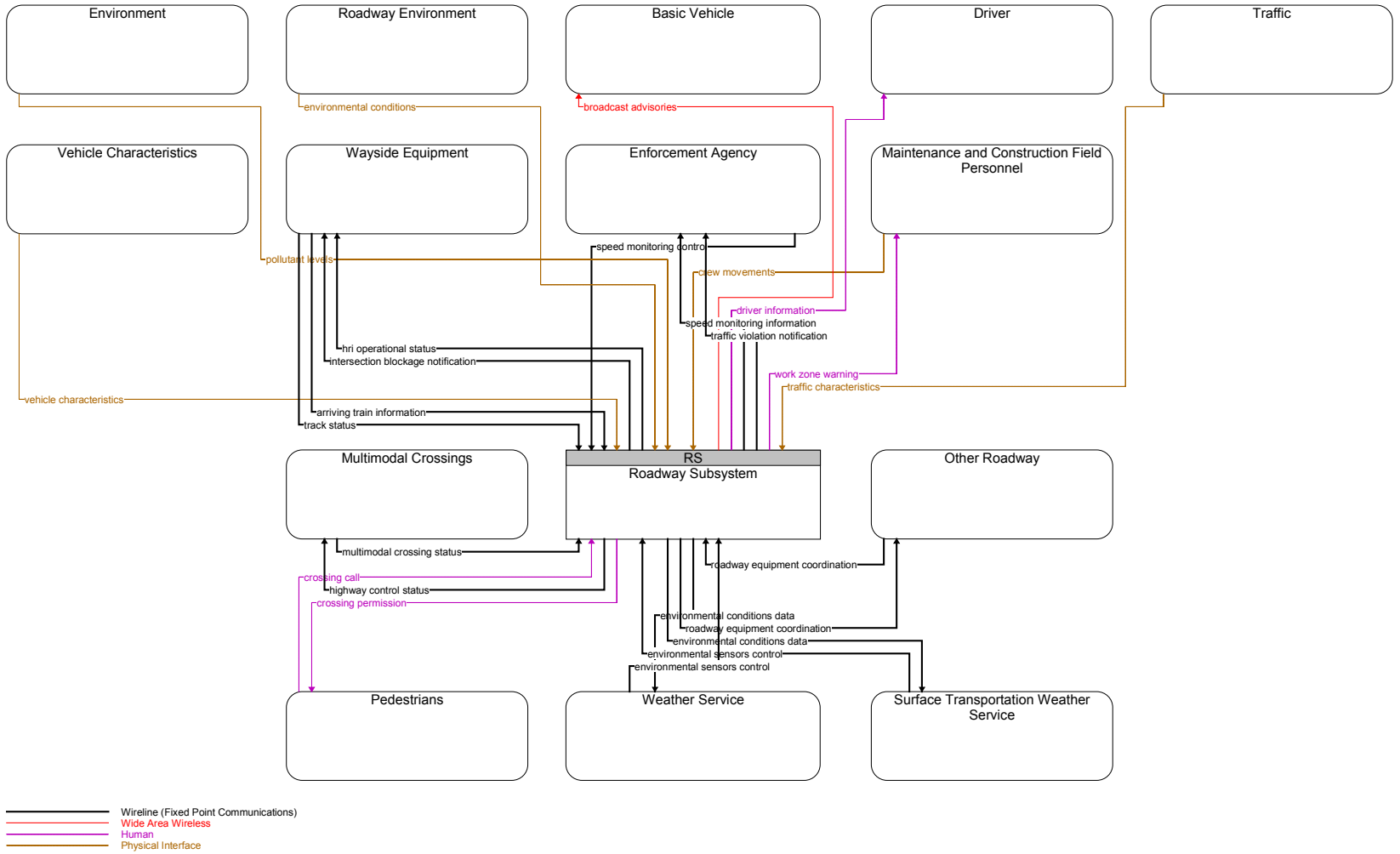


Figure 2-34 Terminator Architecture Flow Diagram for RS

2.19 Toll Administration

The Toll Administration Subsystem provides general payment administration capabilities and supports the electronic transfer of authenticated funds from the customer to the transportation system operator. This subsystem supports traveler enrollment and collection of both pre-payment and post-payment transportation fees in coordination with the existing, and evolving financial infrastructure supporting electronic payment transactions. The system may establish and administer escrow accounts depending on the clearinghouse scheme and the type of payments involved. This subsystem posts a transaction to the customer account and generates a bill (for post-payment accounts), debits an escrow account, or interfaces to the financial infrastructure to debit a customer designated account. It supports communications with the Toll Collection Subsystem to support fee collection operations. The subsystem also sets and administers the pricing structures and includes the capability to implement road pricing policies in coordination with the Traffic Management Subsystem. The electronic financial transactions in which this subsystem is an intermediary between the customer and the financial infrastructure shall be cryptographically protected and authenticated to preserve privacy and ensure authenticity and auditability.

2.19.1 Subsystem Equipment Packages and Supporting Process Specifications for TAS

Toll Administration
This Equipment package provides the capability to maintain database information with pricing structure information. This capability shall be provided through database software containing pricing structure and current traffic conditions on the transportation network obtained from the transportation management center. This capability allows the determination of dynamic tolls according to congestion levels for demand management. Secure wireline communications with the financial infrastructure and distributed toll plazas supports electronic payments and other ancillary requirements such as lost/stolen tag identification and management. Dependent on customer account requirements and the clearinghouse arrangement, this Equipment package may also contain a billing database.

Process Specifications

5.4.2	**Process Violations for Tolls**
7.1.1.3	**Manage Bad Toll Payment Data**
7.1.1.6	**Collect Probe Data From Toll Transactions**
7.1.1.7	**Update Toll Price Data**
7.1.1.8	**Register for Advanced Toll Payment**
7.1.1.9	**Manage Toll Financial Processing**
7.1.8	**Exchange Data with Other Toll Administration**

Toll Data Collection
This equipment package collects and stores toll information that is collected in the course of toll operations performed

by the Toll Administration Subsystem. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.

Process Specifications
7.1.1.11 Manage Toll Archive Data

2.19.2 Subsystem Interfaces for TAS

Archived Data Management Subsystem -> Toll Administration

Physical Architecture Flow Name: archive requests

A request to a data source for information on available data (i.e. "catalog") or a request that defines the data to be archived. The request can be a general subscription intended to initiate a continuous or regular data stream or a specific request intended to initiate a one-time response from the recipient.

Logical Architecture Reference Flow(s):
toll_archive_request

Physical Architecture Flow Name: archive status

Notification that data provided to an archive contains erroneous, missing, or suspicious data or verification that the data provided appears valid. If an error has been detected, the offending data and the nature of the potential problem are identified.

Logical Architecture Reference Flow(s):
toll_archive_status

DMV -> Toll Administration

Physical Architecture Flow Name: registration

Registered owner of vehicle and associated vehicle information.

Logical Architecture Reference Flow(s):
fdmv_toll_violation_vehicle_registration
fdmv_toll_violation_state_identity

Financial Institution -> Toll Administration

Physical Architecture Flow Name: transaction status

Response to transaction request. Normally dealing with a request for payment.

Logical Architecture Reference Flow(s):
ffi_bad_toll_payment_updates
ffi_confirm_toll_payment

Fleet and Freight Management -> Toll Administration

Physical Architecture Flow Name: toll data request

Request made to obtain toll schedule information or pay a toll in advance. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.

Logical Architecture Reference Flow(s):
cvo_advanced_toll_request
cvo_toll_price_request

Information Service Provider -> Toll Administration

Physical Architecture Flow Name: toll data request

Request made to obtain toll schedule information or pay a toll in advance. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.

Logical Architecture Reference Flow(s):
advanced_other_tolls_request
advanced_traveler_tolls_request
toll_price_data_request

Other Toll Administration -> Toll Administration

Physical Architecture Flow Name: toll coordination

This flow supports reciprocity between toll agencies/service centers by exchanging information that supports reconciliation of toll charges by customers that are enrolled with other toll service centers. In addition to toll charge reconciliation, exchanged information may include toll schedule information, customer information and other toll service information that is coordinated between toll agencies or centers.

Logical Architecture Reference Flow(s):
fota_toll_charges_reconciliation_data
fota_toll_pricing_data

Toll Administration -> Archived Data Management Subsystem

Physical Architecture Flow Name: toll archive data

Data indicating toll facility usage and pricing schedules. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.

Logical Architecture Reference Flow(s):
toll_archive_data

Toll Administration -> DMV

Physical Architecture Flow Name: license request

Request supporting registration data based on license plate read during violation.

Logical Architecture Reference Flow(s):
tdmv_toll_violation_identity_code
tdmv_toll_violation_vehicle_license

Toll Administration -> Enforcement Agency

Physical Architecture Flow Name: payment violation notification

Notification to enforcement agency of a toll, parking, or transit fare payment violation.

Logical Architecture Reference Flow(s):
tea_toll_violation_data

Toll Administration -> Financial Institution

Physical Architecture Flow Name: payment request

Request for payment from financial institution.

Logical Architecture Reference Flow(s):
tfi_toll_payment_violator_data
tfi_request_toll_payment

Toll Administration -> Fleet and Freight Management

Physical Architecture Flow Name: toll data

Current toll schedules for different types of vehicles as well as advanced toll payment information.

Logical Architecture Reference Flow(s):
cvo_toll_price
cvo_advanced_toll_confirmation

Toll Administration -> Information Service Provider

Physical Architecture Flow Name: probe data

Aggregate data from probe vehicles including location, speed for a given link or collection of links.

Logical Architecture Reference Flow(s):
vehicle_toll_probe_data

Physical Architecture Flow Name: toll data

Current toll schedules for different types of vehicles as well as advanced toll payment information.

Logical Architecture Reference Flow(s):
advanced_traveler_tolls_confirm
toll_price_data
advanced_other_tolls_confirm

Toll Administration -> Other Toll Administration

Physical Architecture Flow Name: toll coordination

This flow supports reciprocity between toll agencies/service centers by exchanging information that supports reconciliation of toll charges by customers that are enrolled with other toll service centers. In addition to toll charge reconciliation, exchanged information may include toll schedule information, customer information and other toll service information that is coordinated between toll agencies or centers.

Logical Architecture Reference Flow(s):
tota_toll_charges_reconciliation_data
tota_toll_pricing_data

Toll Administration -> Toll Administrator

Physical Architecture Flow Name: toll revenues and summary reports

Summary of toll revenues and toll-related reports to toll service provider.

Logical Architecture Reference Flow(s):

tta_archive_status
tta_toll_price_changes_request
tta_transaction_reports
tta_request_advanced_toll

Toll Administration -> Toll Collection

Physical Architecture Flow Name: toll instructions

Demand management toll pricing information based on current congestion.

Logical Architecture Reference Flow(s):

toll_price_data_for_vehicle_toll
advanced_toll_needed
toll_price_data_for_advanced_toll
toll_bad_payment_check_response

Toll Administration -> Traffic Management

Physical Architecture Flow Name: probe data

Aggregate data from probe vehicles including location, speed for a given link or collection of links.

Logical Architecture Reference Flow(s):

probe_data_for_traffic

Physical Architecture Flow Name: toll demand management response

Response to toll demand management change requests indicating level of compliance with request.

Logical Architecture Reference Flow(s):

toll_price_direct_details
toll_price_changes_response

Toll Administrator -> Toll Administration

Physical Architecture Flow Name: toll administration requests

Instructions indicating toll fees which should be charged.

Logical Architecture Reference Flow(s):

fta_toll_price_data
fta_toll_price_changes_response
fta_archive_commands
fta_confirm_advanced_toll

Toll Collection -> Toll Administration

Physical Architecture Flow Name: toll transactions

Detailed list of transactions from a toll station.

Logical Architecture Reference Flow(s):

confirm_advanced_tolls_payment
current_toll_transactions

advanced_toll_transactions
toll_bad_payment_check_request
toll_violation_information
toll_payment_violator_data

Traffic Management -> **Toll Administration**

Physical Architecture Flow Name: toll demand management request

Request to change the demand for toll road facility use through pricing or other mechanisms.

Logical Architecture Reference Flow(s):

toll_price_changes_request
toll_price_direct_request

2.19.3 Architecture Flow Diagrams for TAS

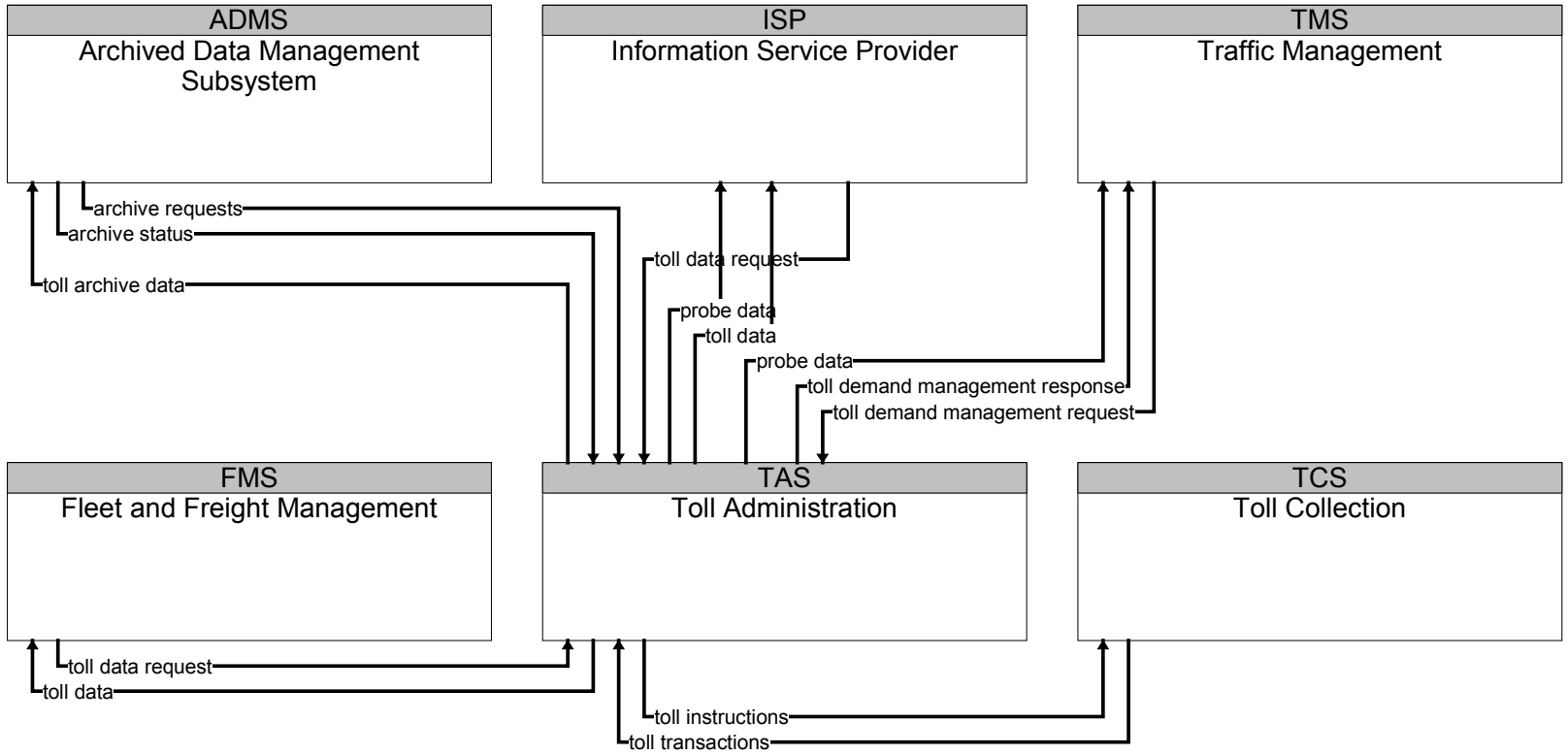


Figure 2-35 Subsystem Architecture Flow Diagram for TAS

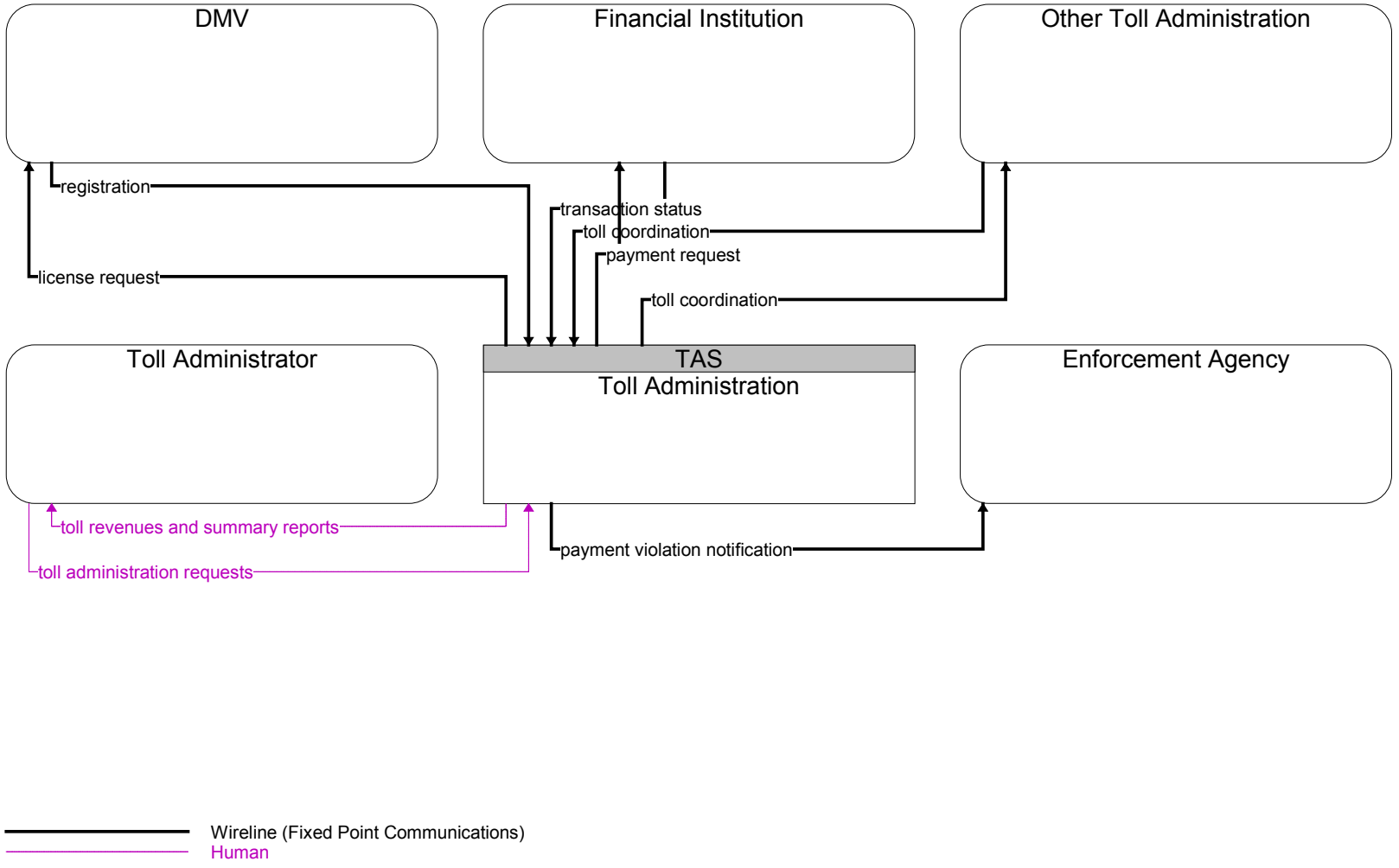


Figure 2-36 Terminator Architecture Flow Diagram for TAS

2.20 Toll Collection

The Toll Collection Subsystem provides the capability for vehicle operators to pay tolls without stopping their vehicles using locally determined pricing structures and including the capability to implement various variable road pricing policies. Each transaction is accompanied by feedback to the customer which indicates the general status of the customer account. A record of the transactions is provided to the Toll Administration subsystem for reconciliation and so that the customer can periodically receive a detailed record of the transactions.

2.20.1 Subsystem Equipment Packages and Supporting Process Specifications for TCS

Toll Plaza Toll Collection
This Equipment package provides existing toll plazas the capability to identify properly equipped vehicles and automatically perform toll collection. These capabilities are provided with active tag readers and vehicle identification software running on a workstation type processor. A camera for performing violation identification shall interface to a monitor, the workstation, and database software. Automated account reconciliation and notification to authorities of violations shall be supported using wireline communications.

Process Specifications

7.1.1.1 Read Tag Data for Tolls

7.1.1.10 Determine Advanced Toll Bill

7.1.1.2 Calculate Vehicle Toll

7.1.1.4 Check for Advanced Tolls Payment

7.1.1.5 Bill Driver for Tolls

7.1.2 Produce Roadside Displays

7.1.3 Obtain Toll Violator Image

7.1.5 Detect Vehicle for Tolls

2.20.2 Subsystem Interfaces for TCS

Toll Administration -> Toll Collection

Physical Architecture Flow Name: toll instructions

Demand management toll pricing information based on current congestion.

Logical Architecture Reference Flow(s):
toll_bad_payment_check_response
toll_price_data_for_vehicle_toll
advanced_toll_needed
toll_price_data_for_advanced_toll

Toll Collection -> Driver

Physical Architecture Flow Name: roadside transaction status

The status of an electronic payment transaction provided directly to the driver via sign or other roadside infrastructure.

Logical Architecture Reference Flow(s):
td_toll_payment_invalid
td_toll_payment_confirmed

Toll Collection -> Toll Administration

Physical Architecture Flow Name: toll transactions

Detailed list of transactions from a toll station.

Logical Architecture Reference Flow(s):
advanced_toll_transactions
toll_bad_payment_check_request
confirm_advanced_tolls_payment
current_toll_transactions
toll_violation_information
toll_payment_violator_data

Toll Collection -> Toll Operator

Physical Architecture Flow Name: toll transaction reports

Summary report sent to toll collection point operator containing previous toll transactions.

Logical Architecture Reference Flow(s):
tto_transaction_reports

Toll Collection -> Vehicle

Physical Architecture Flow Name: request tag data

Request for tag information including credit identity, stored value card cash, etc.

Logical Architecture Reference Flow(s):
toll_tag_data_request
toll_payment_request

Physical Architecture Flow Name: tag update

Update data held in tag which can be read by another roadside device (Commercial Vehicle Check Subsystem, Toll Collection Subsystem, etc.).

Logical Architecture Reference Flow(s):
toll_payment_debited
toll_tag_data_clear
toll_tag_data_update

Toll Operator -> **Toll Collection**

Physical Architecture Flow Name: toll operator requests

Request for information from toll operator at toll collection site.

Logical Architecture Reference Flow(s):
fto_local_toll_price_variations

Vehicle -> **Toll Collection**

Physical Architecture Flow Name: tag data

Unique tag ID and related vehicle information.

Logical Architecture Reference Flow(s):
toll_tag_data_collect
toll_payment_confirmation

Vehicle Characteristics -> **Toll Collection**

Physical Architecture Flow Name: vehicle characteristics

The physical or visible characteristics of an individual vehicle that can be measured to classify a vehicle and imaged to uniquely identify a vehicle.

Logical Architecture Reference Flow(s):
From_Vehicle_Characteristics

2.20.3 Architecture Flow Diagrams for TCS

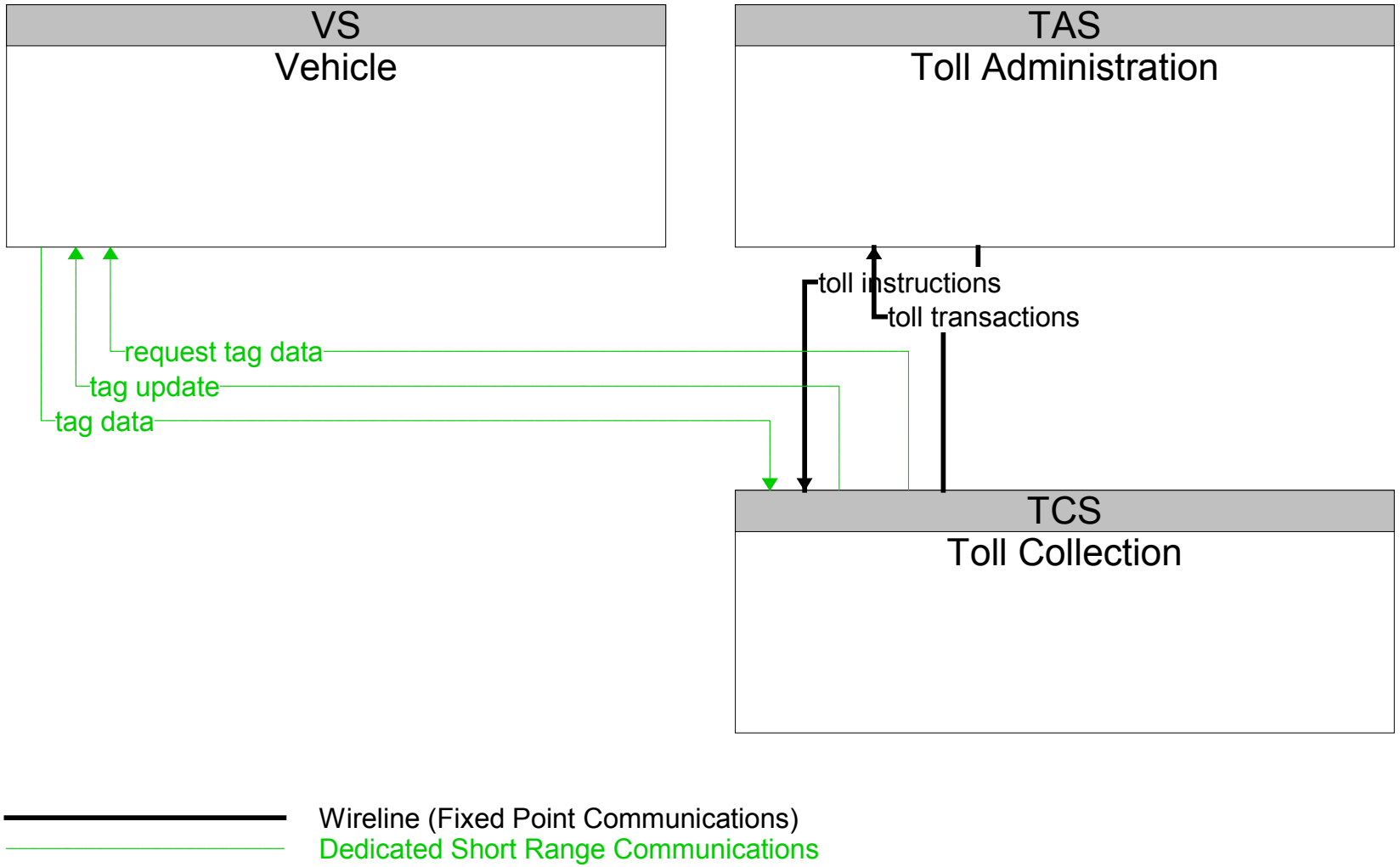


Figure 2-37 Subsystem Architecture Flow Diagram for TCS

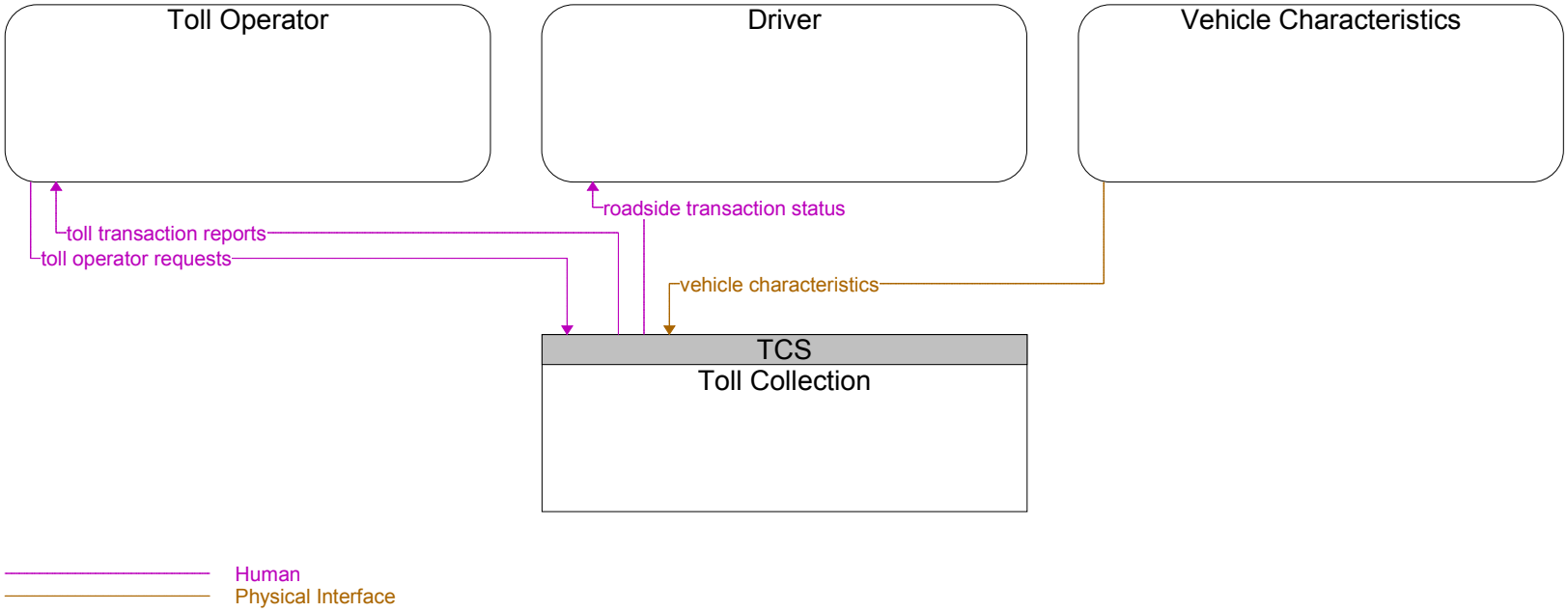


Figure 2-38 Terminator Architecture Flow Diagram for TCS

2.21 Traffic Management

The Traffic Management Subsystem operates within a traffic management center or other fixed location. This subsystem communicates with the Roadway Subsystem to monitor and manage traffic flow. Incidents are detected and verified and incident information is provided to the Emergency Management Subsystem, travelers (through Roadway Subsystem Highway Advisory Radio and Dynamic Message Signs), and to third party providers. The subsystem supports HOV lane management and coordination, road pricing, and other demand management policies that can alleviate congestion and influence mode selection. The subsystem monitors and manages maintenance work and disseminates maintenance work schedules and road closures. The subsystem also manages reversible lane facilities, and processes probe vehicle information. The subsystem communicates with other Traffic Management Subsystems to coordinate traffic information and control strategies in neighboring jurisdictions. It also coordinates with rail operations to support safer and more efficient highway traffic management at highway-rail intersections. Finally, the Traffic Management Subsystem provides the capabilities to exercise control over those devices utilized for AHS traffic and vehicle control.

2.21.1 Subsystem Equipment Packages and Process Specifications for TMS

Collect Traffic Surveillance
This Equipment package collects, stores, and provides electronic access to the traffic surveillance data.

Process Specifications

1.1.2.1 Process Traffic Data for Storage

1.1.2.2 Process Traffic Data

1.1.2.3 Update Data Source Static Data

1.1.4.1 Retrieve Traffic Data

1.1.4.2 Provide Traffic Operations Personnel Traffic Data Interface

1.1.4.4 Update Traffic Display Map Data

HRI Traffic Management
This equipment package monitors highway-rail intersection (HRI) equipment at the roadside which manages highway traffic. Various levels of roadside equipment may be interfaced to, and supported by, this equipment package to include standard speed active warning systems and high speed systems which provide additional information on approaching trains and detect and report on obstructions in the HRI. This equipment package remotely monitors and reports the status of this roadside equipment. A two way interface supports explicitly status requests or remote control plan updates to be generated by this equipment package. Status may also be received periodically in the absence of a request or asynchronously in the event of a detected failure or other unsafe condition at the intersection.

Process Specifications

1.6.2.1 Exchange Data with Rail Operations

1.6.2.2 Manage Alerts and Advisories

1.6.4.1 Manage HRI Closures

1.6.4.2 Exchange Data with Traffic Management

Rail Operations Coordination

This equipment package provides strategic coordination between rail operations and traffic management centers. It receives train schedules, maintenance schedules, and any other forecast events which will result in highway-rail intersection (HRI) closures from Rail Operations. The provided information is used to develop forecast HRI closure times and durations which may be applied in advanced traffic control strategies or delivered as enhanced traveler information. This equipment package includes the processing and algorithms necessary to derive HRI closure times and the communications capabilities necessary to communicate with rail operations and interface to the traffic control and information distribution capabilities included in other Traffic Management Subsystem equipment packages.

Process Specifications

1.1.3 Generate Predictive Traffic Model

1.6.2.1 Exchange Data with Rail Operations

1.6.2.3 Manage Rail Traffic Control Data

TMC Environmental Monitoring

This equipment package assimilates current and forecast road conditions and surface weather information using a combination of weather service provider information and an array of environmental sensors deployed on and about the roadway. The collected environmental information is monitored and presented to the operator. This information can be used to more effectively deploy road maintenance resources, issue general traveler advisories, and support location specific warnings to drivers. Other equipment packages process the collected information and provide decision support.

Process Specifications

1.1.2.1 Process Traffic Data for Storage

1.1.2.2 Process Traffic Data

1.1.4.1 Retrieve Traffic Data

1.3.2.1 Store Possible Incident Data

1.3.2.2 Review and Classify Possible Incidents

1.3.4.2 Provide Traffic Operations Personnel Incident Data Interface

1.3.4.5 Manage Resources for Incidents

TMC for AHS
This Equipment package provides the capability to exercise control over those devices utilized for AHS traffic and vehicle control.

Process Specifications
3.2.7 Manage AHS Operations

TMC Freeway Management
Control system for efficient freeway management including integration of surveillance information with freeway road geometry, vehicle control such as ramp metering, CMS, HAR. Interface to coordinated traffic subsystems for information dissemination to the public.

Process Specifications
1.1.4.2 Provide Traffic Operations Personnel Traffic Data Interface

1.2.2.1 Determine Indicator State for Freeway Management

1.2.3 Determine Ramp State

1.2.4.2 Output Control Data for Freeways

TMC HOV Lane Management
This Equipment package provides the capability to manage HOV lanes by coordinating freeway ramp meters and connector signals with HOV lane usage signals, and giving preferential treatments to HOV lanes to encourage drivers to carpool.

Process Specifications
1.1.2.4 Monitor HOV lane use

1.2.4.2 Output Control Data for Freeways

5.4.1 Process TM Detected Violations

TMC Incident Detection
This Equipment package provides the capability to traffic managers to detect and verify incident. This capability includes analyzing and reducing the collected data from traffic surveillance equipment, including planned incidents and hazardous conditions.

Process Specifications
1.3.1.1 Analyze Traffic Data for Incidents

1.3.1.2 Maintain Static Data for Incident Management

1.3.2.1 Store Possible Incident Data
1.3.2.2 Review and Classify Possible Incidents

1.3.2.3 Review and Classify Planned Events

1.3.2.4 Provide Planned Events Store Interface

1.3.2.5 Provide Current Incidents Store Interface

1.3.4.2 Provide Traffic Operations Personnel Incident Data Interface

1.3.4.3 Provide Media Incident Data Interface

TMC Incident Dispatch Coordination/Communication
This Equipment package provides the capability for an incident response formulation function minimizing the incident potential, incident impacts, and/or resources required for incident management including proposing and facilitating the dispatch of emergency response and service vehicles as well as coordinating response with all appropriate cooperating agencies.

Process Specifications
1.1.5 Exchange data with Other Traffic Centers

1.2.4.1 Output Control Data for Roads

1.2.4.2 Output Control Data for Freeways

1.3.2.3 Review and Classify Planned Events

1.3.3 Respond to Current Incidents

1.3.4.1 Retrieve Incident Data

1.3.4.2 Provide Traffic Operations Personnel Incident Data Interface

1.3.4.4 Update Incident Display Map Data

1.3.4.5 Manage Resources for Incidents
1.3.5 Manage Possible Predetermined Responses Store

1.3.6 Manage Predetermined Incident Response Data

1.3.7 Analyze Incident Response Log

TMC Input to In-Vehicle Signing
This Equipment package shall provide the capability to allow traffic managers input to operation and maintenance of the roadway vehicle signing devices.

Process Specifications
1.2.4.3 Output In-vehicle Signage Data

TMC Multimodal Coordination
This Equipment package provides traffic signal priority for transit vehicles. Two options are provided including a wide-area option based on center to center communications between the Traffic Management and Transit Managemetn Subsystems and a localized option based on direct communications between the transit vehicle and the individual intersection.

Process Specifications
1.2.2.1 Determine Indicator State for Freeway Management

1.2.2.2 Determine Indicator State for Road Management

1.2.3 Determine Ramp State

1.4.2 Collect Demand Forecast Data

TMC Multimodal Crossing Management
This equipment package monitors and manages multimodal crossings and disseminates associated traveler information. Equipment controlled includes warning lights, gates, dynamic message signs, and other systems that provide driver information and control traffic at multimodal crossings. This equipment package manages draw bridges and miscellaneous other interference crossings between highway traffic and other modes. Railroad grade crossings are covered by the HRI Traffic Management equipment package.

Process Specifications
1.1.2.2 Process Traffic Data

1.1.4.1 Retrieve Traffic Data

1.2.4.1 Output Control Data for Roads
1.2.4.2 Output Control Data for Freeways

1.2.4.4 Output Roadway Information Data

1.3.2.2 Review and Classify Possible Incidents

TMC Probe Information Collection
This Equipment package provides the capability to accept and process probe vehicle information. This capability shall be provided through the use of additional hardware and probe vehicle control and tracking software.

Process Specifications
1.1.2.5 Process Probe Data

1.1.4.1 Retrieve Traffic Data

TMC Regional Traffic Control
This Equipment package provides capabilities in addition to those provided by the TMC Basic Signal Control Equipment package for analyzing, controlling, and optimizing area-wide traffic flow. These capabilities provide for wide area optimization integrating control of a network signal system with control of freeway, considering current demand as well as expected demand with a goal of providing the capability for real-time traffic adaptive control while balancing inter-jurisdictional control issues to achieve regional solutions. These capabilities are best provided using a Traffic Management Center (TMC) to monitor and manage freeway ramp meters and intersection traffic signals and software to process traffic information and implement traffic management measures (e.g., ramp metering, signalization, and traffic coordination between both local and regional jurisdiction). The TMC shall be able to communicate with other TMCs in order to receive and transmit traffic information on other jurisdictions within the region.

Process Specifications
1.1.4.2 Provide Traffic Operations Personnel Traffic Data Interface

1.1.5 Exchange data with Other Traffic Centers

1.2.4.1 Output Control Data for Roads

1.2.4.2 Output Control Data for Freeways

TMC Reversible Lane Management
This Equipment package provides the capability for access and management of reversible lane facilities, including the direction of traffic flow changes during the day, especially between the peak hours and dedication of more lanes to the congestion direction during special events.

Process Specifications
1.1.2.7 Monitor Reversible Lanes
1.2.4.2 Output Control Data for Freeways

1.3.4.2 Provide Traffic Operations Personnel Incident Data Interface

5.4.1 Process TM Detected Violations

TMC Signal Control
This Equipment package provides the capability for traffic managers to monitor and manage the traffic flow at signalized intersections. This capability includes analyzing and reducing the collected data from traffic surveillance equipment and developing and implementing control plans for signalized intersections. Control plans may be developed and implemented that coordinate signals at many intersections under the domain of a single traffic management subsystem.
In advanced implementations, this package collects route planning information and integrates and uses this information in predicting future traffic conditions and optimizing the traffic control strategy for these conditions. These capabilities are achieved through real-time communication of logged routes from an Information Service Provider. The planned control strategies can be passed back to the Information Service Provider so that the intended strategies can be reflected in future route planning.

Process Specifications
1.1.2.2 Process Traffic Data

1.1.4.2 Provide Traffic Operations Personnel Traffic Data Interface

1.2.1 Select Strategy

1.2.2.2 Determine Indicator State for Road Management

1.2.4.1 Output Control Data for Roads

TMC Speed Monitoring
This equipment package manages remote devices that monitor vehicle speeds and optionally provide safe speed advisories to the motorist. This equipment package can monitor speeds and notify an enforcement agency if excessive speeds are identified.

Process Specifications
9.3.3.3 Monitor Vehicle Speed on Roadway

TMC Toll/Parking Coordination
This Equipment package provides the transportation management center with the capability to transform and transmit network traffic congestion information to the Toll Administration or Parking Management so that dynamic pricing for demand management is possible.

Process Specifications
1.4.4 Implement Demand Management Policy

TMC Traffic Information Dissemination
This Equipment package provides the capability to disseminate incident related information to travelers, potential travelers, and private information service providers. These capabilities shall be provided using a workstation type processor within a facility connected to traveler information providers by utilizing existing wireline links.

Process Specifications
1.1.4.1 Retrieve Traffic Data

1.1.4.2 Provide Traffic Operations Personnel Traffic Data Interface

1.1.4.3 Provide Direct Media Traffic Data Interface

1.2.4.4 Output Roadway Information Data

1.3.4.3 Provide Media Incident Data Interface

TMC Traffic Network Performance Evaluation
This Equipment package provides the capability to predict travel demand patterns to support traffic flow

optimization, demand management, and incident management. This Equipment package requires the data collected by surveillance Equipment packages as well as input from other management subsystems including the ISP Subsystem, Transit Management Subsystem.

Process Specifications

1.1.2.1 Process Traffic Data for Storage

1.1.2.2 Process Traffic Data

1.1.3 Generate Predictive Traffic Model

1.1.5 Exchange data with Other Traffic Centers

1.2.6.1 Maintain Traffic and Sensor Static Data

1.2.6.2 Provide Static Data Store Output Interface

1.4.1 Provide Traffic Operations Personnel Demand Interface
1.4.2 Collect Demand Forecast Data

1.4.3 Update Demand Display Map Data

1.4.4 Implement Demand Management Policy

1.4.5 Calculate Forecast Demand

TMC Work Zone Traffic Management
This equipment package supports coordination with maintenance systems so that work zones are established that have minimum traffic impact. Traffic control strategies are implemented to further mitigate traffic impacts associated with work zones that are established.

Process Specifications

1.2.4.4 Output Roadway Information Data

1.3.1.1 Analyze Traffic Data for Incidents

1.3.2.1 Store Possible Incident Data

1.3.2.2 Review and Classify Possible Incidents

Traffic Data Collection
This equipment package collects and stores traffic information that is collected in the course of traffic operations

performed by the Traffic Management Subsystem. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.

Process Specifications
1.1.4.7 Manage Traffic Archive Data

Traffic Maintenance
This Equipment package provides monitoring and remote diagnostics of field equipment to detect field equipment failures, issues problem reports, and tracks the repair or replacement of the failed equipment.

Process Specifications
1.1.1.2 Collect and Process Sensor Fault Data

1.2.8.1 Collect Indicator Fault Data

1.2.8.2 Maintain Indicator Fault Data Store
1.2.8.3 Provide Device Fault Interface for M and C

1.2.8.4 Provide Traffic Operations Personnel Indicator Fault Interface

2.21.2 Subsystem Interfaces for TMS

Archived Data Management -> Traffic Management Subsystem

Physical Architecture Flow Name: archive requests

A request to a data source for information on available data (i.e. "catalog") or a request that defines the data to be archived. The request can be a general subscription intended to initiate a continuous or regular data stream or a specific request intended to initiate a one-time response from the recipient.

Logical Architecture Reference Flow(s):
traffic_management_archive_request

Physical Architecture Flow Name: archive status

Notification that data provided to an archive contains erroneous, missing, or suspicious data or verification that the data provided appears valid. If an error has been detected, the offending data and the nature of the potential problem are identified.

Logical Architecture Reference Flow(s):
traffic_management_archive_status

DMV -> Traffic Management

Physical Architecture Flow Name: registration

Registered owner of vehicle and associated vehicle information.

Logical Architecture Reference Flow(s):
fdmv_traffic_violation_vehicle_registration
fdmv_traffic_violation_state_identity

Emergency Management -> Traffic Management

Physical Architecture Flow Name: emergency traffic control request

Special request to preempt the current traffic control strategy in effect at one or more signalized intersections or highway segments. For example, this flow can request all signals to red-flash, request a progression of traffic control preemptions along an emergency vehicle route, or request another special traffic control plan.

Logical Architecture Reference Flow(s):
emergency_traffic_control_request

Physical Architecture Flow Name: incident information

Notification of existence of incident and expected severity, location, time and nature of incident.

Logical Architecture Reference Flow(s):
incident_details

Physical Architecture Flow Name: incident response status

Status of the current incident response including traffic management strategies implemented at the site (e.g., closures, diversions, traffic signal control overrides).

Logical Architecture Reference Flow(s):
incident_response_status

Physical Architecture Flow Name: remote surveillance control

The control commands used to remotely operate another center's sensors or surveillance equipment so that roadside surveillance assets can be shared by more than one agency.

Logical Architecture Reference Flow(s):
remote_video_image_control

Physical Architecture Flow Name: resource request

A request for traffic management resources to implement special traffic control measures, assist in clean up, verify an incident, etc.

Logical Architecture Reference Flow(s):
resource_request

Physical Architecture Flow Name: road network probe information

Aggregated route usage, travel times, environmental conditions, and other aggregated data collected from probe vehicles.

Logical Architecture Reference Flow(s):
traffic_probe_info_from_evs_for_traffic

Emissions Management -> Traffic Management

Physical Architecture Flow Name: widearea statistical pollution information

Aggregated region-wide measured emissions data and possible pollution incident information.

Logical Architecture Reference Flow(s):
pollution_incident

pollution_state_data
wide_area_pollution_data

Event Promoters -> Traffic Management

Physical Architecture Flow Name: event plans

Plans for major events possibly impacting traffic.

Logical Architecture Reference Flow(s):
fevp_event_information

Information Service Provider -> Traffic Management

Physical Architecture Flow Name: fare and price information

Current transit, parking, and toll fee schedule information.

Logical Architecture Reference Flow(s):
parking_lot_charge_details
toll_price_details
transit_fare_details

Physical Architecture Flow Name: logged special vehicle route

Anticipated route information for special vehicles (e.g., oversize vehicles) or groups of vehicles (e.g., governor's motorcade) that may require changes in traffic control strategy.

Logical Architecture Reference Flow(s):
special_vehicle_priority_routing
logged_special_vehicle_route

Physical Architecture Flow Name: request for road network conditions

Request for traffic information, road conditions, surface weather conditions, incident information, and other road network status. The request specifies the region/route of interest, the desired effective time period, and other parameters that allow preparation of a tailored response. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.

Logical Architecture Reference Flow(s):
traffic_data_distribution_request

Physical Architecture Flow Name: road network probe information

Aggregated route usage, travel times, environmental conditions, and other aggregated data collected from probe vehicles.

Logical Architecture Reference Flow(s):
current_other_routes_use
current_transit_routes_use
current_road_network_use

Maintenance and Construction Management -> Traffic Management

Physical Architecture Flow Name: current asset restrictions

Restrictions levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.

Logical Architecture Reference Flow(s):
asset_restrictions_for_traffic

Physical Architecture Flow Name: equipment maintenance status

Current status of field equipment maintenance actions.

Logical Architecture Reference Flow(s):
field_equip_maint_status

Physical Architecture Flow Name: incident information

Notification of existence of incident and expected severity, location, time and nature of incident.

Logical Architecture Reference Flow(s):
incident_info_for_traffic

Physical Architecture Flow Name: maint and constr resource response

Current status of maintenance and construction resources including availability and deployment status.

Logical Architecture Reference Flow(s):
m_and_c_resource_response_to_traffic

Physical Architecture Flow Name: maint and constr work plans

Future construction and maintenance work schedules and activities including anticipated closures with anticipated impact to the roadway, alternate routes, anticipated delays, closure times, and durations.

Logical Architecture Reference Flow(s):
m_and_c_work_plans_for_traffic

Physical Architecture Flow Name: road weather information

Road conditions and weather information that are made available by road maintenance operations to other transportation system operators.

Logical Architecture Reference Flow(s):
road_weather_info_for_traffic

Physical Architecture Flow Name: roadway maintenance status

Summary of maintenance fleet operations affecting the road network. This includes the status of winter maintenance (snow plow schedule and current status).

Logical Architecture Reference Flow(s):
roadway_maint_status_for_traffic

Physical Architecture Flow Name: work zone information

Summary of maintenance and construction work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

Logical Architecture Reference Flow(s):
work_zone_images_for_traffic
work_zone_info_for_traffic

Map Update Provider -> Traffic Management

Physical Architecture Flow Name: map updates

Map update which could include a new underlying static or real-time map or map layer(s) update.

Logical Architecture Reference Flow(s):

fmup_demand_display_update
fmup_incident_display_update
fmup_traffic_display_update

Media -> Traffic Management

Physical Architecture Flow Name: external reports

Traffic and incident information that is collected by the media through a variety of mechanisms (e.g., radio station call-in programs, air surveillance).

Logical Architecture Reference Flow(s):

fm_incident_information

Physical Architecture Flow Name: media information request

Request from the media for current transportation information.

Logical Architecture Reference Flow(s):

fm_traffic_data_request
fm_incident_data_request

Multimodal Crossings -> Traffic Management

Physical Architecture Flow Name: multimodal crossing status

Indication of operational status and pending requests for right-of-way from equipment supporting the non-highway mode at multimodal crossings.

Logical Architecture Reference Flow(s):

fmmc_crossing_closure_schedule

Other TM -> Traffic Management

Physical Architecture Flow Name: traffic control coordination

Information transfers that enable remote monitoring and control of traffic management devices. This flow is intended to allow cooperative access to, and control of, field equipment during incidents and special events and during day-to-day operations. This flow also allows 24-hour centers to monitor and control assets of other centers during off-hours, allows system redundancies and fail-over capabilities to be established, and otherwise enables integrated traffic control strategies in a region.

Logical Architecture Reference Flow(s):

fotc_traffic_control_and_status
fotc_identity

Physical Architecture Flow Name: traffic information coordination

Traffic information exchanged between TMC's. Normally would include incidents, congestion data, traffic data, signal timing plans, and real-time signal control information.

Logical Architecture Reference Flow(s):

fotc_transfer_data
fotc_identity

fotc_data_request

Parking Management -> Traffic Management

Physical Architecture Flow Name: parking availability

Current parking lot occupancy, parking availability, and cost information.

Logical Architecture Reference Flow(s):

parking_lot_current_state
parking_guidance_for_dms

Physical Architecture Flow Name: parking demand management response

Response to parking demand management change requests indicating level of compliance with request.

Logical Architecture Reference Flow(s):

parking_lot_charge_change_response
parking_lot_charge_direct_details

Rail Operations -> Traffic Management

Physical Architecture Flow Name: railroad advisories

Real-time notification of railway-related incident or advisory.

Logical Architecture Reference Flow(s):

fro_incident_notification

Physical Architecture Flow Name: railroad schedules

Train schedules, maintenance schedules, and other information from the railroad that supports forecast of HRI closures.

Logical Architecture Reference Flow(s):

fro_maintenance_schedules
fro_train_schedules

Roadway Subsystem -> Traffic Management

Physical Architecture Flow Name: AHS status

Status of AHS equipment, lane controls etc.

Logical Architecture Reference Flow(s):

ahs_checking_details

Physical Architecture Flow Name: emissions data

Emissions data and associated imagery collected by roadside equipment.

Logical Architecture Reference Flow(s):

vehicle_pollution_message
vehicle_pollution_alert

Physical Architecture Flow Name: environmental conditions data

Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) as measured and reported by environmental sensors.

Logical Architecture Reference Flow(s):
environmental_sensor_status
environment_sensor_data

Physical Architecture Flow Name: environmental probe data

Current environmental conditions (e.g., air temperature, wind speed, surface temperature) as measured by vehicle-based environmental sensors. In addition to environmental sensor inputs, this flow may also include vehicle control system information that may indicate adverse road surface conditions (e.g., traction control system activations).

Logical Architecture Reference Flow(s):
vehicle_smart_probe_data_for_storage
smart_probe_reader_status

Physical Architecture Flow Name: freeway control status

Current operational status and operating parameters for ramp meters, mainline metering/lane controls and other control equipment associated with freeway operations.

Logical Architecture Reference Flow(s):
indicator_input_data_from_highways

Physical Architecture Flow Name: hov data

Current HOV lane information including both standard traffic flow measures and information regarding vehicle occupancy in HOV lanes.

Logical Architecture Reference Flow(s):
hov_lane_data_input
hov_sensor_data

Physical Architecture Flow Name: hri status

Status of the highway-rail intersection equipment including both the current state or mode of operation and the current equipment condition.

Logical Architecture Reference Flow(s):
rail_operations_message
hri_status
hri_guidance_for_dms
hri_guidance_for_beacon_message
traffic_management_request
hri_traffic_data

Physical Architecture Flow Name: intersection blockage notification

Notification that a highway-rail intersection is obstructed and supporting information.

Logical Architecture Reference Flow(s):
hri_blockage
intersection_blocked

Physical Architecture Flow Name: request for right-of-way

Forwarded request from signal prioritization, signal preemption, pedestrian call, multi-modal crossing activation, or other source for right-of-way.

Logical Architecture Reference Flow(s):
pedestrian_sensor_data
indicator_input_data_from_roads
multimodal_crossing_sensor_data
signal_override_status

Physical Architecture Flow Name: reversible lane status

Current reversible lane status including traffic sensor and surveillance data and the operational status and mode of the reversible lane control equipment.

Logical Architecture Reference Flow(s):

sensor_data_for_reversible_lanes
reversible_lane_video_images

Physical Architecture Flow Name: roadway information system status

Current operating status of dynamic message signs, highway advisory radios, beacon systems, or other configurable field equipment that provides dynamic information to the driver.

Logical Architecture Reference Flow(s):

dms_status
har_status
vehicle_sign_data_status

Physical Architecture Flow Name: signal control status

Status of surface street signal controls.

Logical Architecture Reference Flow(s):

indicator_input_data_from_roads
traffic_control_device_status

Physical Architecture Flow Name: speed monitoring information

System status including current operational state and logged information including measured speeds, warning messages displayed, and violation records.

Logical Architecture Reference Flow(s):

speed_sensor_log_for_traffic
speed_violation_notification_for_traffic
speed_sensor_status_for_traffic
speed_data_for_traffic_speed_monitoring

Physical Architecture Flow Name: traffic flow

Raw and/or processed traffic detector data which allows derivation of traffic flow variables (e.g., speed, volume, and density measures) and associated information (e.g., congestion, potential incidents).

Logical Architecture Reference Flow(s):

traffic_sensor_status
incident_analysis_data
traffic_sensor_fault_data
traffic_image_data
traffic_sensor_data

Physical Architecture Flow Name: traffic images

High fidelity, real-time traffic images suitable for surveillance monitoring by the operator or for use in machine vision applications. This flow includes the images and the operational status of the surveillance system.

Logical Architecture Reference Flow(s):

traffic_video_image_for_display
incident_video_image
video_device_status
traffic_video_image

Physical Architecture Flow Name: vehicle probe data

Vehicle probe data indicating identity, route segment identity, link time and location.

Logical Architecture Reference Flow(s):
vehicle_tag_data

Surface Transportation Weather Service -> Traffic Management

Physical Architecture Flow Name: environmental conditions data

Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) as measured and reported by environmental sensors.

Logical Architecture Reference Flow(s):
fstws_env_sensor_data_for_traffic
fstws_surface_trans_weather_observations

Physical Architecture Flow Name: transportation weather information

Current and forecast road conditions and weather information (e.g., surface condition, flooding, wind advisories, visibility, etc.) associated with the transportation network. This information is of a resolution, timeliness, and accuracy to be useful in transportation decision making.

Logical Architecture Reference Flow(s):
fstws_surface_trans_weather_forecasts

Toll Administration -> Traffic Management

Physical Architecture Flow Name: probe data

Aggregate data from probe vehicles including location, speed for a given link or collection of links.

Logical Architecture Reference Flow(s):
probe_data_for_traffic

Physical Architecture Flow Name: toll demand management response

Response to toll demand management change requests indicating level of compliance with request.

Logical Architecture Reference Flow(s):
toll_price_direct_details
toll_price_changes_response

Traffic Management -> Archived Data Management Subsystem

Physical Architecture Flow Name: traffic archive data

Information describing the use and vehicle composition on transportation facilities and the traffic control strategies employed. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.

Logical Architecture Reference Flow(s):
traffic_management_archive_data

Traffic Management -> DMV

Physical Architecture Flow Name: license request

Request supporting registration data based on license plate read during violation.

Logical Architecture Reference Flow(s):

tdmv_traffic_violation_vehicle_license
tdmv_traffic_violation_identity_code

Traffic Management -> Emergency Management

Physical Architecture Flow Name: emergency traffic control response

Status of the special traffic signal control strategy implemented in response to the emergency traffic control request.

Logical Architecture Reference Flow(s):

emergency_traffic_control_response

Physical Architecture Flow Name: incident information

Notification of existence of incident and expected severity, location, time and nature of incident.

Logical Architecture Reference Flow(s):

wrong_way_vehicle_detection
incident_alert
incident_response_clear

Physical Architecture Flow Name: incident information request

Request for incident information, clearing time, severity. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.

Logical Architecture Reference Flow(s):

incident_details_request

Physical Architecture Flow Name: resource deployment status

Status of traffic management center resource deployment identifying the resources available and their current deployment status.

Logical Architecture Reference Flow(s):

resource_deployment_status

Physical Architecture Flow Name: road network conditions

Current and forecasted traffic information, road and weather conditions, incident information, and other road network status. Either raw data, processed data, or some combination of both may be provided by this architecture flow.

Logical Architecture Reference Flow(s):

incident_video_for_emergency_services
traffic_data_for_emergency_services

Traffic Management -> Emissions Management

Physical Architecture Flow Name: pollution state data request

Aggregated emissions data information request.

Logical Architecture Reference Flow(s):

pollution_state_data_request

Traffic Management -> **Enforcement Agency**

Physical Architecture Flow Name: request for enforcement

Request for traffic enforcement to address safety issues in a work zone or other special situations.

Logical Architecture Reference Flow(s):

tea_enforcement_request_from_traffic

Physical Architecture Flow Name: traffic violation notification

Notification to enforcement agency of a detected traffic violation including speed violations, HOV passenger occupancy violations, and vehicle emissions violations.

Logical Architecture Reference Flow(s):

tea_traffic_violation_data

Traffic Management -> **Event Promoters**

Physical Architecture Flow Name: event confirmation

Confirmation that special event details have been received and processed.

Logical Architecture Reference Flow(s):

tevp_event_confirmation

Traffic Management -> **Information Service Provider**

Physical Architecture Flow Name: request fare and price information

Requests for current fare and price information from a service provider that can be used to augment the traffic manager's overall view of current transportation network status.

Logical Architecture Reference Flow(s):

toll_price_request
transit_fare_request
parking_lot_charge_request

Physical Architecture Flow Name: road network conditions

Current and forecasted traffic information, road and weather conditions, incident information, and other road network status. Either raw data, processed data, or some combination of both may be provided by this architecture flow.

Logical Architecture Reference Flow(s):

current_road_network_state
sensor_data_for_distribution
traffic_data_for_distribution
planned_events
link_data_for_guidance
prediction_data
current_highway_network_state

Traffic Management -> **Maintenance and Construction Management**

Physical Architecture Flow Name: field equipment status

Identification of field equipment requiring repair and known information about the associated faults.

Logical Architecture Reference Flow(s):
field_equipment_status_from_traffic

Physical Architecture Flow Name: incident information

Notification of existence of incident and expected severity, location, time and nature of incident.

Logical Architecture Reference Flow(s):
incident_info_from_traffic

Physical Architecture Flow Name: maint and constr resource request

Request for road maintenance and construction resources that can be used in the diversion of traffic (cones, portable signs), clearance of a road hazard, repair of ancillary damage, or any other incident response.

Logical Architecture Reference Flow(s):
roadway_maint_action_req_from_traffic
m_and_c_resource_request_from_traffic
winter_maint_action_req_from_traffic

Physical Architecture Flow Name: road network conditions

Current and forecasted traffic information, road and weather conditions, incident information, and other road network status. Either raw data, processed data, or some combination of both may be provided by this architecture flow.

Logical Architecture Reference Flow(s):
road_network_info_from_traffic
environmental_sensor_data_from_traffic_management

Physical Architecture Flow Name: work plan feedback

Comments and suggested changes to proposed construction and maintenance work schedules and activities. This information influences work plan schedules so that they minimize impact to other system operations and the overall transportation system.

Logical Architecture Reference Flow(s):
m_and_c_plan_feedback_from_traffic

Traffic Management -> Map Update Provider

Physical Architecture Flow Name: map update request

Request for a map update which could include a new underlying map or map layer updates.

Logical Architecture Reference Flow(s):
tmup_request_traffic_display_update
tmup_map_static_data
tmup_request_incident_display_update
tmup_request_demand_display_update

Traffic Management -> Media

Physical Architecture Flow Name: road network conditions

Current and forecasted traffic information, road and weather conditions, incident information, and other road network status. Either raw data, processed data, or some combination of both may be provided by this architecture flow.

Logical Architecture Reference Flow(s):
tm_traffic_data

tm_incident_data

Traffic Management -> Other TM

Physical Architecture Flow Name: traffic control coordination

Information transfers that enable remote monitoring and control of traffic management devices. This flow is intended to allow cooperative access to, and control of, field equipment during incidents and special events and during day-to-day operations. This flow also allows 24-hour centers to monitor and control assets of other centers during off-hours, allows system redundancies and fail-over capabilities to be established, and otherwise enables integrated traffic control strategies in a region.

Logical Architecture Reference Flow(s):

totc_traffic_control_and_status
totc_identity

Physical Architecture Flow Name: traffic information coordination

Traffic information exchanged between TMC's. Normally would include incidents, congestion data, traffic data, signal timing plans, and real-time signal control information.

Logical Architecture Reference Flow(s):

totc_data_request
totc_identity
totc_transfer_data

Traffic Management -> Parking Management

Physical Architecture Flow Name: parking demand management request

Request to change the demand for parking facility use through pricing or other mechanisms.

Logical Architecture Reference Flow(s):

parking_lot_charge_direct_request
parking_lot_charge_change_request

Physical Architecture Flow Name: parking instructions

Information that allows local parking facilities to be managed to support regional traffic management objectives.

Logical Architecture Reference Flow(s):

selected_parking_lot_control_strategy
static_data_for_parking_lots
parking_lot_input_data

Traffic Management -> Rail Operations

Physical Architecture Flow Name: hri advisories

Notification of Highway-Rail Intersection equipment failure, intersection blockage, or other condition requiring attention, and maintenance activities at or near highway rail intersections.

Logical Architecture Reference Flow(s):

tro_incident_notification
tro_event_schedules
tro_equipment_status

Traffic Management -> Roadway Subsystem

Physical Architecture Flow Name: AHS control information

Control data to AHS roadway equipment.

Logical Architecture Reference Flow(s):

ahs_control_data_changes
automated_lane_changing_control_data

Physical Architecture Flow Name: environmental sensors control

Data used to configure and control environmental sensors.

Logical Architecture Reference Flow(s):

environment_sensor_configuration_data

Physical Architecture Flow Name: freeway control data

Control commands and operating parameters for ramp meters, mainline metering/lane controls and other systems associated with freeway operations.

Logical Architecture Reference Flow(s):

indicator_control_data_for_highways
indicator_control_monitoring_data_for_highways

Physical Architecture Flow Name: hri control data

Data required for HRI information transmitted at railroad grade crossings and within railroad operations.

Logical Architecture Reference Flow(s):

rail_operations_advisories
indicator_sign_control_data_for_hri
hri_traffic_surveillance
rail_operations_device_command

Physical Architecture Flow Name: hri request

A request for highway-rail intersection status or a specific control request intended to modify HRI operation.

Logical Architecture Reference Flow(s):

tms_requests
ro_requests

Physical Architecture Flow Name: roadway information system data

Information used to initialize, configure, and control roadside systems that provide driver information (e.g., dynamic message signs, highway advisory radio, beacon systems). This flow can provide message content and delivery attributes, local message store maintenance requests, control mode commands, status queries, and all other commands and associated parameters that support remote management of these systems.

Logical Architecture Reference Flow(s):

dms_data
vehicle_sign_data
har_data

Physical Architecture Flow Name: signal control data

Information used to configure and control traffic signal systems.

Logical Architecture Reference Flow(s):

indicator_control_monitoring_data_for_roads

indicator_control_data_for_roads

Physical Architecture Flow Name: speed monitoring control

Information used to configure and control automated speed monitoring, speed warning, and speed enforcement systems.

Logical Architecture Reference Flow(s):

speed_sensor_control_from_traffic

Physical Architecture Flow Name: traffic sensor control

Information used to configure and control traffic sensor systems.

Logical Architecture Reference Flow(s):

sensor_configuration_data

Physical Architecture Flow Name: video surveillance control

Information used to configure and control video surveillance systems.

Logical Architecture Reference Flow(s):

incident_video_image_control

Traffic Management -> Surface Transportation Weather Service

Physical Architecture Flow Name: environmental conditions data

Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) as measured and reported by environmental sensors.

Logical Architecture Reference Flow(s):

tstws_env_sensor_data_from_traffic

Physical Architecture Flow Name: transportation weather information request

A request for transportation weather information that may specify the area of interest (a geographic region, particular routes within a region, specific road segments), the type of information that is required, the desired spatial resolution of the information, and time horizon.

Logical Architecture Reference Flow(s):

tstws_trans_weather_info_request

Traffic Management -> Toll Administration

Physical Architecture Flow Name: toll demand management request

Request to change the demand for toll road facility use through pricing or other mechanisms.

Logical Architecture Reference Flow(s):

toll_price_changes_request
toll_price_direct_request

Traffic Management -> Traffic Operations Personnel

Physical Architecture Flow Name: traffic operator data

Presentation of traffic operations data to the operator including traffic conditions, current operating status of traffic control equipment, maintenance activity status, incident status, and other information. This data keeps the operator appraised of current road network status, provides feedback to the operator as traffic control actions are implemented, and supports review of

historical data and preparation for future traffic operations activities.

Logical Architecture Reference Flow(s):

ttop_resource_response
ttop_demand_policy_activation_result
ttop_demand_forecast_data
ttop_weather_information
ttop_current_sensor_faults
ttop_archive_status
ttop_wrong_way_detection
ttop_demand_forecast_result
ttop_undefined_response_details
ttop_incident_information_display
ttop_incident_video_image_output
ttop_possible_defined_response_output
ttop_demand_policy_information
ttop_demand_data
ttop_traffic_control_information_display
ttop_video_image_output
ttop_defined_incident_responses_data
ttop_current_indicator_faults
ttop_possible_incidents_data

Traffic Management -> Transit Management

Physical Architecture Flow Name: request transit information

Request for transit service information and current transit status.

Logical Architecture Reference Flow(s):

transit_conditions_demand_request
transit_fare_direct_request
transit_services_demand_request

Physical Architecture Flow Name: road network conditions

Current and forecasted traffic information, road and weather conditions, incident information, and other road network status. Either raw data, processed data, or some combination of both may be provided by this architecture flow.

Logical Architecture Reference Flow(s):

planned_events
prediction_data
traffic_data_for_transit

Physical Architecture Flow Name: traffic control priority status

Status of signal priority request functions at the roadside (e.g. enabled or disabled).

Logical Architecture Reference Flow(s):

transit_ramp_priority_given
transit_road_priority_given
transit_highway_priority_given

Physical Architecture Flow Name: transit demand management request

Request to change the demand for transit facility use through pricing or other mechanisms.

Logical Architecture Reference Flow(s):

transit_services_changes_request

Traffic Management -> Weather Service

Physical Architecture Flow Name: environmental conditions data

Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) as measured and reported by environmental sensors.

Logical Architecture Reference Flow(s):

tws_env_sensor_data_from_traffic

Traffic Operations Personnel -> Traffic Management

Physical Architecture Flow Name: traffic operator inputs

Traffic operations requests for information, configuration changes, commands to adjust current traffic control strategies (e.g., adjust signal timing plans, change DMS messages), and other traffic operations data entry.

Logical Architecture Reference Flow(s):

ftop_incident_information_requests
ftop_traffic_information_requests
ftop_strategy_override
ftop_request_possible_incidents_data
ftop_static_data
ftop_sensor_fault_data_input
ftop_roadway_characteristics
ftop_resource_request
ftop_output_possible_defined_responses
ftop_update_defined_incident_responses
ftop_archive_command
ftop_indicator_fault_data_request
ftop_defined_incident_response_data_request
ftop_indicator_fault_data_update
ftop_defined_incident_response_data_update
ftop_incident_camera_action_request
ftop_demand_policy_updates
ftop_demand_policy_information_request
ftop_weather_request_information
ftop_incident_data_amendment
ftop_video_camera_strategy_change
ftop_traffic_data_parameter_updates
ftop_demand_policy_activation
ftop_demand_forecast_request
ftop_demand_data_update_request
ftop_demand_data_request
ftop_indicator_fault_data_input

Transit Management -> Traffic Management

Physical Architecture Flow Name: request for road network conditions

Request for traffic information, road conditions, surface weather conditions, incident information, and other road network status. The request specifies the region/route of interest, the desired effective time period, and other parameters that allow preparation of a tailored response. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.

Logical Architecture Reference Flow(s):
transit_request_for_traffic_info
transit_request_for_prediction_data

Physical Architecture Flow Name: road network probe information

Aggregated route usage, travel times, environmental conditions, and other aggregated data collected from probe vehicles.

Logical Architecture Reference Flow(s):
transit_probe_data

Physical Architecture Flow Name: traffic control priority request

Request for signal priority at one or more intersections along a particular route.

Logical Architecture Reference Flow(s):
transit_highway_overall_priority
transit_road_overall_priority
transit_ramp_overall_priority

Physical Architecture Flow Name: transit demand management response

Response to transit demand management change requests indicating level of compliance with request.

Logical Architecture Reference Flow(s):
transit_services_changes_response

Physical Architecture Flow Name: transit system data

Current transit system operations information indicating current transit routes, the level of service on each route, and the progress of individual vehicles along their routes for use in forecasting demand and estimating current transportation network performance.

Logical Architecture Reference Flow(s):
transit_running_data_for_demand
transit_services_for_demand
transit_fare_direct_details

Weather Service -> Traffic Management

Physical Architecture Flow Name: environmental conditions data

Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) as measured and reported by environmental sensors.

Logical Architecture Reference Flow(s):
fws_env_sensor_data_for_traffic

Physical Architecture Flow Name: weather information

Accumulated forecasted and current weather data (e.g., temperature, pressure, wind speed, wind direction, humidity, precipitation, visibility, light conditions, etc.).

Logical Architecture Reference Flow(s):
fws_current_weather_observations
fws_weather_forecasts

2.21.3 Architecture Flow Diagrams for TMS

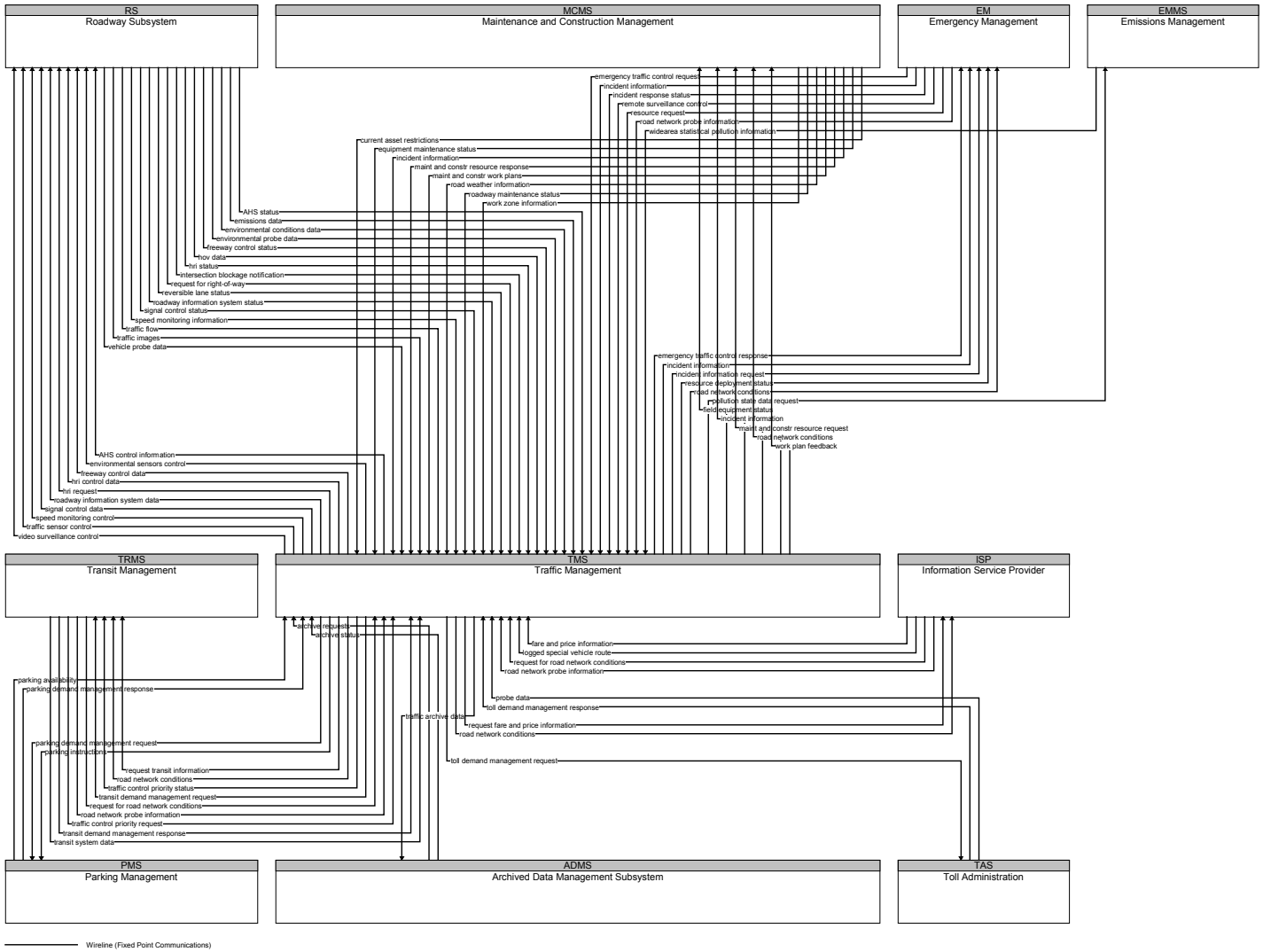


Figure 2-39 Subsystem Architecture Flow Diagram for TMS

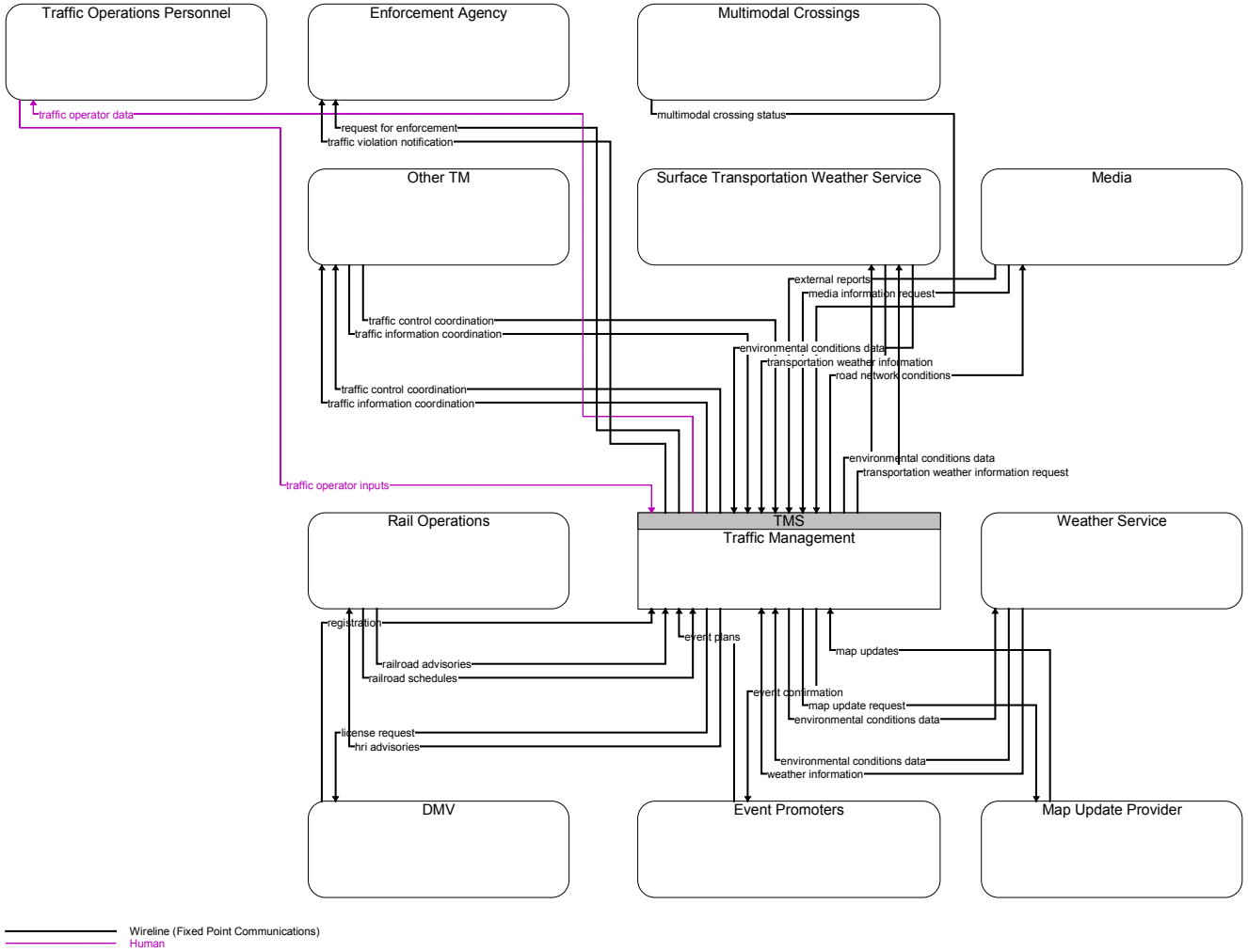


Figure 2-40 Terminator Architecture Flow Diagram for TMS

2.22 Transit Management

The transit management subsystem manages transit vehicle fleets and coordinates with other modes and transportation services. It provides operations, maintenance, customer information, planning and management functions for the transit property. It spans distinct central dispatch and garage management systems and supports the spectrum of fixed route, flexible route, paratransit services, and bus rapid transit (BRT) service. The subsystem's interfaces allow for communication between transit departments and with other operating entities such as emergency response services and traffic management systems. This subsystem receives special event and real-time incident data from the traffic management subsystem. It provides current transit operations data to other center subsystems. The Transit Management Subsystem collects and stores accurate ridership levels and implements corresponding fare structures. It collects operational and maintenance data from transit vehicles, manages vehicle service histories, and assigns drivers and maintenance personnel to vehicles and routes. The Transit Management Subsystem also provides the capability for automated planning and scheduling of public transit operations. It furnishes travelers with real-time travel information, continuously updated schedules, schedule adherence information, transfer options, and transit routes and fares. In addition, the monitoring of key transit locations with both video and audio systems is provided with automatic alerting of operators and police of potential incidents including support for traveler activated alarms.

2.22.1 Subsystem Equipment Packages and Supporting Process Specifications for TRMS

Transit Center Fare and Load Management
This Equipment package provides the capability to accept collected data required to determine accurate ridership levels and implement variable and flexible fare structures. Support shall be provided for the traveler for use of a fare medium for all applicable surface transportation services, to pay without stopping, have payment media automatically identified as void and/or invalid and eligibility verified, and allow for third party payment. In addition, capability to provide expansion into other uses for payment medium such as retail and telephone and for off-line billing for fares paid by agencies shall be supported. This Equipment package also supports the capability for two-way voice communication between the transit vehicle driver and a facility, two-way data communication between the transit vehicles and a facility, sensor data to be transmitted from the transit vehicles to a facility, and data transmission from individual facilities to a central facility for processing/analysis if desired. These capabilities shall be provided through a workstation type processor with GUI, high capacity storage, ride share software housed in a building with dialup lines and wireline telephone and require integration with an existing Transit Center Tracking and Dispatch Equipment package.

Process Specifications

4.6.8 **Manage Transit Vehicle Advanced Payments**

5.4.4 **Process Fare Payment Violations**

5.4.5 **Process Vehicle Fare Collection Violations**

5.4.7 **Process Roadside Fare Collection Violations**

7.3.1.1 **Register for Advanced Transit Fare Payment**

7.3.1.2 **Determine Advanced Transit Fares**

7.3.1.3 **Manage Transit Fare Financial Processing**

7.3.1.4 Check for Advanced Transit Fare Payment

7.3.1.5 Bill Transit User for Transit Fare

7.3.1.6 Collect Bad Transit Fare Payment Data

7.3.1.7 Update Transit Fare Data

7.4.1.5 Process Transit User Other Services Payments

Transit Center Fixed-Route Operations

This Equipment package enhances the planning and scheduling associated with fixed route transit services. The package allows fixed-route services to develop, print and disseminate schedules and automatically updates customer service operator systems with the most current schedule information. Current vehicle schedule adherence and optimum scenarios for schedule adjustment shall also be provided.

Process Specifications

4.1.6 Manage Transit Vehicle Operations Data

4.2.2 Provide Transit Plans Store Interface

4.2.3.1 Generate Transit Routes

4.2.3.2 Generate Transit Schedules

4.2.3.4 Provide Transit Fleet Manager Interface for Services Generation

4.2.3.5 Manage Transit Operational Data Store

4.2.3.6 Produce Transit Service Data for Manage Transit Use

Transit Center Information Services

This equipment package collects the latest available information for a transit service and makes it available to transit customers and to Information Service Providers for further distribution. Customers are provided information at transit stops and other public transportation areas before they embark and on-board the transit vehicle once they are enroute. Information provided can include the latest available information on transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events. In addition to general service information, tailored information (e.g, itineraries) are provided to individual transit users.

Process Specifications

4.1.5 Provide Transit Vehicle Status Information

4.1.6 Manage Transit Vehicle Operations Data

4.2.3.3 Produce Transit Service Data for External Use

4.6.8 Manage Transit Vehicle Advanced Payments

Transit Center Multi-Modal Coordination

This Equipment package provides the transit management subsystem the capability to determine the need for transit priority on routes and at certain intersections and request transit vehicle priority at these locations. It also supports schedule coordination between transit properties and coordinates with other surface and air transportation modes.

Process Specifications

4.1.2.4 Provide Transit Vehicle Correction Data Output Interface

4.1.4 Manage Transit Vehicle Deviations

4.1.5 Provide Transit Vehicle Status Information

4.1.7 Provide Transit Vehicle Deviation Data Output Interface

4.2.3.2 Generate Transit Schedules

4.2.3.7 Provide Interface for Other TRM Data

4.2.3.8 Provide Interface for Transit Service Raw Data

Transit Center Paratransit Operations

This Equipment package provides the capability to automate the planning and scheduling, allowing improvements in paratransit routes and services to develop, printing and disseminating schedules, and automatically updating customer service operator systems with the most current schedule. In addition, this Equipment package provides the capability to assign drivers to routes in a fair manner while minimizing labor and overtime services, including driver preferences and qualifications, and automatically tracking and validating the number of work hours performed by each individual driver. These capabilities shall be provided through the utilization of dispatch and fleet management software running on a workstation type processor.

Process Specifications

4.1.6 Manage Transit Vehicle Operations Data

4.2.1.1 Process Demand Responsive Transit Trip Request

4.2.1.2 Compute Demand Responsive Transit Vehicle Availability

4.2.1.3 Generate Demand Responsive Transit Schedule and Routes

4.2.1.4 Confirm Demand Responsive Transit Schedule and Route

Transit Center Security

This Equipment package provides the capability to monitor key transit locations and transit vehicles with both video and audio systems automatically alerting operators and police of potential incidents and supporting traveler activated

alarms. The monitoring equipment shall also include capabilities to assist in responding to terrorist incidents.

Process Specifications

4.4.1.1 Manage Transit Security

4.4.1.3 Provide Transit System Operator Security Interface

4.4.1.4 Provide Transit External Interface for Emergencies

4.4.1.6 Collect Transit Vehicle Emergency Information

4.4.2 Coordinate Multiple Agency Responses to Transit Incidents

4.4.3 Generate Responses for Transit Incidents

7.3.3 Get Transit User Image for Violation

Transit Center Tracking and Dispatch

This Equipment package provides the capabilities for monitoring transit vehicle locations and determining vehicle schedule adherence. The Equipment package shall also furnish users with real-time travel related information, continuously updated with real-time information from each transit system within the local area of jurisdiction, inclusive of all transportation modes, from all providers of transportation services, and provide users with the latest available information on transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents conditions, weather conditions, and special events. This Equipment package also supports the capability for two-way voice communication between the transit vehicle driver and a facility, two-way data communication between the transit vehicles and a facility.

Process Specifications

4.1.6 Manage Transit Vehicle Operations Data

4.2.3.9 Update Transit Map Data

Transit Data Collection

This equipment package collects and stores transit information that is collected in the course of transit operations performed by the Transit Management Subsystem. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.

Process Specifications

4.2.4 Manage Transit Archive Data

Transit Environmental Monitoring
This equipment package assimilates current and forecast road conditions and surface weather information from a variety of sources, including both weather service providers and vehicle probes. The collected environmental information is monitored and presented to the operator. This information can be used to more effectively manage transit operations.

Process Specifications
4.1.6 Manage Transit Vehicle Operations Data

Transit Garage Maintenance
This Equipment package provides advanced maintenance functions for the transit property. It collects operational and maintenance data from transit vehicles, manages vehicle service histories, and monitors drivers and vehicles. It collects vehicle mileage data and uses it to automatically generate preventative maintenance schedules for each vehicle by utilizing vehicle tracking data from a prerequisite vehicle tracking equipment package. In addition, it provides information to proper service personnel to support maintenance activities and records and verifies that maintenance work was performed. This equipment package receives special events and real-time incident data from the traffic management subsystem and assigns operators to vehicles and transit routes. Garage maintenance also receives information about incidents involving transit vehicles from the TMC in order to dispatch tow trucks and other repair vehicles.

Process Specifications
4.3.1 Monitor Transit Vehicle Condition

4.3.2 Generate Transit Vehicle Maintenance Schedules

4.3.3 Generate Technician Work Assignments

4.3.4 Monitor And Verify Maintenance Activity

4.3.5 Report Transit Vehicle Information

4.3.6 Update Transit Vehicle Information

4.3.7 Manage Transit Vehicle Operations Data Store

Transit Garage Operations
This Equipment package automates and supports the assignment of transit vehicles and drivers to enhance the daily operation of a transit service. It provides the capability to assign drivers to routes or service areas in a fair manner while minimizing labor and overtime services, considering driver preferences and qualifications, and automatically tracking and validating the number of work hours performed by each individual driver.

Process Specifications
4.5.1 Assess Transit Driver Performance

4.5.2 Assess Transit Driver Availability

4.5.3 Access Transit Driver Cost Effectiveness

4.5.4 Assess Transit Driver Eligibility

4.5.5 Generate Transit Driver Route Assignments

4.5.6 Update Transit Driver Information

4.5.7 4.5.7 Report Transit Driver Information
4.5.8 Provide Transit Driver Information Store Interface

2.22.2 Subsystem Interfaces for TRMS

Archived Data Management Subsystem -> **Transit Management**

Physical Architecture Flow Name: archive requests

A request to a data source for information on available data (i.e. "catalog") or a request that defines the data to be archived. The request can be a general subscription intended to initiate a continuous or regular data stream or a specific request intended to initiate a one-time response from the recipient.

Logical Architecture Reference Flow(s):
transit_archive_request

Physical Architecture Flow Name: archive status

Notification that data provided to an archive contains erroneous, missing, or suspicious data or verification that the data provided appears valid. If an error has been detected, the offending data and the nature of the potential problem are identified.

Logical Architecture Reference Flow(s):
transit_archive_status

Emergency Management -> **Transit Management**

Physical Architecture Flow Name: transit emergency coordination data

Data exchanged between centers dealing with a transit-related incident.

Logical Architecture Reference Flow(s):
transit_incident_coordination_data

Financial Institution -> **Transit Management**

Physical Architecture Flow Name: transaction status

Response to transaction request. Normally dealing with a request for payment.

Logical Architecture Reference Flow(s):
ffi_confirm_fare_payment
ffi_bad_fare_payment_updates
ffi_other_services_payment_confirm

Information Service Provider -> **Transit Management**

Physical Architecture Flow Name: demand responsive transit request

Request for paratransit support.

Logical Architecture Reference Flow(s):
paratransit_trip_request

Physical Architecture Flow Name: selected routes

Routes selected based on route request criteria.

Logical Architecture Reference Flow(s):
advanced_tolls_and_charges_vehicle_confirm
paratransit_service_confirmation

Physical Architecture Flow Name: transit information request

Request for transit operations information including schedule and fare information. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.

Logical Architecture Reference Flow(s):
transit_services_advisories_request
transit_services_guidance_request
advanced_traveler_fares_request
advanced_other_fares_request
transit_vehicle_deviations_details_request
transit_fare_data_request

Maintenance and Construction Management -> **Transit Management**

Physical Architecture Flow Name: current asset restrictions

Restrictions levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This includes standard facility design height, width, and weight restrictions, special restrictions such as spring weight restrictions, and temporary facility restrictions that are imposed during maintenance and construction.

Logical Architecture Reference Flow(s):
asset_restrictions_for_transit

Physical Architecture Flow Name: maint and constr work plans

Future construction and maintenance work schedules and activities including anticipated closures with anticipated impact to the roadway, alternate routes, anticipated delays, closure times, and durations.

Logical Architecture Reference Flow(s):
m_and_c_work_plans_for_transit

Physical Architecture Flow Name: road weather information

Road conditions and weather information that are made available by road maintenance operations to other transportation system operators.

Logical Architecture Reference Flow(s):
road_weather_info_for_transit

Physical Architecture Flow Name: roadway maintenance status

Summary of maintenance fleet operations affecting the road network. This includes the status of winter maintenance (snow plow schedule and current status).

Logical Architecture Reference Flow(s):
roadway_maint_status_for_transit

Physical Architecture Flow Name: work zone information

Summary of maintenance and construction work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits. This information may be augmented with images that provide a visual indication of current work zone status and traffic impacts.

Logical Architecture Reference Flow(s):
work_zone_info_for_transit

Map Update Provider -> **Transit Management**

Physical Architecture Flow Name: map updates

Map update which could include a new underlying static or real-time map or map layer(s) update.

Logical Architecture Reference Flow(s):
fmup_transit_map_update

Media -> **Transit Management**

Physical Architecture Flow Name: media information request

Request from the media for current transportation information.

Logical Architecture Reference Flow(s):
fm_transit_schedule_deviations_request
fm_transit_incident_information_request

Multimodal Transportation Service Provider -> **Transit Management**

Physical Architecture Flow Name: multimodal service data

Multimodal transportation schedules and other service information.

Logical Architecture Reference Flow(s):
fmtsp_transit_service_data

Other TRM -> **Transit Management**

Physical Architecture Flow Name: TRMS coord

Coordination information between local/regional transit organizations including schedule, on-time information, incident information, and ridership.

Logical Architecture Reference Flow(s):
fotrm_transit_services

Parking Management -> **Transit Management**

Physical Architecture Flow Name: transit parking coordination

Request for coordinated fare payment and parking lot price data.

Logical Architecture Reference Flow(s):

parking_lot_transit_request

Personal Information Access -> **Transit Management**

Physical Architecture Flow Name: transit information user request

Request for special transit routing, real-time schedule information, and availability information.

Logical Architecture Reference Flow(s):

transit_services_personal_request

Remote Traveler Support -> **Transit Management**

Physical Architecture Flow Name: emergency notification

An emergency request for assistance originated by a traveler using an in-vehicle, public access, or personal device.

Logical Architecture Reference Flow(s):

emergency_request_transit_details
transit_user_roadside_image

Physical Architecture Flow Name: secure area surveillance data

Data collected from surveillance systems used to monitor secure areas. Includes video, audio, and other security sensor outputs.

Logical Architecture Reference Flow(s):

transit_area_surveillance_information

Physical Architecture Flow Name: transit fare payment requests

Information provided from the transit user location that supports fare payments and associated record-keeping.

Logical Architecture Reference Flow(s):

fare_collection_roadside_violation_information
request_roadside_fare_payment
transit_roadside_fare_payment_confirmation
transit_roadside_passenger_data

Physical Architecture Flow Name: transit information user request

Request for special transit routing, real-time schedule information, and availability information.

Logical Architecture Reference Flow(s):

transit_services_kiosk_request
transit_services_travelers_request
other_services_roadside_request

Surface Transportation Weather Service -> **Transit Management**

Physical Architecture Flow Name: transportation weather information

Current and forecast road conditions and weather information (e.g., surface condition, flooding,

wind advisories, visibility, etc.) associated with the transportation network. This information is of a resolution, timeliness, and accuracy to be useful in transportation decision making.

Logical Architecture Reference Flow(s):

fstws_surface_trans_weather_forecasts
fstws_surface_trans_weather_observations

Traffic Management -> **Transit Management**

Physical Architecture Flow Name: request transit information

Request for transit service information and current transit status.

Logical Architecture Reference Flow(s):

transit_fare_direct_request
transit_conditions_demand_request
transit_services_demand_request

Physical Architecture Flow Name: road network conditions

Current and forecasted traffic information, road and weather conditions, incident information, and other road network status. Either raw data, processed data, or some combination of both may be provided by this architecture flow.

Logical Architecture Reference Flow(s):

traffic_data_for_transit
planned_events
prediction_data

Physical Architecture Flow Name: traffic control priority status

Status of signal priority request functions at the roadside (e.g. enabled or disabled).

Logical Architecture Reference Flow(s):

transit_ramp_priority_given
transit_road_priority_given
transit_highway_priority_given

Physical Architecture Flow Name: transit demand management request

Request to change the demand for transit facility use through pricing or other mechanisms.

Logical Architecture Reference Flow(s):

transit_services_changes_request

Transit Driver -> **Transit Management**

Physical Architecture Flow Name: transit driver availability

Transit driver availability data that can be used to develop driver assignments and detailed operations schedules.

Logical Architecture Reference Flow(s):

ftd_information_updates

Transit Fleet Manager -> **Transit Management**

Physical Architecture Flow Name: transit fleet manager inputs

Instructions governing service availability, schedules, emergency response plans, transit personnel assignments, transit maintenance requirements, and other inputs that establish general system operating requirements and procedures.

Logical Architecture Reference Flow(s):

ftfm_technician_information_updates
ftfm_response_parameters
ftfm_technician_information_request
ftfm_planning_parameters_update_request
ftfm_transit_display_update_request
ftfm_transit_vehicle_maintenance_information_request
ftfm_request_response_parameter_output
ftfm_transit_services_output_request
ftfm_approved_corrections
ftfm_coordination_data
ftfm_initiate_service_updates
ftfm_passenger_loading_updates
ftfm_planning_parameters
ftfm_transit_driver_information_request
ftfm_transit_driver_information_updates
ftfm_request_transit_vehicle_data
ftfm_transit_driver_route_preferences
ftfm_transit_vehicle_maintenance_specs

Transit Maintenance Personnel -> **Transit Management**

Physical Architecture Flow Name: maintenance status

Current maintenance status of vehicle.

Logical Architecture Reference Flow(s):

ftmp_transit_vehicle_maintenance_updates

Transit Management -> **Archived Data Management Subsystem**

Physical Architecture Flow Name: transit archive data

Data used to describe and monitor transit demand, fares, operations, and system performance. Content may include a catalog of available information, the actual information to be archived, and associated meta data that describes the archived information.

Logical Architecture Reference Flow(s):

transit_archive_data

Transit Management -> **Emergency Management**

Physical Architecture Flow Name: transit emergency data

Initial notification of transit emergency at a transit stop or on transit vehicles and further coordination as additional details become available and the response is coordinated.

Logical Architecture Reference Flow(s):

transit_emergency_data
transit_coordination_data
transit_incident_details

Transit Management -> **Enforcement Agency**

Physical Architecture Flow Name: payment violation notification

Notification to enforcement agency of a toll, parking, or transit fare payment violation.

Logical Architecture Reference Flow(s):

tea_fare_collection_vehicle_violation_data
tea_fare_collection_roadside_violation_data
tea_fare_payment_violation_data

Transit Management -> **Financial Institution**

Physical Architecture Flow Name: payment request

Request for payment from financial institution.

Logical Architecture Reference Flow(s):

tfi_other_services_payment_request
tfi_fare_payment_violator_data
tfi_request_fare_payment

Transit Management -> **Information Service Provider**

Physical Architecture Flow Name: demand responsive transit plan

Plan regarding overall demand responsive transit schedules and deployment.

Logical Architecture Reference Flow(s):

paratransit_personal_schedule

Physical Architecture Flow Name: transit and fare schedules

Specific transit and fare schedule information including schedule adherence.

Logical Architecture Reference Flow(s):

transit_services_for_guidance
transit_vehicle_deviations_details
transit_services_for_advisory_data
transit_deviation_data_received
transit_fare_data

Physical Architecture Flow Name: transit incident information

Information on transit incidents that impact transit services for public dissemination.

Logical Architecture Reference Flow(s):

transit_incident_data

Physical Architecture Flow Name: transit request confirmation

Confirmation of a request for transit information or service.

Logical Architecture Reference Flow(s):

advanced_other_fares_confirm
advanced_traveler_fares_confirm
advanced_tolls_and_charges_vehicle_request

Transit Management -> **Maintenance and Construction Management**

Physical Architecture Flow Name: road network probe information

Aggregated route usage, travel times, environmental conditions, and other aggregated data collected from probe vehicles.

Logical Architecture Reference Flow(s):

env_probe_info_from_transit

Physical Architecture Flow Name: work plan feedback

Comments and suggested changes to proposed construction and maintenance work schedules and activities. This information influences work plan schedules so that they minimize impact to other system operations and the overall transportation system.

Logical Architecture Reference Flow(s):
m_and_c_plan_feedback_from_transit

Transit Management -> **Map Update Provider**
Physical Architecture Flow Name: map update request

Request for a map update which could include a new underlying map or map layer updates.

Logical Architecture Reference Flow(s):
tmup_transit_map_update_request

Transit Management -> **Media**

Physical Architecture Flow Name: transit incidents for media

Report of an incident impacting transit operations for public dissemination through the media.

Logical Architecture Reference Flow(s):
tm_transit_emergency_information
tm_transit_incident_information

Physical Architecture Flow Name: transit information for media

Report of transit schedule deviations for public dissemination through the media.

Logical Architecture Reference Flow(s):
tm_transit_schedule_deviations_to_media

Transit Management -> **Multimodal Transportation Service Provider**

Physical Architecture Flow Name: transit multimodal information

Transit schedule information for coordination at modal interchange points.

Logical Architecture Reference Flow(s):
tmtsp_transit_arrival_deviations
tmtsp_transit_service_data
tmtsp_transit_arrival_changes

Transit Management -> **Other TRM**

Physical Architecture Flow Name: TRMS coord

Coordination information between local/regional transit organizations including schedule, on-time information, incident information, and ridership.

Logical Architecture Reference Flow(s):
totrm_transit_services

Transit Management -> **Parking Management**
Physical Architecture Flow Name: transit parking lot response

Response to transit occupancy inquiries and coordination with parking lots.

Logical Architecture Reference Flow(s):
parking_lot_transit_response

Transit Management -> **Personal Information Access**

Physical Architecture Flow Name: personal transit information

General and personalized transit information for a particular fixed route, flexible route, or paratransit system.

Logical Architecture Reference Flow(s):
transit_services_for_personal_devices
transit_vehicle_arrival_time

Transit Management -> **Remote Traveler Support**

Physical Architecture Flow Name: emergency acknowledge

Acknowledge request for emergency assistance and provide additional details regarding actions and verification requirements.

Logical Architecture Reference Flow(s):
request_transit_user_roadside_image
emergency_acknowledge_transit_details

Physical Architecture Flow Name: secure area monitoring support

Commands that control surveillance equipment and security sensors that monitor secure public transportation areas. Also includes information for general advisories and alerts intended for general dissemination in these same public areas.

Logical Architecture Reference Flow(s):
transit_area_monitoring_control

Physical Architecture Flow Name: transit fare payment responses

Information provided by transit management that supports a fare payment transaction.

Logical Architecture Reference Flow(s):
transit_services_for_roadside_fares
confirm_roadside_fare_payment
transit_roadside_fare_payment_request
transit_roadside_fare_data
transit_roadside_fare_payment_debited

Physical Architecture Flow Name: transit traveler information

Transit information prepared to support transit users and other travelers. It contains transit schedules, real-time arrival information, fare schedules, and general transit service information.

Logical Architecture Reference Flow(s):
transit_area_broadcast_message
transit_services_for_travelers
transit_services_for_kiosks
other_services_roadside_response
transit_vehicle_arrival_time
transit_vehicle_user_data

Transit Management -> **Surface Transportation**

Weather Service

Physical Architecture Flow Name: transportation weather information request

A request for transportation weather information that may specify the area of interest (a geographic region, particular routes within a region, specific road segments), the type of information that is required, the desired spatial resolution of the information, and time horizon.

Logical Architecture Reference Flow(s):

tstws_trans_weather_info_request

Transit Management -> **Traffic Management**

Physical Architecture Flow Name: request for road network conditions

Request for traffic information, road conditions, surface weather conditions, incident information, and other road network status. The request specifies the region/route of interest, the desired effective time period, and other parameters that allow preparation of a tailored response. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.

Logical Architecture Reference Flow(s):

transit_request_for_prediction_data
transit_request_for_traffic_info

Physical Architecture Flow Name: road network probe information

Aggregated route usage, travel times, environmental conditions, and other aggregated data collected from probe vehicles.

Logical Architecture Reference Flow(s):

transit_probe_data

Physical Architecture Flow Name: traffic control priority request

Request for signal priority at one or more intersections along a particular route.

Logical Architecture Reference Flow(s):

transit_highway_overall_priority
transit_ramp_overall_priority
transit_road_overall_priority

Physical Architecture Flow Name: transit demand management response

Response to transit demand management change requests indicating level of compliance with request.

Logical Architecture Reference Flow(s):

transit_services_changes_response

Physical Architecture Flow Name: transit system data

Current transit system operations information indicating current transit routes, the level of service on each route, and the progress of individual vehicles along their routes for use in forecasting demand and estimating current transportation network performance.

Logical Architecture Reference Flow(s):

transit_running_data_for_demand
transit_services_for_demand
transit_fare_direct_details

Transit Management -> **Transit Driver**

Physical Architecture Flow Name: route assignment

Route assignment information for transit driver.

Logical Architecture Reference Flow(s):

ttd_route_assignments

Transit Management -> **Transit Fleet Manager**

Physical Architecture Flow Name: transit operations planning data

Accumulated schedule and fare information, emergency response plans, transit personnel information, maintenance records, and other information intended to support overall planning and management of a transit property.

Logical Architecture Reference Flow(s):

ttfm_paratransit_service
ttfm_transit_driver_information
ttfm_transit_vehicle_maintenance_information
ttfm_transit_vehicle_data
ttfm_transit_services_output
ttfm_transaction_reports
ttfm_parameters
ttfm_response_parameter_output
ttfm_technician_information
ttfm_passenger_loading_error
ttfm_proposed_corrections
ttfm_coordination_request

Transit Management -> **Transit Maintenance Personnel**

Physical Architecture Flow Name: transit work schedule

Orders for maintenance of transit vehicle or other transit system equipment.

Logical Architecture Reference Flow(s):

ttmp_work_schedule

Transit Management -> **Transit System Operators**

Physical Architecture Flow Name: transit operator display

Display for transit operations personnel regarding performance of the transit fleet, current ridership and on-time performance.

Logical Architecture Reference Flow(s):

ttso_emergency_request
ttso_transit_fare_output
ttso_video_image_data
ttso_potential_security_problem
ttso_transaction_reports
ttso_media_parameters
ttso_potential_incidents_alarm
ttso_archive_status

Transit Management -> **Transit Vehicle Subsystem**

Physical Architecture Flow Name: bad tag list

List of invalid transit user tags which may have previously failed a fare payment transaction.

Logical Architecture Reference Flow(s):

bad_tag_list_update

Physical Architecture Flow Name: driver instructions

Transit service instructions, traffic information, road conditions, and other information for both transit and paratransit drivers.

Logical Architecture Reference Flow(s):

paratransit_transit_driver_instructions
transit_services_for_corrections
transit_services_for_eta
road_network_info_for_transit
approved_corrective_plan

Physical Architecture Flow Name: emergency acknowledge

Acknowledge request for emergency assistance and provide additional details regarding actions and verification requirements.

Logical Architecture Reference Flow(s):

transit_operator_request_acknowledge
request_transit_user_vehicle_image

Physical Architecture Flow Name: fare management information

Transit fare information and transaction data used to manage transit fare processing on the transit vehicle.

Logical Architecture Reference Flow(s):

transit_vehicle_fare_payment_request
transit_vehicle_fare_payment_debited
transit_vehicle_fare_data
transit_vehicle_advanced_payment_response
transit_services_for_vehicle_fares
confirm_vehicle_fare_payment

Physical Architecture Flow Name: request for vehicle measures

Request for vehicle performance and maintenance data collected by onboard sensors.

Logical Architecture Reference Flow(s):

transit_vehicle_collected_maintenance_data_request

Physical Architecture Flow Name: transit schedule information

Current and projected transit schedule adherence.

Logical Architecture Reference Flow(s):

transit_vehicle_advisory_eta

Physical Architecture Flow Name: transit traveler information

Transit information prepared to support transit users and other travelers. It contains transit schedules, real-time arrival information, fare schedules, and general transit service information.

Logical Architecture Reference Flow(s):

traveler_transit_information
traveler_transit_information_for_transit_advisories
other_services_vehicle_response

Transit System Operators -> **Transit Management**

Physical Architecture Flow Name: transit operator management data

Information and control provided by transit system operators involving many aspects of managing transit operations.

Logical Architecture Reference Flow(s):

ftso_emergency_request_acknowledge
ftso_fare_updates
ftso_media_parameter_request
ftso_media_parameter_updates
ftso_request_fare_output
ftso_video_camera_action_request
ftso_archive_commands
ftso_security_action

Transit Vehicle Subsystem -> **Transit Management**

Physical Architecture Flow Name: emergency notification

An emergency request for assistance originated by a traveler using an in-vehicle, public access, or personal device.

Logical Architecture Reference Flow(s):

transit_emergency_details
transit_emergency_information
transit_operator_emergency_request

Physical Architecture Flow Name: environmental probe data

Current environmental conditions (e.g., air temperature, wind speed, surface temperature) as measured by vehicle-based environmental sensors. In addition to environmental sensor inputs, this flow may also include vehicle control system information that may indicate adverse road surface conditions (e.g., traction control system activations).

Logical Architecture Reference Flow(s):

env_probe_data_from_transit_vehicle

Physical Architecture Flow Name: fare and payment status

Current fare collection information including the operational status of the fare collection equipment and financial payment transaction data.

Logical Architecture Reference Flow(s):

transit_vehicle_advanced_payment_request
fare_collection_vehicle_violation_information
request_vehicle_fare_payment
transit_user_vehicle_image
transit_vehicle_fare_payment_confirmation

Physical Architecture Flow Name: request for bad tag list

Request for list of bad vehicle tag IDs.

Logical Architecture Reference Flow(s):

bad_tag_list_request

Physical Architecture Flow Name: transit traveler request

Request by a Transit traveler to summon assistance, request transit information, or request any other transit services.

Logical Architecture Reference Flow(s):
transit_services_for_eta_request
other_services_vehicle_request

Physical Architecture Flow Name: transit vehicle conditions

Operating conditions of transit vehicle (e.g., mileage).

Logical Architecture Reference Flow(s):
transit_vehicle_collected_maintenance_data

Physical Architecture Flow Name: transit vehicle location data

Current transit vehicle location and related operational conditions data provided by a transit vehicle.

Logical Architecture Reference Flow(s):
transit_vehicle_location_for_store
transit_vehicle_location
transit_vehicle_collected_trip_data

Physical Architecture Flow Name: transit vehicle passenger and use data

Data collected on board the transit vehicle pertaining to availability and/or passenger count.

Logical Architecture Reference Flow(s):
paratransit_transit_vehicle_availability
transit_vehicle_passenger_data

Physical Architecture Flow Name: transit vehicle schedule performance

Estimated times of arrival and anticipated schedule deviations reported by a transit vehicle.

Logical Architecture Reference Flow(s):
transit_vehicle_deviations_from_schedule
transit_vehicle_schedule_deviation
transit_vehicle_location_for_deviation
transit_vehicle_arrival_conditions
transit_vehicle_eta

Weather Service -> **Transit Management**

Physical Architecture Flow Name: weather information

Accumulated forecasted and current weather data (e.g., temperature, pressure, wind speed, wind direction, humidity, precipitation, visibility, light conditions, etc.).

Logical Architecture Reference Flow(s):
fws_weather_forecasts
fws_current_weather_observation

2.22.3 Architecture Flow Diagrams for TRMS

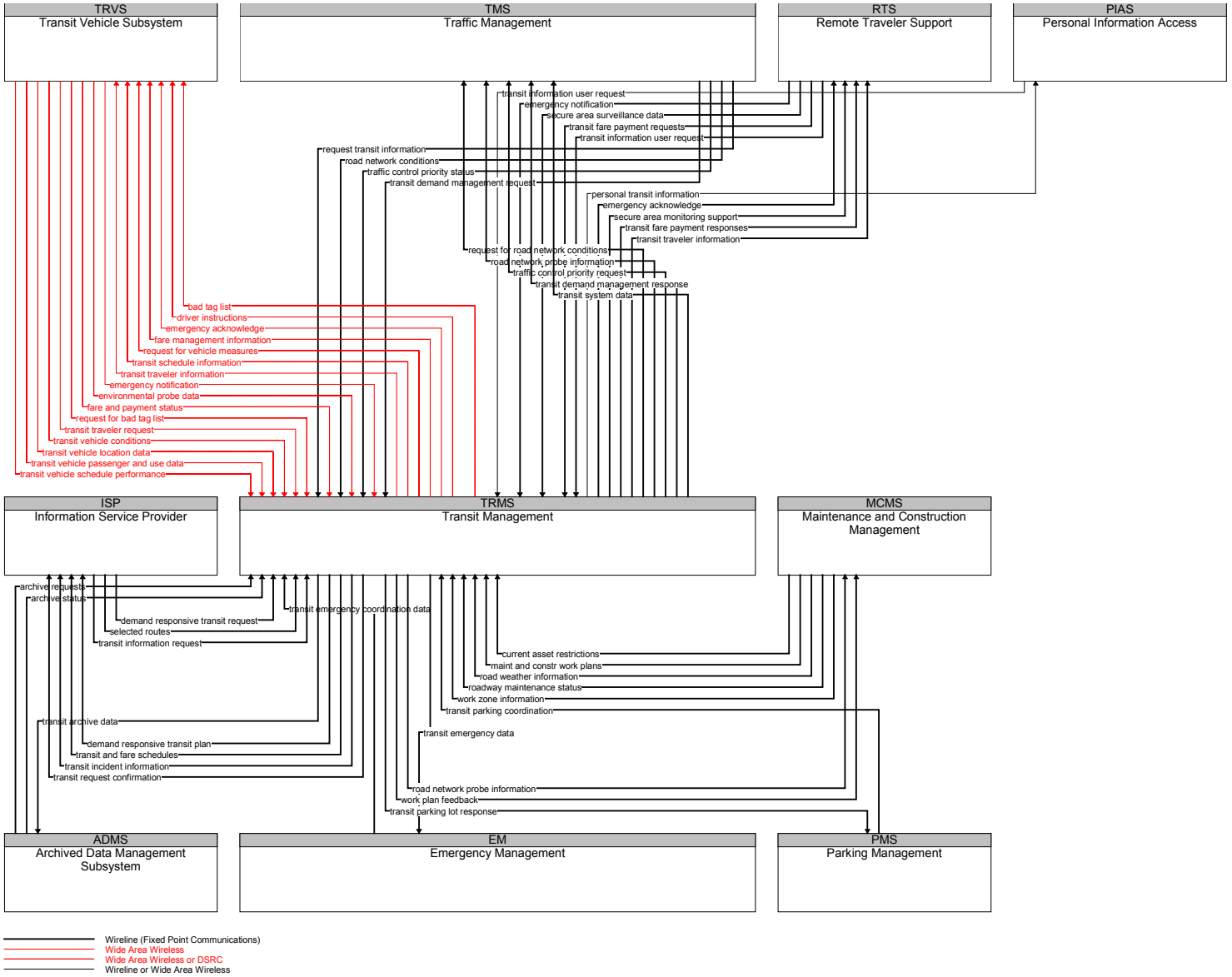


Figure 2-41 Subsystem Architecture Flow Diagram for TRMS

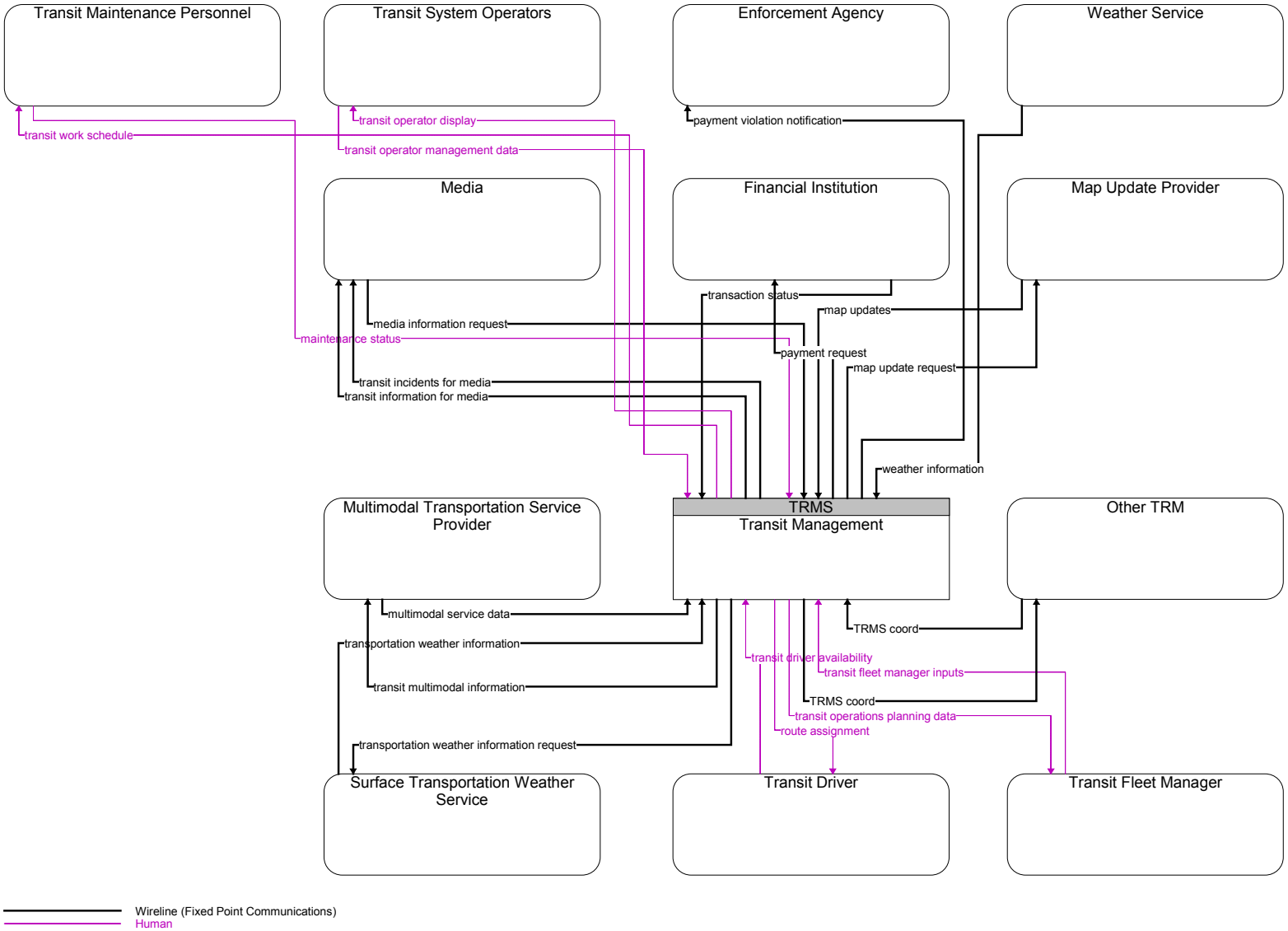


Figure 2-42 Terminator Architecture Flow Diagram for TRMS

2.23 Transit Vehicle Subsystem

This subsystem resides in a transit vehicle and provides the sensory, processing, storage, and communications functions necessary to support safe and efficient movement of passengers. This subsystem resides in a transit vehicle and provides the sensory, processing, storage, and communications functions necessary to support safe and efficient movement of passengers. The Transit Vehicle Subsystem collects accurate ridership levels and supports electronic fare collection. An optional traffic signal prioritization function communicates with the roadside subsystem to improve on-schedule performance. Automated vehicle location functions enhance the information available to the Transit Management Subsystem enabling more efficient operations. On-board sensors support transit vehicle maintenance. The Transit Vehicle Subsystem also furnishes travelers with real-time travel information, continuously updated schedules, transfer options, routes, and fares.An optional traffic signal prioritization function communicates with the roadside subsystem to improve on-schedule performance. Automated vehicle location functions enhance the information available to the Transit Management Subsystem enabling more efficient operations. On-board sensors support transit vehicle maintenance. The Transit Vehicle Subsystem also furnishes travelers with real-time travel information, continuously updated schedules, transfer options, routes, and fares.

2.23.1 Subsystem Equipment Packages and Supporting Process Specifications for TRVS

On-Board Environmental Monitoring
This equipment package collects current road and weather conditions using sensor systems. Environmental information including road surface temperature and air temperature is measured and spatially located and time stamped.

Process Specifications
4.1.1 Process Transit Vehicle Sensor Data

On-board Fixed Route Schedule Management
This Equipment package provides the capabilities for automated planning and scheduling, by collecting data for schedule generation. Capability shall also be provided to automatically determine optimum scenarios for schedule adjustment. This Equipment package also supports the capability for two-way voice communication between the transit vehicle driver and a facility, two-way data communication between the transit vehicles and a facility, on-board safety sensor data to be transmitted from the transit vehicles to a facility, and data transmission from individual facilities to a central facility for processing/analysis if desired.

Process Specifications
4.1.2.1 Determine Transit Vehicle Deviation and ETA

4.1.2.2 Determine Transit Vehicle Corrective Instructions

4.1.2.3 Provide Transit Vehicle Driver Interface

On-board Maintenance
This Equipment package provides the capability to use transit vehicle mileage data to automatically generate preventative maintenance schedules for each specific bus by utilizing vehicle tracking data and storing with a trip computer. It also provides the capability for real-time condition monitoring on board the vehicle, and transmission of this information via two-way communication to the management center.

Process Specifications

4.1.1 Process Transit Vehicle Sensor Data

4.1.9 Process Transit Vehicle Sensor Maintenance Data

On-board Paratransit Operations

This equipment package forwards paratransit dispatch requests to the driver and forwards acknowledgements to the center. It coordinates with, and assists the driver in managing multi-stop runs associated with demand responsive, flexibly routed transit services.

Process Specifications

4.2.1.5 Process Demand Responsive Transit Vehicle Availability Data

4.2.1.6 Provide Demand Responsive Transit Driver Interface

On-board Transit Fare and Load Management

This Equipment package provides the capability to collect data required to determine accurate ridership levels and implement variable and flexible fare structures. Support shall be provided for the traveler for use of a fare medium for all applicable surface transportation services, to pay without stopping, have payment media automatically identified as void and/or invalid and eligibility verified, and allow for third party payment. In addition, capability to provide expansion into other uses for payment medium such as retail and telephone and for off-line billing for fares paid by agencies shall be supported. This Equipment package also supports the capability for two-way voice communication between the transit vehicle driver and a facility, two-way data communication between the transit vehicles and a facility, sensor data to be transmitted from the transit vehicles to a facility, and data transmission from individual facilities to a central facility for processing/analysis if desired. These capabilities require integration with an existing On-board Trip Monitoring Equipment package.

Process Specifications

4.6.1 Detect Transit User on Vehicle

4.6.2 Determine Transit User Needs on Vehicle

4.6.3 Determine Transit Fare on Vehicle

4.6.4 Manage Transit Fare Billing on Vehicle

4.6.5 Provide Transit User Fare Payment Interface on Vehicle

4.6.6 Update Transit Vehicle Fare Data

4.6.7 Provide Transit Vehicle Passenger Data

7.3.5 Provide Transit Vehicle Traveler Card Interface

On-board Transit Information Services

The Equipment package furnishes enroute transit users with real-time travel-related information. Current information

that can be provided to transit users includes transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, non-motorized transportation services, and special events are provided. In addition to tailored information for individual transit users, this equipment package also supports general annunciation and/or display of general schedule information, imminent arrival information, and other information of general interest to transit users.

Process Specifications
6.2.3 Provide Transit User Advisory Interface

6.2.7 Provide Transit Advisory Data On Vehicle

On-board Transit Security
This Equipment package provides the capability to monitor the safety of transit vehicles using on-board safety sensors, processors and communications from the prerequisite On-board Trip Monitoring Equipment package.

Process Specifications
4.4.1.2 Manage Transit Emergencies

4.4.1.5 Provide Transit Driver Interface for Emergencies

On-board Transit Signal Priority
This Equipment package provides the capability for transit vehicles to request signal priority through short range communication directly with traffic control equipment at the roadside.

Process Specifications
4.1.2.5 Request Transit Vehicle Priorities

On-board Transit Trip Monitoring
This Equipment package provides the capabilities to support fleet management with automatic vehicle location and automated mileage and fuel reporting and auditing. This package may also record other special events resulting from communication with roadside equipment. This includes only the equipment on board the vehicle to support this function including the vehicle location devices such as GPS equipment, communication interfaces, a processor to record trip length, and the sensors/actuators/interfaces necessary to record mileage and fuel usage.

Process Specifications
4.1.1 Process Transit Vehicle Sensor Data
4.1.3 Provide Transit Vehicle Location Data

2.23.2 Subsystem Interfaces for TRVS

Basic Transit Vehicle -> **Transit Vehicle Subsystem**

Physical Architecture Flow Name: transit vehicle measures

Transit vehicle status measured by on-board ITS equipment.

Logical Architecture Reference Flow(s):
fbtv_vehicle_maintenance_data
fbtv_vehicle_trip_data
fbtv_availability

Roadway Environment -> **Transit Vehicle Subsystem**

Physical Architecture Flow Name: environmental conditions

Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) that are measured by environmental sensors.

Logical Architecture Reference Flow(s):

fre_environmental_conditions

Transit Driver -> **Transit Vehicle Subsystem**

Physical Architecture Flow Name: transit driver inputs

Transit driver emergency request as well as fare transaction data.

Logical Architecture Reference Flow(s):

ftd_emergency_request
ftd_request_batch_mode_data_transfer
ftd_fare_transaction_mode_set_up

Transit Management -> **Transit Vehicle Subsystem**

Physical Architecture Flow Name: bad tag list

List of invalid transit user tags which may have previously failed a fare payment transaction.

Logical Architecture Reference Flow(s):

bad_tag_list_update

Physical Architecture Flow Name: driver instructions

Transit service instructions, traffic information, road conditions, and other information for both transit and paratransit drivers.

Logical Architecture Reference Flow(s):

approved_corrective_plan
transit_services_for_corrections
road_network_info_for_transit
transit_services_for_eta
paratransit_transit_driver_instructions

Physical Architecture Flow Name: emergency acknowledge

Acknowledge request for emergency assistance and provide additional details regarding actions and verification requirements.

Logical Architecture Reference Flow(s):

transit_operator_request_acknowledge
request_transit_user_vehicle_image

Physical Architecture Flow Name: fare management information

Transit fare information and transaction data used to manage transit fare processing on the transit vehicle.

Logical Architecture Reference Flow(s):

transit_services_for_vehicle_fares
confirm_vehicle_fare_payment
transit_vehicle_fare_payment_request
transit_vehicle_fare_payment_debited
transit_vehicle_fare_data

transit_vehicle_advanced_payment_response

Physical Architecture Flow Name: request for vehicle measures

Request for vehicle performance and maintenance data collected by onboard sensors.

Logical Architecture Reference Flow(s):

transit_vehicle_collected_maintenance_data_request

Physical Architecture Flow Name: transit schedule information

Current and projected transit schedule adherence.

Logical Architecture Reference Flow(s):

transit_vehicle_advisory_eta

Physical Architecture Flow Name: transit traveler information

Transit information prepared to support transit users and other travelers. It contains transit schedules, real-time arrival information, fare schedules, and general transit service information.

Logical Architecture Reference Flow(s):

traveler_transit_information
traveler_transit_information_for_transit_advisories
other_services_vehicle_response

Transit User -> Transit Vehicle Subsystem

Physical Architecture Flow Name: emergency request

An emergency assistance request originated by a transit traveler using an in-vehicle, public access, or personal device.

Logical Architecture Reference Flow(s):

ftu_emergency_request

Physical Architecture Flow Name: transit user inputs

Requests from transit user through either an on-board or fixed location traveler information station.

Logical Architecture Reference Flow(s):

ftu_transit_user_vehicle_image
ftu_request_advisory_information
ftu_destination_on_vehicle
ftu_other_services_vehicle_request

Transit Vehicle Subsystem -> Roadway Subsystem

Physical Architecture Flow Name: local signal priority request

Request from a vehicle to a signalized intersection for priority at that intersection.

Logical Architecture Reference Flow(s):

transit_vehicle_roadway_priorities

Transit Vehicle Subsystem -> Transit Driver

Physical Architecture Flow Name: transit driver display

Display (either video or audio) to transit driver containing status of various ITS services.

Logical Architecture Reference Flow(s):

ttd_paratransit_information
ttd_transit_vehicle_schedule_deviations
ttd_request_fare_transaction_mode_set_up
ttd_batch_mode_data_transfer_status
ttd_emergency_information
ttd_corrective_instructions

Transit Vehicle Subsystem -> **Transit Management**

Physical Architecture Flow Name: emergency notification

An emergency request for assistance originated by a traveler using an in-vehicle, public access, or personal device.

Logical Architecture Reference Flow(s):
transit_operator_emergency_request
transit_emergency_information
transit_emergency_details

Physical Architecture Flow Name: environmental probe data

Current environmental conditions (e.g., air temperature, wind speed, surface temperature) as measured by vehicle-based environmental sensors. In addition to environmental sensor inputs, this flow may also include vehicle control system information that may indicate adverse road surface conditions (e.g., traction control system activations).

Logical Architecture Reference Flow(s):
env_probe_data_from_transit_vehicle

Physical Architecture Flow Name: fare and payment status

Current fare collection information including the operational status of the fare collection equipment and financial payment transaction data.

Logical Architecture Reference Flow(s):
transit_vehicle_fare_payment_confirmation
transit_vehicle_advanced_payment_request
fare_collection_vehicle_violation_information
request_vehicle_fare_payment
transit_user_vehicle_image

Physical Architecture Flow Name: request for bad tag list

Request for list of bad vehicle tag IDs.

Logical Architecture Reference Flow(s):
bad_tag_list_request

Physical Architecture Flow Name: transit traveler request

Request by a Transit traveler to summon assistance, request transit information, or request any other transit services.

Logical Architecture Reference Flow(s):
transit_services_for_eta_request
other_services_vehicle_request

Physical Architecture Flow Name: transit vehicle conditions

Operating conditions of transit vehicle (e.g., mileage).

Logical Architecture Reference Flow(s):
transit_vehicle_collected_maintenance_data

Physical Architecture Flow Name: transit vehicle location data

Current transit vehicle location and related operational conditions data provided by a transit vehicle.

Logical Architecture Reference Flow(s):

transit_vehicle_collected_trip_data
transit_vehicle_location_for_store
transit_vehicle_location

Physical Architecture Flow Name: transit vehicle passenger and use data

Data collected on board the transit vehicle pertaining to availability and/or passenger count.

Logical Architecture Reference Flow(s):

transit_vehicle_passenger_data
paratransit_transit_vehicle_availability

Physical Architecture Flow Name: transit vehicle schedule performance

Estimated times of arrival and anticipated schedule deviations reported by a transit vehicle.

Logical Architecture Reference Flow(s):

transit_vehicle_eta
transit_vehicle_arrival_conditions
transit_vehicle_location_for_deviation
transit_vehicle_deviations_from_schedule
transit_vehicle_schedule_deviation

Transit Vehicle Subsystem -> Transit User

Physical Architecture Flow Name: transit user fare status

Status of fare transaction for transit user.

Logical Architecture Reference Flow(s):

ttu_vehicle_payment_confirmed

Physical Architecture Flow Name: transit user outputs

Information for traveler from either an on-board or fixed location traveler information station.

Logical Architecture Reference Flow(s):

ttu_other_services_vehicle_confirmed
ttu_traveler_information
ttu_advisory_information
ttu_vehicle_access_message

Transit Vehicle Subsystem -> Traveler Card

Physical Architecture Flow Name: request for payment

Request to deduct cost of service from user's payment account.

Logical Architecture Reference Flow(s):

ttc_debited_payment_on_transit_vehicle
ttc_request_fare_payment_on_transit_vehicle

Transit Vehicle Subsystem -> Vehicle

Physical Architecture Flow Name: traveler advisory request

In vehicle communication between transit and vehicle systems includes advisories and advance payment deductions.

Logical Architecture Reference Flow(s):

transit_user_advisory_information_request
transit_user_advanced_payment_on_vehicle

Traveler Card -> **Transit Vehicle Subsystem**

Physical Architecture Flow Name: payment

Payment of some kind (e.g., toll, parking, fare) by traveler which, in most cases, can be related to a credit account.

Logical Architecture Reference Flow(s):

ftc_confirm_fare_payment_on_transit_vehicle
ftc_transit_vehicle_tag_data

Vehicle -> **Transit Vehicle Subsystem**

Physical Architecture Flow Name: vehicle location

Location of vehicle and other vehicle characteristics which are exchanged between vehicle subsystems.

Logical Architecture Reference Flow(s):

transit_user_vehicle_credit_identity
vehicle_location_for_transit
transit_user_advisory_information

2.23.3 Architecture Flow Diagrams for TRVS

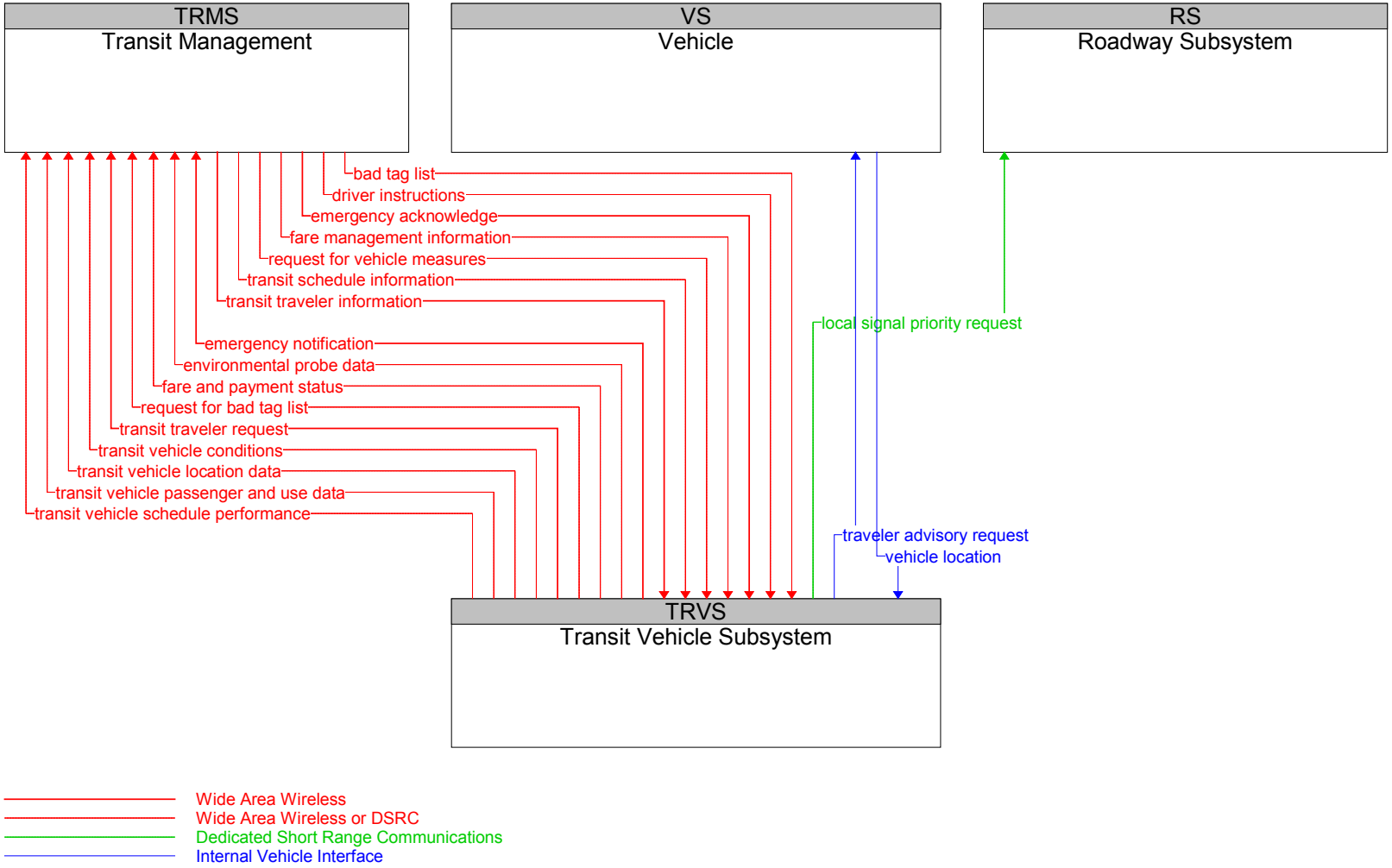


Figure 2-43 Subsystem Architecture Flow Diagram for TRVS

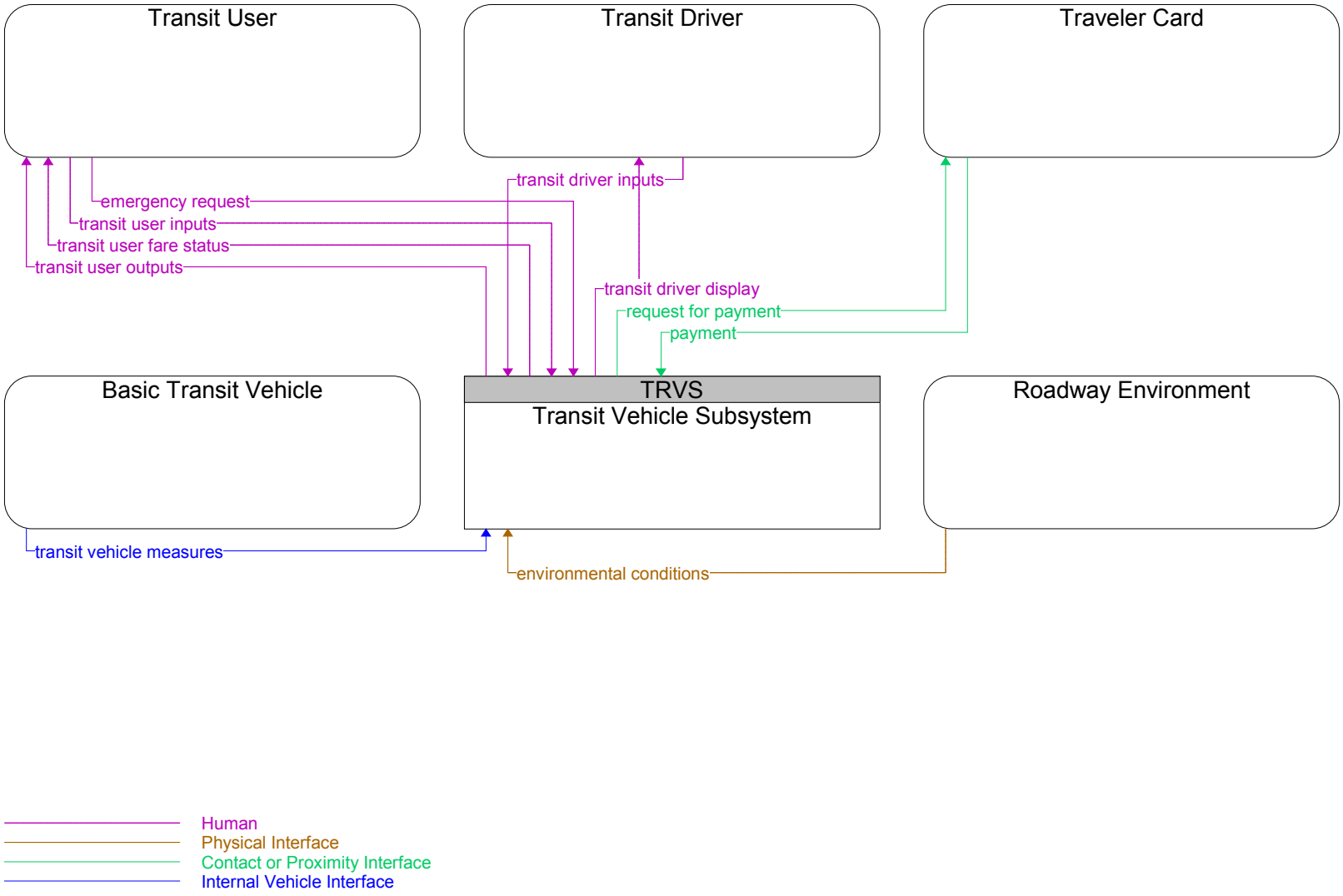


Figure 2-44 Terminator Architecture Flow Diagram for TRVS

2.24 Vehicle

This subsystem provides the sensory, processing, storage, and communications functions necessary to support efficient, safe, and convenient travel. These functions reside in general vehicles including personal automobiles, commercial vehicles, emergency vehicles, transit vehicles, or other vehicle types. Information services provide the driver with current travel conditions and the availability of services along the route and at the destination. Both one-way and two-way communications options support a spectrum of information services from low-cost broadcast services to advanced, pay for use personalized information services. Route guidance capabilities assist in formulation of an optimal route and step by step guidance along the travel route. Advanced sensors, processors, enhanced driver interfaces, and actuators complement the driver information services so that, in addition to making informed mode and route selections, the driver travels these routes in a safer and more consistent manner. Initial collision avoidance functions provide "vigilant co-pilot" driver warning capabilities. More advanced functions assume limited control of the vehicle to maintain safe headway. Ultimately, this subsystem supports completely automated vehicle operation through advanced communications with other vehicles in the vicinity and in coordination with supporting infrastructure subsystems. Pre-crash safety systems are deployed and emergency notification messages are issued when unavoidable collisions do occur.

2.24.1 Subsystem Equipment Packages and Supporting Process Specifications for VS

Basic Vehicle Reception
This Equipment package shall provide the capability for drivers to interface with the ISP Subsystem Basic Information Broadcast Equipment package and receive formatted traffic advisories including accurate traveling information concerning available travel options and their availability, and congestion information in their vehicle. These capabilities shall be based upon the reception of infrastructure information using in-vehicle devices such as an in-vehicle AM/FM radio with data Subcarrier connected with the existing audio system and a dash-mounted LCD.

Process Specifications
6.2.2 Prepare and Output In-vehicle Displays

6.2.5 Provide Driver Information Interface

Driver Safety Monitoring System
This Equipment package shall provide the capability to determine the driver's condition and warn the driver of potential dangers. This Equipment package includes driver sensors to assess the suitability of the driver (e.g., fitness and alertness) to assume manual control of the vehicle.

Process Specifications
3.1.2 Carry-out Safety Analysis

3.1.3 Process Vehicle On-board Data

6.2.5 Provide Driver Information Interface

Driver Visibility Improvement System
The Equipment package shall provide the capability to augment the vehicle operator's ability to see objects in the vehicle path in conditions where driving visibility is poor (e.g., bad weather, night driving, etc.). These capabilities shall be provided using equipment such as on-board sensor system (e.g., an infrared sensor system) to create images that in turn could be relayed to the driver using a heads-up display. The on-board systems to implement this Equipment

package shall include a local sensor system, an image creation and processing capability, and a visual display to the driver.

Process Specifications
3.4 Enhance Driver's Vision

6.2.5 Provide Driver Information Interface

Interactive Vehicle Reception
This Equipment package shall provide the capability for drivers to interface with the ISP Subsystem Infrastructure Equipment packages including the Interactive Infrastructure Information Equipment package, the Infrastructure Provided Route Selection, Yellow Pages and Reservation, and Dynamic Ridesharing Equipment packages. These capabilities shall be provided using the Vehicle Subsystem equipment.

Process Specifications
6.2.2 Prepare and Output In-vehicle Displays

6.2.5 Provide Driver Information Interface

In-Vehicle Signing System
This Equipment package shall provide the capability to assist individuals with impaired vision, individuals needing local guidance in areas that the driver is unfamiliar, and implemented in a manner that augments existing signs. This package shall also provide the capability to customize warnings, utilize data from roadside environmental sensors, and provide travelers with information on road conditions and with precautionary reminder messages. These capabilities shall be provided through the use of equipment such as an interface to active tag reader and processor to display the information from the active tag.

Process Specifications
6.2.2 Prepare and Output In-vehicle Displays

6.2.5 Provide Driver Information Interface

Smart Probe
Vehicle Probes with added capability and intelligence to sense and send road conditions as the vehicle travels. The same vehicle equipment that improves stability in adverse conditions and provides driver information is a potential source for this information. Smart probe data may include road conditions and surface weather information.

Process Specifications
3.1.3 Process Vehicle On-board Data

Vehicle Autonomous Route Guidance
This Equipment package provides route planning and turn by turn route guidance. It provides autonomous route guidance in the absence of real-time information or factors information provided by the infrastructure into its route selection and guidance algorithms. The equipment package also includes those truly autonomous systems that are not configured to receive or process any external data.

Process Specifications
6.7.2.1.3 Provide Autonomous In-Vehicle Guidance

6.7.2.3 Provide Driver Guidance Interface

6.7.2.4 Update Vehicle Navigable Map Database

Vehicle Intersection Collision Warning
This Equipment package shall provide the capability for the detection of an impending collision with a moving or stationary object prior to crash impact in an intersection with notification provided to the driver of the presence of potentially hazardous situations and need for immediate collision avoidance action. These capabilities shall be provided through the use of equipment such as an intersection hazard warning sensor and actuator.

Process Specifications
3.1.1 Produce Collision and Crash Avoidance Data

3.1.3 Process Vehicle On-board Data

3.2.3.5 Process Vehicle Sensor Data

6.2.5 Provide Driver Information Interface

Vehicle Intersection Control
This Equipment package shall provide the capability for the detection of an impending collision with a moving or stationary object prior to crash impact in an intersection and automatically avoid the intersection collision. These capabilities shall be provided through the use of equipment such as an intersection hazard warning sensor and actuator.

Process Specifications
3.1.1 Produce Collision and Crash Avoidance Data

3.1.3 Process Vehicle On-board Data

6.2.5 Provide Driver Information Interface

Vehicle Lateral Control
This Equipment package shall provide the capability for lateral control of a vehicle on roads to allow "hands off" driving, automating the steering control function. This capability shall be provided through the use of equipment provided to detect lanes, obstacles or vehicles to the sides of the vehicle. This sensor information shall be processed on board the vehicle, and appropriate steering control actions shall be initiated using steering actuators. Appropriate lane maintenance may thus be maintained automatically.

Process Specifications
3.2.1 Provide Driver Interface

3.2.3.1 Provide Command Interface

3.2.3.3 Process data for Vehicle Actuators

3.2.3.4.3 Provide Lane Servo Control

3.2.3.4.4 Provide Change Lane Servo Control

3.2.3.4.5 Provide Vehicle Control Data Interface

Vehicle Lateral Warning System

This Equipment 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.

Process Specifications

3.1.1 Produce Collision and Crash Avoidance Data

3.1.3 Process Vehicle On-board Data

3.2.3.5 Process Vehicle Sensor Data

6.2.5 Provide Driver Information Interface

Vehicle Location Determination

This equipment package determines current location information and provides this information to other equipment packages that use the location information to provide various ITS services.

Process Specifications

6.7.2.2 Process Vehicle Location Data

Vehicle Longitudinal Control

This Equipment package shall provide the capability for longitudinal control of a vehicle on roads to allow "feet off" driving, automating the function of speed control, acceleration, and braking. This capability shall be provided through the use of equipment to detect obstacles or vehicles in the longitudinal path of the vehicle. This sensor information shall be processed on board the vehicle, and appropriate control actions (acceleration, braking, or maintaining speed) shall be initiated using accelerator and/or brake actuators. Appropriate following distances may thus be maintained automatically.

Process Specifications

3.1.3 Process Vehicle On-board Data

3.2.1 Provide Driver Interface

3.2.3.1 Provide Command Interface

3.2.3.3 Process data for Vehicle Actuators

3.2.3.4.1 Provide Speed Servo Control

3.2.3.4.2 Provide Headway Servo Control
3.2.3.4.5 Provide Vehicle Control Data Interface

6.2.5 Provide Driver Information Interface

Vehicle Longitudinal Warning System
This Equipment 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.

Process Specifications
3.1.1 Produce Collision and Crash Avoidance Data

3.1.3 Process Vehicle On-board Data

3.2.3.5 Process Vehicle Sensor Data

6.2.5 Provide Driver Information Interface

Vehicle Mayday I/F
This Equipment package shall provide the capability for an in-vehicle manually initiated distress signal with cancel a prior issued manual request for help feature. This capability shall include automatically identifying that a collision had occurred using equipment such as collision detection sensors with interface to mayday type equipment that would automatically detect vehicle problems and for some cases, automatically send appropriate distress signals to the Emergency Management Subsystem.

Process Specifications
3.3.1 Provide Communications Function

3.3.2 Build Automatic Collision Notification Message

6.2.5 Provide Driver Information Interface

6.7.1.1 Build Driver Personal Security Message

6.7.1.2 Provide Driver In-vehicle Communications Function
Vehicle Pre-Crash Safety Systems
This Equipment package provides the capability to sense local conditions, determine collision probability, and deploy a pre-crash safety system. These capabilities shall be provided by equipment such as on-board sensors to determine the location or distance away and closing rates of neighboring vehicles or other roadway obstacles. These detection systems shall be supplemented by additional sensors for existing weather and roadway conditions and roadway geometry. A processor in the vehicle shall assimilate this information and determine the probability of a collision with the other vehicle or obstacle. If the collision probability is high, it shall deploy a pre-crash safety system either to avoid the accident or to reduce the accident severity.

Process Specifications
3.1.1 Produce Collision and Crash Avoidance Data

3.1.3 Process Vehicle On-board Data

3.2.3.5 Process Vehicle Sensor Data

Vehicle Probe Support
This Equipment package includes capabilities for the probe vehicle to identify its location, measure traffic conditions such as link travel time and speed and possibly environmental hazards such as icy road conditions, and transmit these data to either the ISP or TMC.

Process Specifications
3.2.3.5 Process Vehicle Sensor Data

6.7.2.1.2 Provide Dynamic In-Vehicle Guidance

Vehicle Provider-Based Route Guidance
This Equipment package coordinates with an ISP-Based route planning service to select a suggested route plan that is tailored to the driver's preferences. Coordination continues during the trip so that the route plan can be modified to account for new information and vehicle probe data can be returned to the ISP. Many equipment configurations are possible including basic systems that provide only a route plan to the driver as well as systems that include the necessary on-board equipment to provide turn by turn route guidance following the selected route.

Process Specifications
6.7.2.1.1 Determine In-Vehicle Guidance Method

6.7.2.1.2 Provide Dynamic In-Vehicle Guidance

6.7.2.3 Provide Driver Guidance Interface

6.7.2.4 Update Vehicle Navigable Map Database
Vehicle Safety Monitoring System
This Equipment package shall provide the capability to diagnose critical components of the vehicle and warn the driver of potential dangers. These capabilities are provided by equipment such as a set of on-board sensors to monitor continuously the vehicle condition and performance, including steering, braking, acceleration, emissions, fuel economy, engine performance, etc. Problems with any of these systems shall be identified using processors on board the vehicle, providing a timely display to the driver of the situation. The sensors shall provide warnings to the driver in the event of a serious condition (e.g., likely failure or damage).

Process Specifications
3.1.2 Carry-out Safety Analysis

3.1.3 Process Vehicle On-board Data

6.2.5 Provide Driver Information Interface

Vehicle Systems for AHS
This Equipment package provides the capability for "hands-off" and "feet off" operation of an equipped vehicle on the automated portion of the highway system including the longitudinal control, lateral control for lane change/merge and

roadway departure, regulating the vehicle speed and steering control, and sensing impending hazards and responding appropriately. These capabilities shall be provided by systems on board the vehicle to regulate longitudinal and lateral control maneuvers, including acceleration, braking, and steering functions. The capability to control access to the automated highway system shall be provided through an automated check-in procedure in which the vehicle and driver are checked for their fitness.

Process Specifications
3.1.3 Process Vehicle On-board Data

3.2.1 Provide Driver Interface

3.2.2 Provide AHS Control

3.2.3.2 Manage Platoon Following

3.2.3.3 Process data for Vehicle Actuators

3.2.3.6 Communicate with other Platoon Vehicles

3.2.4 Process Sensor Data for AHS input

Vehicle Toll/Parking Interface

This Equipment package shall provide the capability for vehicle operators to pay toll without stopping their vehicles and pay for parking without the use of cash. These capabilities shall be provided through the use of equipment such as an active tag interface and debit/credit card interface.

Process Specifications
7.1.4 Provide Driver Toll Payment Interface

7.1.7 Provide Traveler Card Interface for Tolls

7.2.4 Provide Driver Parking Lot Payment Interface

7.2.7 Provide Traveler Card Interface for Parking

7.5.1 Provide Vehicle Traveler Card Interface

2.24.2 Subsystem Interfaces for VS

Basic Vehicle -> Vehicle

Physical Architecture Flow Name: basic vehicle measures

Information provided to on-board ITS equipment from the vehicle platform indicating current

vehicle status.

Logical Architecture Reference Flow(s):

fbv_vehicle_attitude_data
fbv_vehicle_proximity_data
fbv_vehicle_safety_status
fbv_vehicle_motion_data
fbv_vehicle_on_ahs_lane
fbv_vehicle_lane_position
fbv_vehicle_speed
fbv_vehicle_condition
fbv_vehicle_security_status
fbv_throttle_servo_response
fbv_steering_servo_response
fbv_driver_safety_status
fbv_diagnostics_data
fbv_crash_sensor_data
fbv_brake_servo_response
fbv_vehicle_identity
fbv_vehicle_headway

Commercial Vehicle Subsystem -> **Vehicle**

Physical Architecture Flow Name: commercial vehicle data

Information about the commercial vehicles cargo, credentials, and payments.

Logical Architecture Reference Flow(s):

processed_cargo_data
cv_driver_enrollment_cost

Driver -> **Vehicle**

Physical Architecture Flow Name: driver inputs

Driver commands to the vehicle.

Logical Architecture Reference Flow(s):

fd_request_advisory_information
fd_guidance_data
fd_guidance_map_update_request
fd_guidance_route_accepted
fd_activate_vehicle_control

Physical Architecture Flow Name: request for service

A traveler service request initiated by a driver or traveler. The request may result in a financial transaction, summon an emergency response, or initiate another service at the behest of the driver.

Logical Architecture Reference Flow(s):

fd_guidance_request
fd_emergency_request
fd_other_services_toll_request
fd_other_services_parking_request

Emergency Management -> **Vehicle**

Physical Architecture Flow Name: emergency acknowledge

Acknowledge request for emergency assistance and provide additional details regarding actions

and verification requirements.

Logical Architecture Reference Flow(s):
emergency_request_vehicle_acknowledge
emergency_request_driver_acknowledge

Physical Architecture Flow Name: emergency data request

A request for additional information or a control command issued by the emergency response agency in response to an emergency request for assistance from a traveler.

Logical Architecture Reference Flow(s):
vehicle_security_system_commands
emergency_data_request

Information Service Provider -> **Vehicle**

Physical Architecture Flow Name: broadcast information

General broadcast information that contains link travel times, incidents, advisories, transit services and a myriad of other traveler information.

Logical Architecture Reference Flow(s):
broadcast_data
link_and_queue_data

Physical Architecture Flow Name: traveler information

Traveler information comprised of traffic status, advisories, incidents, payment information and many other travel-related data updates and confirmations.

Logical Architecture Reference Flow(s):
event_information_advisory_data
advanced_tolls_and_fares_response
link_and_queue_data
driver_map_update_payment_response
advanced_fares_and_charges_response
advisory_data

Physical Architecture Flow Name: trip plan

A sequence of links and special instructions comprising of a trip plan indicating efficient routes for navigating the links. Normally coordinated with traffic conditions, other incidents, preemption and prioritization plans.

Logical Architecture Reference Flow(s):
vehicle_guidance_route

Physical Architecture Flow Name: yellow pages information

Travel service information covering tourist attractions, lodging, restaurants, service stations, emergency services, and other services and businesses of interest to the traveler.

Logical Architecture Reference Flow(s):
yellow_pages_advisory_data

Location Data Source -> **Vehicle**

Physical Architecture Flow Name: position fix

Information which provides a traveler's or vehicle's geographical position.

Logical Architecture Reference Flow(s):
From_Location_Data_Source

Maintenance and Construction Vehicle -> **Vehicle**

Physical Architecture Flow Name: vehicle signage data

In-vehicle signage data generated by the roadway infrastructure indicating either road conditions, street names, or special information.

Logical Architecture Reference Flow(s):
work_zone_intrusion_alert_on_board_for_in_vehicle_signing

Map Update Provider -> **Vehicle**

Physical Architecture Flow Name: map updates

Map update which could include a new underlying static or real-time map or map layer(s) update.

Logical Architecture Reference Flow(s):
fmup_vehicle_map_update_cost
fmup_vehicle_map_update

Other Vehicle -> **Vehicle**

Physical Architecture Flow Name: vehicle to vehicle coordination

Any type of advanced vehicle to vehicle communication.

Logical Architecture Reference Flow(s):
From_Other_Vehicle

Parking Management -> **Vehicle**

Physical Architecture Flow Name: request tag data

Request for tag information including credit identity, stored value card cash, etc.

Logical Architecture Reference Flow(s):
parking_lot_payment_request
parking_lot_tag_data_request

Physical Architecture Flow Name: tag update

Update data held in tag which can be read by another roadside device (Commercial Vehicle Check Subsystem, Toll Collection Subsystem, etc.).

Logical Architecture Reference Flow(s):
parking_lot_payment_debited
parking_lot_tag_data_clear
parking_lot_tag_data_update

Potential Obstacles -> **Vehicle**

Physical Architecture Flow Name: physical presence

Detection of an obstacle by a vehicle. Obstacle could include animals, other vehicles, pedestrians, rocks in roadway etc.

Logical Architecture Reference Flow(s):
From_Potential_Obstacles

Roadway Environment -> **Vehicle**

Physical Architecture Flow Name: environmental conditions

Current road conditions (e.g., surface temperature, subsurface temperature, moisture, icing, treatment status) and surface weather conditions (e.g., air temperature, wind speed, precipitation, visibility) that are measured by environmental sensors.

Logical Architecture Reference Flow(s):
fre_environmental_conditions

Physical Architecture Flow Name: roadway characteristics

Detectable or measurable road characteristics such as friction coefficient and general surface conditions, road geometry and markings, etc. These characteristics are monitored or measured by ITS sensors and used to support advanced vehicle safety and control and road maintenance capabilities.

Logical Architecture Reference Flow(s):
fre_roadway_characteristics
fre_roadside_data

Roadway Subsystem -> **Vehicle**

Physical Architecture Flow Name: AHS control data

Information required for vehicles to operate on AHS lanes.

Logical Architecture Reference Flow(s):
lane_change_strategy
lane_change_details
ahs_check_response

Physical Architecture Flow Name: intersection status

Status of intersection congestion, approaching vehicles, etc.

Logical Architecture Reference Flow(s):
intersection_collision_avoidance_data

Physical Architecture Flow Name: request tag data

Request for tag information including credit identity, stored value card cash, etc.

Logical Architecture Reference Flow(s):
toll_tag_data_needed
parking_lot_tag_data_needed

Physical Architecture Flow Name: vehicle signage data

In-vehicle signage data generated by the roadway infrastructure indicating either road conditions, street names, or special information.

Logical Architecture Reference Flow(s):
vehicle_smart_probe_data_output
intrusion_alert_for_in_vehicle_signing
vehicle_signage_data

Toll Collection -> **Vehicle**

Physical Architecture Flow Name: request tag data

Request for tag information including credit identity, stored value card cash, etc.

Logical Architecture Reference Flow(s):

toll_tag_data_request
toll_payment_request

Physical Architecture Flow Name: tag update

Update data held in tag which can be read by another roadside device (Commercial Vehicle Check Subsystem, Toll Collection Subsystem, etc.).

Logical Architecture Reference Flow(s):

toll_payment_debited
toll_tag_data_update
toll_tag_data_clear

Transit Vehicle Subsystem -> **Vehicle**

Physical Architecture Flow Name: traveler advisory request

In vehicle communication between transit and vehicle systems includes advisories and advance payment deductions.

Logical Architecture Reference Flow(s):

transit_user_advisory_information_request
transit_user_advanced_payment_on_vehicle

Traveler Card -> **Vehicle**

Physical Architecture Flow Name: payment

Payment of some kind (e.g., toll, parking, fare) by traveler which, in most cases, can be related to a credit account.

Logical Architecture Reference Flow(s):

ftc_toll_tag_data
ftc_transit_user_vehicle_input_credit_identity
ftc_parking_tag_data
ftc_confirm_payment_at_toll_plaza
ftc_confirm_payment_at_parking_lot
ftc_driver_vehicle_input_credit_identity

Vehicle -> **Basic Vehicle**

Physical Architecture Flow Name: vehicle control

Vehicular control commands

Logical Architecture Reference Flow(s):

tbv_change_brake_setting
tbv_change_direction
tbv_steer_straight
tbv_change_throttle_setting
tbv_steer_right
tbv_vehicle_security_system_commands
tbv_steer_left

tbv_deploy_crash_restraints

Vehicle -> **Commercial Vehicle Subsystem**

Physical Architecture Flow Name: commercial vehicle data request

Requests from the vehicle for information about the commercial vehicle's cargo, credentials, and payments.

Logical Architecture Reference Flow(s):

cargo_data_request
cv_driver_credit_identity

Physical Architecture Flow Name: vehicle location

Location of vehicle and other vehicle characteristics which are exchanged between vehicle subsystems.

Logical Architecture Reference Flow(s):

vehicle_location_for_cv

Vehicle -> **Driver**

Physical Architecture Flow Name: driver updates

Information displayed or otherwise conveyed by the vehicle to the driver.

Logical Architecture Reference Flow(s):

td_guidance_route_details
td_guidance_map_update_response
td_guidance_input_request
td_advisory_information
td_broadcast_information
td_driving_guidance

Physical Architecture Flow Name: in-vehicle transaction status

The status of an electronic payment transaction presented to the driver by in-vehicle equipment.

Logical Architecture Reference Flow(s):

td_other_services_parking_response
td_other_services_toll_response

Vehicle -> **Emergency Management**

Physical Architecture Flow Name: emergency notification

An emergency request for assistance originated by a traveler using an in-vehicle, public access, or personal device.

Logical Architecture Reference Flow(s):

emergency_request_vehicle_details
emergency_request_driver_details
driver_status_update
vehicle_status_update
vehicle_security_system_commands_request

Vehicle -> **Emergency Vehicle Subsystem**

Physical Architecture Flow Name: vehicle location

Location of vehicle and other vehicle characteristics which are exchanged between vehicle subsystems.

Logical Architecture Reference Flow(s):
vehicle_location_for_emergency_services

Vehicle -> Information Service Provider

Physical Architecture Flow Name: environmental probe data

Current environmental conditions (e.g., air temperature, wind speed, surface temperature) as measured by vehicle-based environmental sensors. In addition to environmental sensor inputs, this flow may also include vehicle control system information that may indicate adverse road surface conditions (e.g., traction control system activations).

Logical Architecture Reference Flow(s):
env_probe_data_from_vehicle

Physical Architecture Flow Name: traveler profile

Information about a traveler including equipment capabilities, personal preferences and recurring trip characteristics.

Logical Architecture Reference Flow(s):
traveler_profile_from_vehicle

Physical Architecture Flow Name: traveler request

Request by a traveler to summon assistance, request information, make a reservation, or initiate any other traveler service.

Logical Architecture Reference Flow(s):
advanced_tolls_and_fares_request
event_information_advisory_requests
driver_map_update_payment_request
advanced_fares_and_charges_request
advisory_data_request

Physical Architecture Flow Name: trip confirmation

Acknowledgement by the driver/traveler of acceptance of a route.

Logical Architecture Reference Flow(s):
vehicle_guidance_route_accepted

Physical Architecture Flow Name: trip request

Request by a driver/traveler for special routing.

Logical Architecture Reference Flow(s):
vehicle_route_request

Physical Architecture Flow Name: vehicle probe data

Vehicle probe data indicating identity, route segment identity, link time and location.

Logical Architecture Reference Flow(s):
vehicle_guidance_probe_data

Physical Architecture Flow Name: yellow pages request

Request for information through a yellow pages type service.

Logical Architecture Reference Flow(s):
yellow_pages_advisory_requests

Vehicle -> **Maintenance and Construction Vehicle**

Physical Architecture Flow Name: safety system status

Current vehicle safety system status indicating the operating condition of these systems and the safety status of the vehicle and driver.

Logical Architecture Reference Flow(s):
safety_data_for_mcv

Physical Architecture Flow Name: vehicle location

Location of vehicle and other vehicle characteristics which are exchanged between vehicle subsystems.

Logical Architecture Reference Flow(s):
vehicle_location_for_mcv

Vehicle -> **Map Update Provider**

Physical Architecture Flow Name: map update request

Request for a map update which could include a new underlying map or map layer updates.

Logical Architecture Reference Flow(s):
tmup_vehicle_map_update_cost_request
tmup_vehicle_map_update_request

Vehicle -> **Other Vehicle**

Physical Architecture Flow Name: vehicle to vehicle coordination

Any type of advanced vehicle to vehicle communication.

Logical Architecture Reference Flow(s):
To_Other_Vehicle

Vehicle -> **Parking Management**

Physical Architecture Flow Name: tag data

Unique tag ID and related vehicle information.

Logical Architecture Reference Flow(s):
parking_lot_tag_data_collect
parking_lot_payment_confirmation

Vehicle -> **Roadway Subsystem**

Physical Architecture Flow Name: AHS vehicle data

AHS route and vehicle condition data.

Logical Architecture Reference Flow(s):
ahs_route_data
ahs_vehicle_condition

Physical Architecture Flow Name: environmental probe data

Current environmental conditions (e.g., air temperature, wind speed, surface temperature) as measured by vehicle-based environmental sensors. In addition to environmental sensor inputs, this flow may also include vehicle control system information that may indicate adverse road surface conditions (e.g., traction control system activations).

Logical Architecture Reference Flow(s):

vehicle_status_details_for_emissions
vehicle_smart_probe_data

Physical Architecture Flow Name: vehicle probe data

Vehicle probe data indicating identity, route segment identity, link time and location.

Logical Architecture Reference Flow(s):

parking_lot_tag_data_input
toll_tag_data_input

Vehicle -> Toll Collection

Physical Architecture Flow Name: tag data

Unique tag ID and related vehicle information.

Logical Architecture Reference Flow(s):

toll_payment_confirmation
toll_tag_data_collect

Vehicle -> Transit Vehicle Subsystem

Physical Architecture Flow Name: vehicle location

Location of vehicle and other vehicle characteristics which are exchanged between vehicle subsystems.

Logical Architecture Reference Flow(s):

vehicle_location_for_transit
transit_user_vehicle_credit_identity
transit_user_advisory_information

Vehicle -> Traveler Card

Physical Architecture Flow Name: request for payment

Request to deduct cost of service from user's payment account.

Logical Architecture Reference Flow(s):

ttc_request_payment_at_toll_plaza
ttc_debited_driver_payment_at_vehicle
ttc_request_payment_at_parking_lot
ttc_debited_payment_at_parking_lot
ttc_debited_transit_user_payment_at_vehicle
ttc_debited_payment_at_toll_plaza

2.24.3 Architecture Flow Diagrams for VS

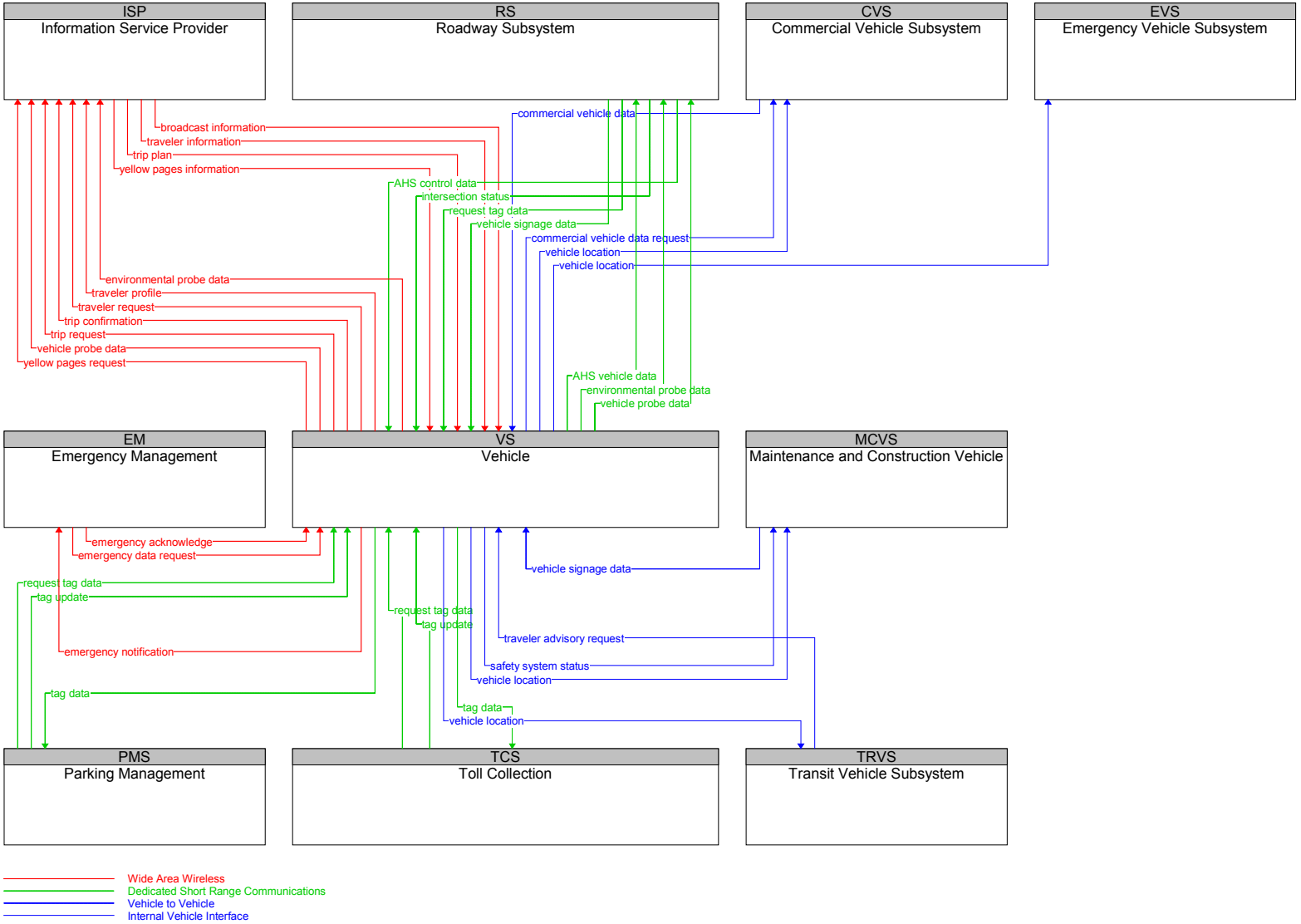


Figure 2-45 Subsystem Architecture Flow Diagrams for VS

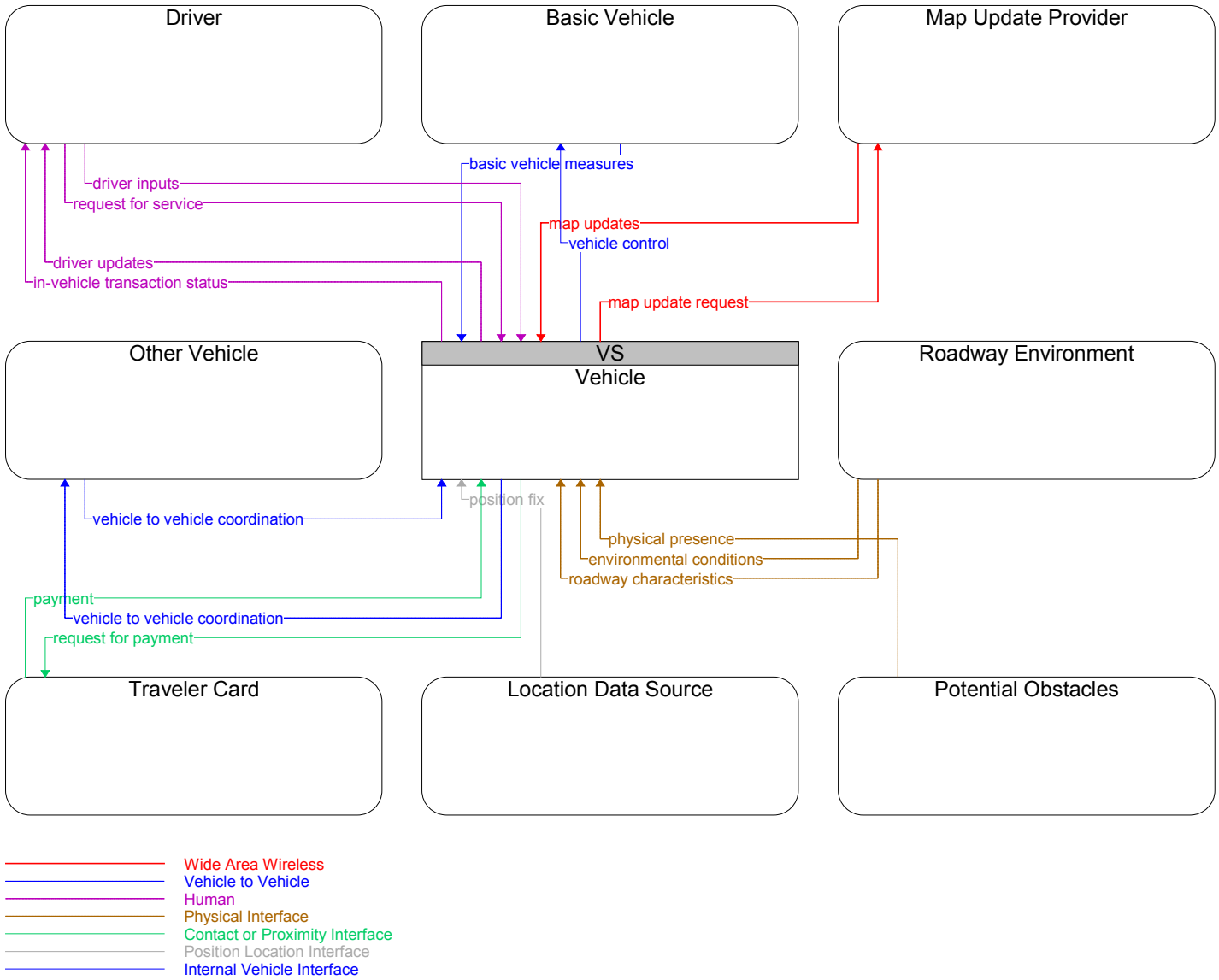


Figure 2-46 Terminator Architecture Flow Diagrams for VS

2.25 Special Constraints

The following section (Communication Layer Section 3) defines the nominal communication requirements for each of the communication channels identified by data flows. Special constraints exist for some of the interconnections between subsystems which should be noted. The following report identifies 5 types of special considerations and the data flows and interconnects which are affected.

Type of Constraint: Emergency Priority

Communication channel requires priority in emergencies. These data channels require that they be operational even when there is an emergency which might place other loads on the interface. A private communication channel or frequency may be required to satisfy the requirement.

Source	Destination	Interconnect	Architecture Flow
Personal Information Access	Emergency Management	U1t	emergency notification
Emergency Management	Maintenance and Construction Management	W	incident information
Care Facility	Emergency Management	W	care facility status
Emergency Management	Vehicle	U1t	emergency acknowledge
Emergency Management	Transit Management	W	transit emergency coordination data
Emergency Vehicle Subsystem	Emergency Management	U1t	emergency dispatch response
Emergency Vehicle Subsystem	Emergency Management	U1t	emergency vehicle tracking data
Maintenance and Construction Management	Emergency Management	W	incident information
Emergency Management	Other EM	W	incident response coordination
Emergency Vehicle Subsystem	Roadway Subsystem	U2	local signal preemption request
Emergency Management	Traffic Management	W	emergency traffic control request
Transit Management	Emergency Management	W	transit emergency data
Emergency Management	Vehicle	U1t	emergency data request
Emergency Management	Fleet and Freight Management	W	hazmat information request

Emergency Management	Emergency Vehicle Subsystem	U1t	suggested route
Emergency Vehicle Subsystem	Emergency Management	U1t	incident command request
Emergency Management	Emergency Vehicle Subsystem	U1t	incident command information
Emergency Vehicle Subsystem	Emergency Management	U1t	incident status
Other EM	Emergency Management	W	incident response coordination
Other EM	Emergency Management	W	incident report
Emergency Management	Maintenance and Construction Management	W	incident response status
Remote Traveler Support	Emergency Management	W,U1t	emergency notification
Remote Traveler Support	Transit Management	W	emergency notification
Commercial Vehicle Subsystem	Emergency Management	U1t	hazmat spill notification
Care Facility	Emergency Vehicle Subsystem	U1t	care facility status
Transit Vehicle Subsystem	Transit Management	U1t	emergency notification
Emergency Management	Other EM	W	incident report
Vehicle	Emergency Management	U1t	emergency notification
Emergency Personnel	Emergency Vehicle Subsystem	H	emergency personnel inputs
Remote Traveler Support	Emergency Management	W	secure area surveillance data
Emergency Vehicle Subsystem	Emergency Personnel	H	incident command information presentation
Emergency Management	Emergency Vehicle Subsystem	U1t	emergency dispatch requests
Transit Management	Remote Traveler Support	W	secure area monitoring support
Maintenance and Construction Management	Traffic Management	W	incident information

Emergency Vehicle Subsystem	Care Facility	U1t	care facility status request
Remote Traveler Support	Transit Management	W	secure area surveillance data
Emergency Vehicle Subsystem	Care Facility	U1t	patient status
Emergency Management	Care Facility	W	care facility status request
Traffic Management	Emergency Management	W	incident information
Traffic Management	Emergency Management	W	incident information request
Traffic Management	Maintenance and Construction Management	W	incident information
Emergency Management	Remote Traveler Support	W	secure area monitoring support
Emergency Vehicle Subsystem	Emergency Personnel	H	dispatch information

Type of Constraint: Financial Security

Data contains financial information and must be protected accordingly. This data is specifically called out between the user's card and the infrastructure and between the infrastructure and financial institutions. Protections currently exist for the latter. Financial data transmitted over the air must be recognized as private data with an additional reliability requirement. Financial data may exist between other subsystems as part of normal messaging. It is assumed that such data will be treated with the same constraints as the interfaces specifically identified

Source	Destination	Interconnect	Architecture Flow
Traveler Card	Personal Information Access	S	payment
Archived Data Management Subsystem	Financial Institution	W	payment request
Traveler Card	Transit Vehicle Subsystem	S	payment
Traveler Card	Parking Management	S	payment
Financial Institution	Toll Administration	W	transaction status
Financial Institution	Parking Management	W	transaction status
Financial Institution	Information Service Provider	W	transaction status
Financial Institution	Commercial Vehicle Administration	W	transaction status
Financial Institution	Archived Data Management	W	transaction status

	Subsystem		
Commercial Vehicle Administration	Financial Institution	W	payment request
Traveler Card	Vehicle	S	payment
Vehicle	Driver	H	in-vehicle transaction status
Traveler Card	Remote Traveler Support	S	payment
Parking Management	Traveler Card	S	request for payment
Remote Traveler Support	Transit Management	W	transit fare payment requests
Transit Management	Remote Traveler Support	W	transit fare payment responses
Information Service Provider	Fleet and Freight Management	W	toll data
Fleet and Freight Management	Toll Administration	W	toll data request
Remote Traveler Support	Traveler Card	S	request for payment
Transit Vehicle Subsystem	Transit Management	U1t,U2	request for bad tag list
Fleet and Freight Management	Information Service Provider	W	toll data request
Transit Vehicle Subsystem	Traveler Card	S	request for payment
Transit Vehicle Subsystem	Transit Management	U1t,U2	fare and payment status
Vehicle	Traveler Card	S	request for payment
Financial Institution	Transit Management	W	transaction status

Type of Constraint: Personal Privacy

Data contains personal information. Traveler requests and traveler location are private and should be protected. Subsystems aggregate these data and forward specific data with the traveler's permission.

Source	Destination	Interconnect	Architecture Flow
Vehicle	Information Service Provider	U1t	vehicle probe data
Vehicle	Roadway Subsystem	U2	vehicle probe data
Transit Management	Information Service Provider	W	transit request confirmation
Transit Management	Information Service Provider	W	demand responsive transit plan

Commercial Vehicle Administration	Enforcement Agency	W	citation
Vehicle	Information Service Provider	U1t	yellow pages request
DMV	Traffic Management	W	registration
Enforcement Agency	Commercial Vehicle Administration	W	information on violators
Fleet and Freight Management	Commercial Vehicle Administration	W	tax filing
Transit Vehicle Subsystem	Transit Management	U1t	transit traveler request
Information Service Provider	Fleet and Freight Management	W	route plan
Vehicle	Information Service Provider	U1t	trip request
Fleet and Freight Management	Information Service Provider	W	route request
Vehicle	Information Service Provider	U1t	trip confirmation
Vehicle	Information Service Provider	U1t	traveler request
Vehicle	Information Service Provider	U1t	traveler profile
Personal Information Access	Traveler	H	traveler interface updates
Commercial Vehicle Check	Commercial Vehicle Administration	W	accident report
Vehicle	Information Service Provider	U1t	environmental probe data
Remote Traveler Support	Traveler	H	traveler interface updates
Information Service Provider	Personal Information Access	W,U1t	traveler information
Vehicle	Parking Management	U2	tag data
Remote Traveler Support	Information Service Provider	W	trip confirmation
Remote Traveler Support	Information Service Provider	W	trip request
Remote Traveler Support	Information Service Provider	W	yellow pages request
Commercial Vehicle	Enforcement Agency	W	accident report

Administration			
Personal Information Access	Information Service Provider	W,U1t	yellow pages request
Commercial Vehicle Administration	Fleet and Freight Management	W	accident report
Information Service Provider	Yellow Pages Service Providers	W	travel service request
Commercial Vehicle Administration	Fleet and Freight Management	W	citation
Vehicle	Roadway Subsystem	U2	environmental probe data
DMV	Toll Administration	W	registration
Remote Traveler Support	Information Service Provider	W	traveler request
Personal Information Access	Information Service Provider	W,U1t	trip request
Maintenance and Construction Management	Enforcement Agency	W	request for enforcement
Personal Information Access	Information Service Provider	W,U1t	trip confirmation
Personal Information Access	Information Service Provider	W,U1t	traveler request
Transit Management	Transit Vehicle Subsystem	U1t	transit traveler information
Personal Information Access	Information Service Provider	W,U1t	traveler profile
Vehicle	Toll Collection	U2	tag data
Information Service Provider	Yellow Pages Service Providers	W	provider profile confirm
Information Service Provider	Remote Traveler Support	W,U1t	trip plan
Enforcement Agency	Commercial Vehicle Check	W	information on violators
Information Service Provider	Personal Information Access	W,U1t	trip plan
Information Service Provider	Transit Management	W	demand responsive transit request
Information Service Provider	Parking Management	W	parking lot data request
Information Service Provider	Parking Management	W	parking reservations request

Information Service Provider	Remote Traveler Support	W,U1t	traveler information
Information Service Provider	Vehicle	U1t,U1b	traveler information
Information Service Provider	Traffic Management	W	logged special vehicle route
Remote Traveler Support	Transit Management	W	transit information user request
Commercial Vehicle Administration	Enforcement Agency	W	violation notification
Fleet and Freight Management	Commercial Vehicle Administration	W	audit data
Information Service Provider	Transit Management	W	selected routes
Information Service Provider	Vehicle	U1t	trip plan
Commercial Vehicle Check	Commercial Vehicle Administration	W	citation

Type of Constraint: Reliability

Failure of the communication medium may result in severe accident. This communication channel may require redundant paths or extra attention paid to potential failure modes. For wireline cases, this may indicate alternate phone or other connections are required. For wireless cases (for AHS applications), special attention will be paid to the transmitters, receivers, and potential interference for these connections

Source	Destination	Interconnect	Architecture Flow
Wayside Equipment	Roadway Subsystem	W	track status
Roadway Subsystem	Wayside Equipment	W	intersection blockage notification
Roadway Subsystem	Wayside Equipment	W	hri operational status
Roadway Subsystem	Multimodal Crossings	W	highway control status
Roadway Subsystem	Vehicle	U2	intersection status
Roadway Subsystem	Vehicle	U2	AHS control data
Roadway Subsystem	Traffic Management	W	traffic flow
Roadway Subsystem	Traffic Management	W	request for right-of-way
Roadway Subsystem	Driver	H	driver information
Roadway Subsystem	Traffic Management	W	hri status
Parking Management	Vehicle	U2	tag update
Basic Transit Vehicle	Transit Vehicle Subsystem	V	transit vehicle measures
Toll Collection	Vehicle	U2	tag update
Roadway Subsystem	Traffic Management	W	intersection blockage notification

Toll Collection	Vehicle	U2	request tag data
Other Vehicle	Vehicle	U3	vehicle to vehicle coordination
Wayside Equipment	Roadway Subsystem	W	arriving train information
Vehicle	Other Vehicle	U3	vehicle to vehicle coordination
Vehicle	Roadway Subsystem	U2	AHS vehicle data
Basic Vehicle	Vehicle	V	basic vehicle measures
Vehicle	Basic Vehicle	V	vehicle control
Basic Commercial Vehicle	Commercial Vehicle Subsystem	V	commercial vehicle measures
Parking Management	Vehicle	U2	request tag data
Traffic Management	Roadway Subsystem	W	hri request
Traffic Management	Roadway Subsystem	W	hri control data
Multimodal Crossings	Roadway Subsystem	W	multimodal crossing status
Multimodal Crossings	Traffic Management	W	multimodal crossing status
Commercial Vehicle Check	Commercial Vehicle Subsystem	U2	pass/pull-in
Traffic Management	Rail Operations	W	hri advisories

Type of Constraint: Performance (Timing)

Timing is critical. Timing for most ITS communication services is based on the response to a request for data. Because of this, common communication media designed to handle voice data will likely support these requirements. The beacon interface has special requirements of identifying the vehicle as well as exchanging information before the vehicle gets out of range. This is more of a problem with vehicles traveling at speed. The architecture constrains such time critical access to data such that the data is available at the beacon site. This obviates the need for explicit specification of other timing information to support data transfer over a short range beacon.

Source	Destination	Interconnect	Architecture Flow
Roadway Subsystem	Traffic Management	W	traffic images
Emergency Vehicle Subsystem	Roadway Subsystem	U2	local signal preemption request
Roadway Subsystem	Vehicle	U2	intersection status
Traffic Management	Roadway Subsystem	W	signal control data
Roadway Subsystem	Vehicle	U2	request tag data
Archived Data Management Subsystem	Roadway Subsystem	W	data collection and monitoring control
Roadway Subsystem	Driver	H	driver information
Roadway Subsystem	Wayside Equipment	W	intersection blockage notification
Remote Traveler	Emergency	W	secure area surveillance data

Support	Management		
Toll Collection	Vehicle	U2	request tag data
Wayside Equipment	Roadway Subsystem	W	track status
Roadway Subsystem	Traffic Management	W	intersection blockage notification
Remote Traveler Support	Transit Management	W	secure area surveillance data
Commercial Vehicle Check	Commercial Vehicle Subsystem	U2	safety inspection request
Roadway Subsystem	Vehicle	U2	AHS control data
Roadway Subsystem	Vehicle	U2	vehicle signage data
Vehicle	Roadway Subsystem	U2	AHS vehicle data
Commercial Vehicle Check	Commercial Vehicle Subsystem	U2	safety inspection record
Emergency Management	Remote Traveler Support	W	secure area monitoring support
Commercial Vehicle Subsystem	Commercial Vehicle Check	U2	screening event record
Commercial Vehicle Subsystem	Commercial Vehicle Check	U2	safety inspection record
Commercial Vehicle Subsystem	Commercial Vehicle Check	U2	on-board safety data
Traffic Management	Roadway Subsystem	W	video surveillance control
Commercial Vehicle Subsystem	Commercial Vehicle Check	U2	driver log
Traffic Management	Rail Operations	W	hri advisories
Commercial Vehicle Check	Commercial Vehicle Subsystem	U2	pass/pull-in
Commercial Vehicle Check	Commercial Vehicle Subsystem	U2	on-board safety request
Commercial Vehicle Check	Commercial Vehicle Subsystem	U2	electronic screening request
Commercial Vehicle Check	Commercial Vehicle Subsystem	U2	electronic lock data request
Commercial Vehicle Check	Commercial Vehicle Subsystem	U2	driver log request
Commercial Vehicle Check	Commercial Vehicle Subsystem	U2	border clearance event
Commercial Vehicle Check	Commercial Vehicle Subsystem	U2	screening event record
Roadway Subsystem	Traffic Management	W	traffic flow

Commercial Vehicle Subsystem	Commercial Vehicle Check	U2	electronic lock data
Vehicle	Toll Collection	U2	tag data
Roadway Subsystem	Archived Data Management Subsystem	W	roadside archive data
Parking Management	Vehicle	U2	tag update
Parking Management	Vehicle	U2	request tag data
Maintenance and Construction Vehicle	Vehicle	V	vehicle signage data
Maintenance and Construction Management	Roadway Subsystem	W	video surveillance control
Transit Vehicle Subsystem	Transit Management	U1t,U2	request for bad tag list
Wayside Equipment	Roadway Subsystem	W	arriving train information
Other Vehicle	Vehicle	U3	vehicle to vehicle coordination
Traffic Management	Roadway Subsystem	W	traffic sensor control
Vehicle	Other Vehicle	U3	vehicle to vehicle coordination
Roadway Subsystem	Maintenance and Construction Management	W	traffic images
Vehicle	Roadway Subsystem	U2	vehicle probe data
Vehicle	Roadway Subsystem	U2	environmental probe data
Toll Collection	Vehicle	U2	tag update
Vehicle	Parking Management	U2	tag data
Traffic Management	Roadway Subsystem	W	freeway control data
Transit Vehicle Subsystem	Transit Management	U1t,U2	fare and payment status
Transit Vehicle Subsystem	Roadway Subsystem	U2	local signal priority request
Transit Management	Remote Traveler Support	W	secure area monitoring support
CVO Inspector	Commercial Vehicle	H	CVC override mode
			Check

3. COMMUNICATIONS LAYER

The overall ITS physical architecture consists of three layers, the Transportation Layer, the Communication Layer – which is presented in this section and has wireless and wireline components – and the Institutional Layer. This

section presents an overview of the Communication Layer and is divided into two main sections: Communication Architecture (Section 3.1), and Communication Layer linkage to the Transportation Layer (Section 3.2).

The Communication Architecture Section (Section 3.1) presents a generic communication model which illustrates the basic relationship between the ITS Physical Architecture's Transportation and Communication Layers. This generic communication model, which should not be confused with the ITS communication network reference model, is based on the International Standards Organization's (ISO) Open Systems Interconnection (OSI) model. The ISO OSI model consists of seven layers: application, presentation, session, transport, network, data link, and physical layer. In general, the application, presentation, and session layers are supported by the Transportation Layer while the transport, network, data link and physical layers are supported by the Communications Layer.

The Communication Architecture Section (Section 3.1) also provides definitions of the various components that make up the communication layer. Some of these components include: communication services, communication logical functions, communication functional entities, and communication network reference model. The communication network reference model is the primary ITS communication model.

The communication architectures for commercial communication systems such as Personal Communication Services (PCS), Group Special Mobile (GSM), TIA-IS-41, Cellular Digital Packet Data (CDPD), to name a few, use communication network reference models. A network reference model is used to identify physical equipment that perform communication functions, and is used to identify reference interfaces between these physical equipment (standards are usually written for these reference interfaces). The ITS network reference model is based on, and presents extensions of, several reference models that were developed for the above mentioned standard communication systems. The model provides a structure that shows how various communication technologies can implement the ITS Architecture Interconnect Diagrams (AIDs), which are presented later in the Communication Layer Linkage Section (Section 3.2).

The Communication Layer Linkage Section also identifies the relationship between the Transportation Layer and Communication Layer definitions. This is accomplished through the following steps:

1. Mapping the communication services to the data flows identified in the Transportation Layer.

2. Generating the Architecture Interconnect Diagrams (AIDs) which define the interconnections between transportation subsystems and modules defined in the Transportation Layer.

3. Identifying the Architecture Renditions (ARs) which are examples, based on the network reference model, of how to provide communication connections between users defined in the Transportation Layer.

4. Mapping of the AIDs to the AR's (each AR stays one level above technology specification, and comprises a family of systems with similar attributes, e.g., wireless packet data networks).

5. Identifying the Architecture Interconnect Specifications (AISs) which are examples of specific systems to implement an applicable communication technology to a particular rendition, for example, the use of CDPD for cellular wide-area wireless data communication.

To summarize, the Communication Layer Linkage Section presents the communication services/data flow mapping, AIDs, ARs, AID/AR mapping, and AISs.

In general, the Communication architecture for ITS will have two components: one wireless and one wireline. All Transportation Layer entities requiring information transfer are supported by one, or both, of these components. Wireline system interconnect includes fixed to fixed communication capabilities, which may include wide area wireless capabilities for transportable devices such as DMS, and may include short hop wireless connections to wireline subsystems from distributed assets such as signal and sensors. It includes normal telephone and public and private fiber-optic links. In most cases, the wireless component merely provides a tetherless user, usually one in a vehicle, with access to fixed (or wireline) network resources. The wireless portion will be manifested in three different ways:

- Wide-area wireless infrastructure supporting wide-area information transfer (many data flows). For example, the direct use of existing and emerging mobile wireless systems.

- Short range wireless infrastructure for short-range information transfer (also many data flows, but limited to specific applications), similar to systems used for electronic toll collection.

- Dedicated wireless system handling high data rate, low probability of error, fairly short range, Advanced Highway Systems related (AHS-related) data flows, such as vehicle to vehicle transceiver radio systems.

Because of the variances in the ITS user service requirements (from a communication perspective), it is clear from a cursory examination that the user services do not share a common information transfer capability. Specifically, ITS user services like electronic toll collection demand communication needs that can only be met by dedicated infrastructures for technical and feasibility, notwithstanding institutional, reasons. The ITS user services information transfer needs are supported by a sample deployment of the communication network reference model described in Section 3.1.4. Implementation candidates are identified as a result of a broad, balanced communication technology assessment task. After examining the assessment results for these candidates, an ITS implement or service provider can decide on the mix of communication technologies that are best suited to the implementation scenario at hand.

The wireline portion can be manifested in many different ways, most implementation dependent. Note that in defining the Communication Layer, no assumptions have been made regarding media type.

The process of developing the communications layer (architecture) is illustrated in Figure 3-1, and starts from the data flows in the transportation layer. In the following sections, the reader is referred to this figure at each step of the design process description.

The upper left block in Figure 3-1 shows the mapping of the identified data flows to communication services. The data flows are derived from the Architecture Flow Diagram (AFD) provided in the Physical Architecture document, which is used to specify which transportation subsystems communicate directly with each other. The communication services are described in Section 3.2.1 in terms of flow response and capabilities (they should not be confused with the ITS user services, which from a communication standpoint, are applications, as will be discussed shortly.) The mapping provides one or more communication services for each of the data flows between transportation entities. The Architecture Interconnect Diagrams (AIDs) encapsulate the type of partition between each of the transportation layer subsystems, as wireline or wireless, accompanied by a description of the communication service and operation mode for all the data flows between each pair of entities.

In parallel, a Network Reference Model (lower left block in Figure 3-1) is derived from models for standard commercial communication systems to fit ITS needs. This communication model is then used, in combination

with feasibility and cost constraints, to develop renditions, or examples, of how to realize the required communication services. These renditions are based on the communication interface type, and are at one level above specific technology.

As shown in Figure 3-1, the MAP AID-AR block is done in an abstract way, identifying which data flows are supported by each rendition. At the same time, the results of the Technology Assessment are used to develop Architecture Interconnect Specifications, which identify and assess specific features of the technology important to interconnecting the transportation layer entities. The AIS involves further specification of the renditions, and completes the description of the ITS Communications Architecture. To illustrate, mobile wireless packet data networks are considered a rendition. Several technologies, like CDPD, RAM, and so on, are specific technologies that belong to this rendition that could be used in the implementation. The AIS Section here is maintained brief, and includes a few examples of the results of the communication technology assessment (from an ITS architecture standpoint) which is presented in Chapter 7 and Appendix D of the Communications Document. The AIS leads to technology recommendations, to be interpreted as implementation examples of the communication elements in the ITS architecture. In a real-world ITS implementation, this last step would be performed by the communication system designer.

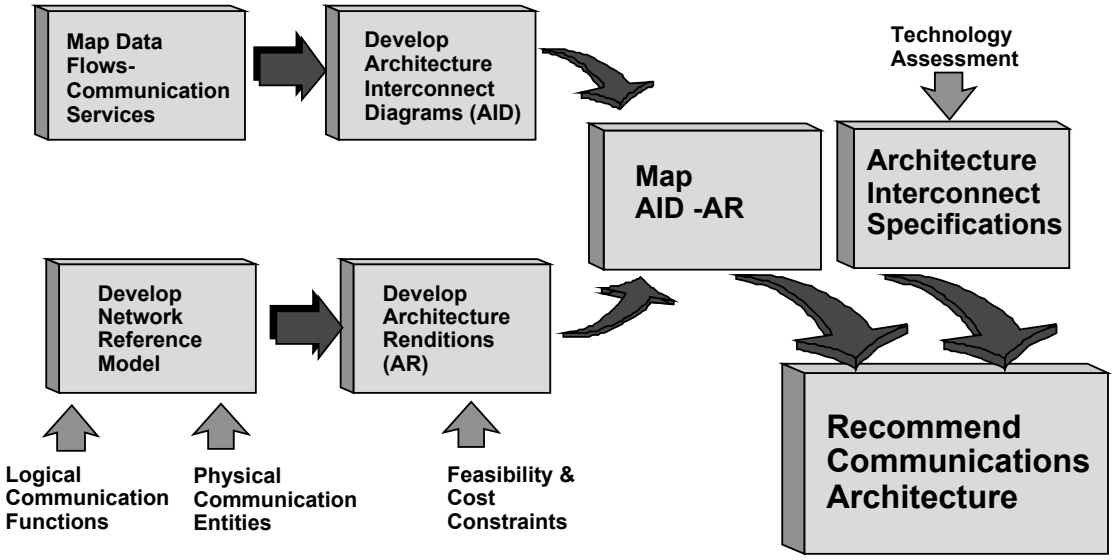


Figure 3-1 Communications Architecture Design Process

3.1 Communication Architecture

The generic communication hierarchical model presented in Figure 3-2shows the relationship between the Transportation and Communication Layers. Each data user can be one entity in the Transportation Layer (e.g., the Information Service Provider Subsystem or Personal Vehicle Subsystem in an information exchange). The user does not care about and should not be concerned with the specifics of this information transfer layer. In fact, the Communication Layer can be viewed as plumbing that carries information from one user to another.

The complex makeup of the network is usually defined by system architectures developed to meet specific requirements, performance objectives, and socio-economic drivers. In the absence of crisp specifications and because of the jurisdictional-independence of this particular architecture, the end framework precludes the design

of low level implementation details. However, to properly evaluate the communication architecture candidates, select technologies and detailed designs are recommended in an evaluatory design (see the later chapters of the Communications Document.)

The generic hierarchical communication model shown in Figure 3-2follows the Open Systems Interconnection model which organizes the communication network in a highly structured format to reduce its overall design complexity. This model is structured as a series of layers each with the function of providing certain services to the layer above and capable of conversing with the corresponding layer at the other end of the link. Thus the high level layers (e.g. ITS application) are shielded from the actual implementation details of the communication services. Different networks can use layers different from the OSI model, such as the IBM SNA (Systems Network Architecture). When different protocols are used in different networks, an inter working function must provide the conversion between the protocols at the various levels.

The lowest layer in the OSI model is the physical layer (layer 1), which provides the transmission of bits over wires or radio links . Layer 2 is the data link layer, and is concerned with making the link appear to the receiver as bit error-free as possible by implementing error detection and correction (EDAC) coding schemes in the transceiver; one example is the use of a cyclic redundancy code (CRC) to a block or frame of the data and when the data passes the CRC check at the receiver, the returned acknowledgment indicates whether re-transmission is needed. Layer 3 is the network layer, which controls the operation of the network, where the key issue is routing packets, which is also used to generate billing information for the communications service provider; billing is tied to IP addresses. Layer 4 is the transport layer, which mediates between the session layer and the network layer, providing end-to-end accounting for all the data at the receiving end, and isolates the system from the changing physical technologies. Layer 5 is the session layer, which allows users on different machines to establish communications, or sessions, between them, involving ordinary data transport but with enhanced services such as remote log-in or file transfer. Layer 6, the presentation layer, performs syntax and semantic operations on the information transmitted between the users, such as encoding data in a standard way, or compressing or encrypting that data. Layer 7 is the application layer, which provides commonly used protocols for such tasks as terminal emulation, file transfer, electronic mail and remote job entry. (Note that for many ITS applications, layers 5 and 6 are absorbed into the application layer, layer 7.)

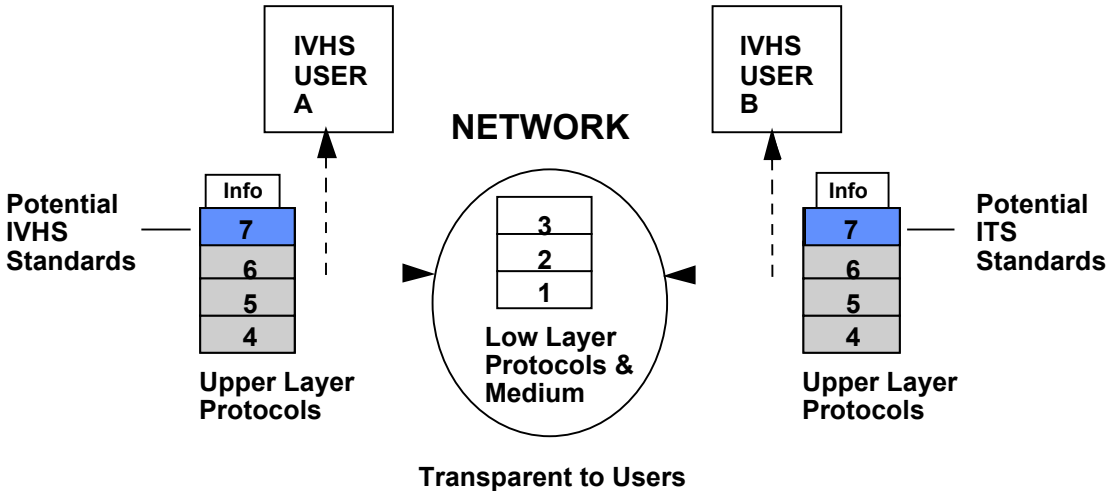


Figure 3-2 Generic Hierarchical Communication Model

From the Communication Layer perspective, the term "services" is defined according to communications governing bodies (*e.g.*, ITU, TIA, etc.), and should be used with care. That is, when describing a communications architecture, one should not refer to Route Guidance or Pre-trip Planning as services. Rather, they are applications in need of a communication service. Elaborating more along these lines, ITS appears to the Communication Layer as a collection of applications with markedly different communication requirements. Thus the service provided by the communication model is characterized more by 1) the application's directionality requirements (*e.g.*, one-way or two-way) for information transport, 2) whether it is between mobile elements, mobile and stationary elements or stationary elements, 3) the amounts of data to be transported, and 4) the urgency rather than the precise description as Route Guidance or Pre-trip Planning.

The next section identifies various communication services to which the Transportation Layer data flows can be matched. This matching process will assign broad generic communication services to the data flows without specifying a particular technology.

3.1.1 Communication Services

The communication services define the exchange of information between two points and are independent of media and application (i.e., ITS user service). In essence, they are a specified set of user-information transfer capabilities provided by the communication layer to a user in the transportation layer. Figure 3-3illustrates the hierarchy of communication services, the detailed of these is given in Appendix A-1 in the Communications Document. In what follows a brief description of the services is presented.

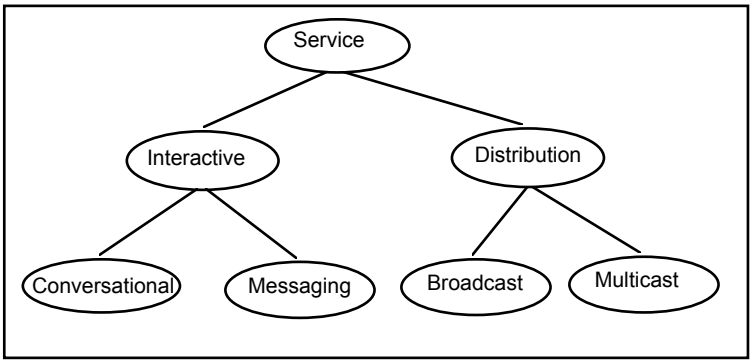


Figure 3-3 Communication Services Hierarchy

Communication services consist of two broad categories, interactive and distribution. Interactive services allow the user to exchange data with other users or providers in real or near real time, asking for service or information and receiving it in the time it takes to communicate or look up the information. Distribution services allow the user to send the same message to multiple other users.

Interactive services may be either conversational or messaging. Conversational implies the use of a two-way connection established before information exchange begins and terminated when the exchange is completed. Messaging, on the other hand, works more like electronic mail being exchanged between users. The messages are exchanged without establishing a dedicated path between the two sites. Each message is addressed and placed on the network for transmission, intermixed with messages from other users. The communications community labels this mode of communication a “datagram” service.

Distribution services may be either broadcast or multicast and may be used over wireline and/or wireless communication links. Broadcast messages are those sent to all users while multicast messages are sent only to a subset of users. Multicast differs from broadcast in its use of a designated address for all users and user groups. Examples of broadcast information might include current weather or road conditions, whereas multicast information might be information sent to all drivers working for a specific company. A changing group membership could be the set of users traveling between two locations or with a certain destination, for which unique information must be transmitted. The services that can be supported using circuit or packet connection mode include voice, video, image and data. (see Appendix A-1 of the Communications Document for a complete description.)

Not shown in the Figure 3-3 are location services. These fall in two categories: (1) the services that do not use the communication network (i.e., GPS, and stand alone terrestrial systems); (2) location services that use the network for providing the service (e.g., cellular based systems). In the latter case, the location services fall under the interactive services. The service will be rendered by a service provider in response to a request for information or help.

3.1.2 Logical Communication Functions

Based on the objectives of the communication architecture, a list of logical functions to support the ITS system communication requirements are identified. The primary logical communication functions can be confined to: wireless and wireline access, switching, routing, registration authentication, inter working, validation, billing, and operations (see Appendix A-2 of the Communications Document for a detailed description.).

3.1.3 Functional Entities

The functional entities that make up the communication layer were derived from existing and emerging infrastructure specifications and standards (*e.g.*, TIA, ITU, Bellcore, ANSI). These basic building blocks form the foundation of a generic communication system. As with the transportation layer, each functional entity consists of one or more logical functions. These entities include: 1) user device, 2) user profile module, 3) switch, 4) wireless controller, 5) wireless base station, 6) inter working platform, 7) profile data base, and 8) wireline network. The detail description of these functional entities is presented in Appendix A-3 of the Communications Document.

3.1.4 Communication Network Reference Model

As shown previously in Figure 3-1, the communication architecture design process consists of several steps. The previous sections listed the communication logical functions and physical entities. The architecture design process now starts on the lower leg of Figure 3-1 with the development of the Communication Network Reference Model. This model provides an architecture or structure that shows how various communication technologies can implement the Architecture Interconnect Diagrams developed in the next section.

The network reference model for ITS is depicted in Figure 3-4, and is a generic abstraction which builds upon several reference models developed for standard commercial systems. Boxes represent the various physical

equipment (with descriptive uppercase letters) that perform the communication functions. Identified by lowercase letters (*s*, *v*, u_1, u_2, u_3) are the interfaces important to ITS. They are described in the following paragraphs.

The most important reference point is the wireless interface (*u*) connecting the WBS and the wireless transceiver. To meet the objectives of the national ITS Architecture it will be necessary in some cases that the air interface become standard. The wireless portion of the architecture is manifested in 3 different ways. The *u* interface is realized in three ways: u_1, u_2, u_3, with each interface corresponding to one of the wireless manifestations, as follows:

- u_1 defines the wide area wireless air-link with one of a set of base stations providing connections to mobile or mobile or untethered users. It is typified by the current cellular telephone and data networks or the larger cells of Specialized Mobile Radio for two way communication, as well as paging and broadcast systems.

- u_2 defines the short-range air-link used for close-proximity (less than 50–100 feet) transmissions between a mobile user and a base station, typified by transfers of vehicle identification numbers at toll booths; and

- u_3 addresses the vehicle-vehicle (AHS-type) air-link, for high data rate, burst, usually line-of-sight transmission with high reliability between vehicles, where standards are in their infancy.

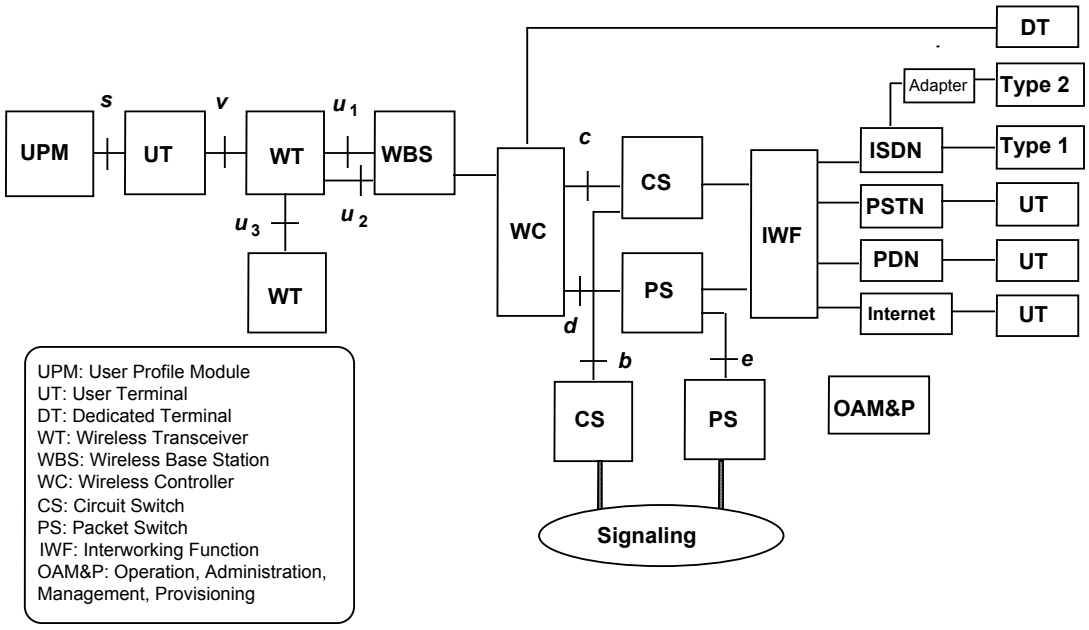


Figure 3-4 Network Reference Model for the Communications Layer

The National ITS architecture provides for implementation flexibility. Various of the data flows in the Architecture can be carried over multiple of these interfaces, and the final choices would be made by the local implementers. This flexibility is depicted conceptually in Figure 3-5.

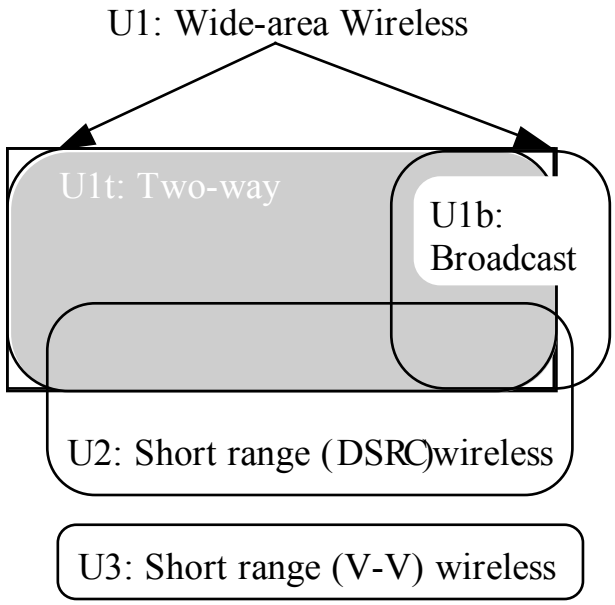


Figure 3-5 Implementation Flexibility

Since the wireline segment encompasses standard wireline configurations, the ITS-critical elements from a standards perspective are those comprising the wireless portion on the left side of Figure 3-4. The wireless portion consists of the User Profile Module (UPM), the User Terminal (UT), the Wireless Transceiver (WT) and the Wireless Base Station (WBS). The connections through the Dedicated Terminal and various User Terminals are shown in the column of boxes on the right. The equipment in the center is the existing public telecommunications services, so the details are transparent to ITS, which is a major benefit to the ITS community. *All management, operations, expansion, and improvement costs are shared with the wider set of all telecommunications users.*

This is an important point to jurisdictions and agencies who prefer to procure and trench their own network along the right-of-way. Whereas a financial sensitivity analysis may point to a private solution, it frequently does not fully consider the large and sustained Operation, Administration, Management , and Provisioning (OAM&P) fees that the agency will have to pay the telecommunications vendor during the system's life cycle.

Appendix A-4 of the Communications Document presents a detailed description of the wireline side of the above network reference model, in addition to a more thorough treatment for the required interfaces, such as switches, controllers, and terminals. This appendix also presents the network entities, interfaces, and signaling plane, and includes a discussion on circuit connection and data packet transmission.

3.2 Communication Layer Linkage

This Communication Layer Linkage Section further identifies the relationship between the Transportation Layer and Communication Layer definitions. This is accomplished by mapping the communication services to the data flows identified in the Transportation Layer, generating the Architecture Interconnect Diagrams (AIDs),

identifying the Architecture Renditions (ARs), mapping the AIDs to the ARs, finally identifying the Architecture Interconnect Specifications (AISs) (based on the technology assessment).

3.2.1 Mapping Communication Services to Data Flows

Mapping of the communication services to the data flows establishes the first link between the transportation layer and the communication layer, and this initial link depends on the completion of two technical architecture milestones. First, the message sizes and data transfer requirements are broadly identified. Second, the physical architecture that allocates logical functions (see Logical Architecture Document) to subsystems necessitates a partitioning exercise, which defines the data flows that require communication. This mapping is an iterative procedure, calibrated by feedback from the logical and physical architectures (and in turn the ITS stakeholders) by retracing the steps shown in Figure 3-1.

Appendix A-5 of the Communications Document details the mapping process. It also depicts the assigned communication service for each data flow with the corresponding rationale.

3.2.2 Architecture Interconnect Diagrams

As denoted in Figure 3-2, this section presents the development of the Architecture Interconnect Diagrams (AIDs). These diagrams show the subsystem-to-subsystem communication interfaces of all transportation subsystem entities (defined in the transportation part of the Physical Architecture). The diagrams identify the communication mode and partition, either wireline or one of three types of wireless connection, as well as documenting the rationale for of these choices when needed for clarification. The diagrams identify the requirements, developed from the physical relationships of the various subsystem entities, but do not force any specific communication technology to be used. The information contained in the AIDs can be traced to the information provided in the Data Flow-Communications Service Mapping Table (Appendix A-5 of the Communications Document).

A template is used to illustrate the interconnections between entities and between modules and is described next. At this stage in the physical architecture, no AIDs are defined for inter-module information transfer within a simple entity. In fact, from the communication layer perspective, this is not necessary. The most important goal is to identify the inter-entity interconnectivity.

The subsections that follow describe the AID template, present the Level 1 and Level 0 (top level) AID's.

3.2.2.1 AID Template

As depicted in Figure 3-6, each AID shows the two communicating transportation subsystem entities, the interconnection partition (i.e., wireline, wireless, or both), and a characterization of the interconnection. The latter is not a link-specific description, which the AIS provides, but a high-level interpretation in terms of services and operation modes. When not obvious, the choice of operation mode is based on the rationale provided in Table 3.3-

1. The interconnect description for each AID provides a data flow, service and operation mode description for each data flow between the two entities. The Data Flow information also provides directionality when more than one data flow exists between the entities, not all of which are in the same direction. If all the data flows are in the same direction, no indication is given and the data flows from the left entity to the one on the right.

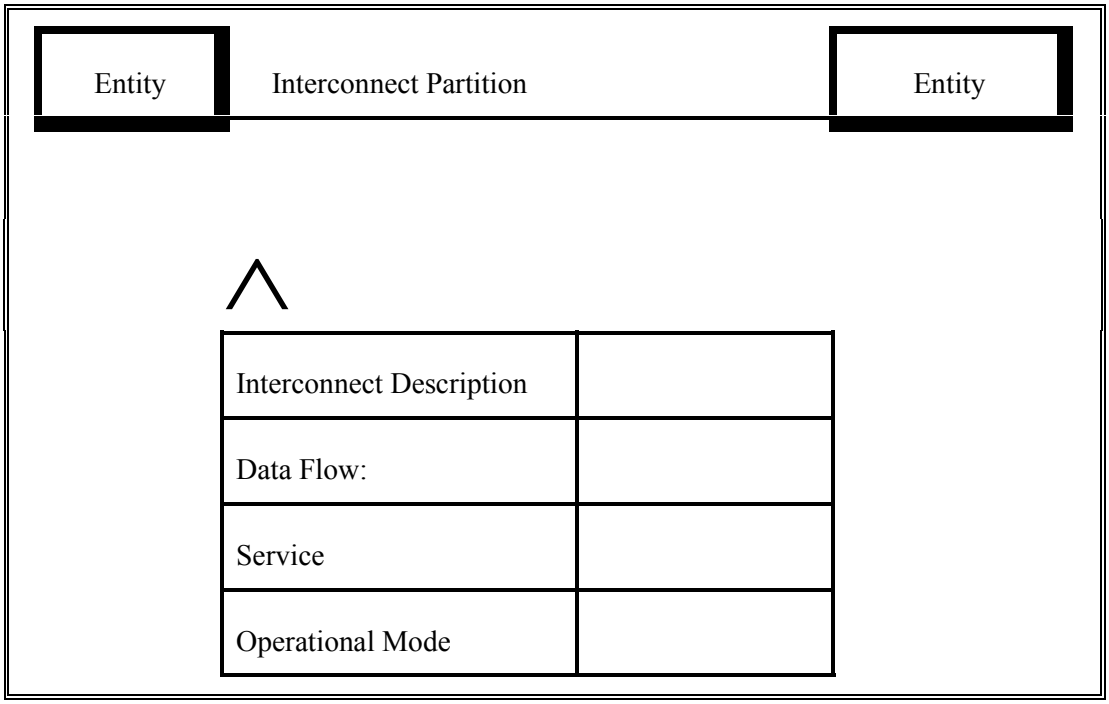


Figure 3-6 Template for the Architecture Interconnect Diagram (AID)

3.2.2.2 Level 1 AIDs

Using the AID template and Table A.5-1, Data Flow – Communication Services Mapping Table, the data flows are represented in an Architecture Interconnect Diagram (AID) format. A single example is presented here in Figure 3-7, and various others are compiled in Appendix B of the Communications Document.

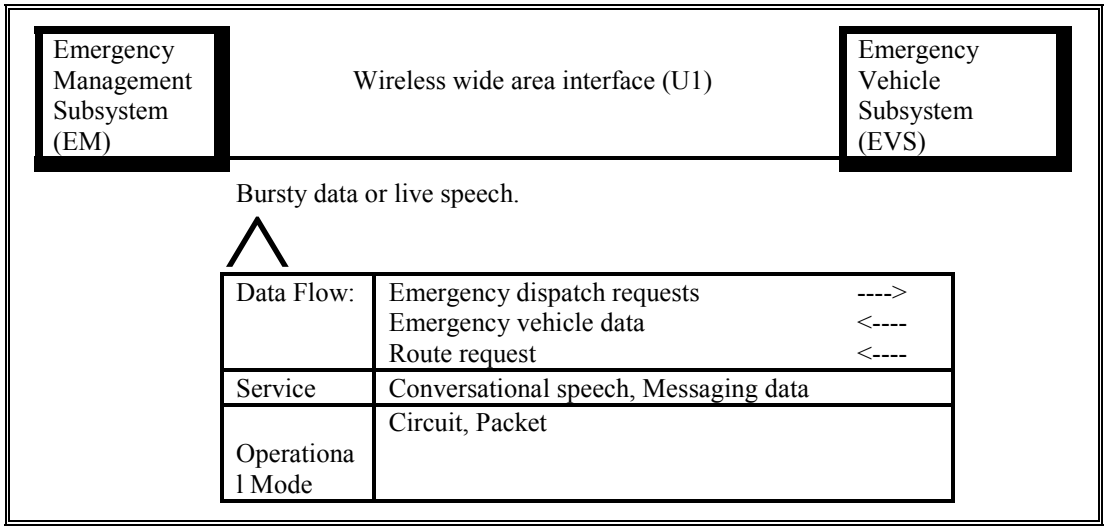


Figure 3-7 Example of AID Level-1

3.2.2.3 Level 0 AID

The Level 0 Architecture Interconnect Diagram shows all communications connectivity required by the Physical Architecture. Several different versions of these diagrams have been generated during the course of architecture development. is a comprehensive interconnect diagram that shows all interconnects between subsystems as well as between subsystems and terminators. This results in a figure that has over 150 connections between more than 70 entities. The figure has been filtered to remove human interconnects and physical/environmental interconnects since these are not the focus of the communications layer. Figure 2-9 shows only the interconnects between subsystems in the architecture which are the primary focus of the communications analysis. This figure is a percolation to a top level of all the detailed, level 1 AID's. It presents all the interfaces between the physical subsystem entities, capturing the wireline (*w*) or wireless (u_1, u_2, or u_3) nature of the interfaces in the ITS architecture. As such, it is a comprehensive, albeit not complete, representation of the ITS communication architecture. More detailed variations can be easily derived from it. For example, Figure 3-10shows the data flows using the U1b wide area wireless broadcast "sub-interface". Figure 3-11 shows the subset that uses either of U1t (two-way wide area wireless) or U1b (wide area wireless broadcast). Note that U1b does not imply a certain technology – FM subcarrier, paging, messaging data networks are possible implementations; they all tend to use a broadcast protocol in the forward, i.e.; fixed to mobile, direction.

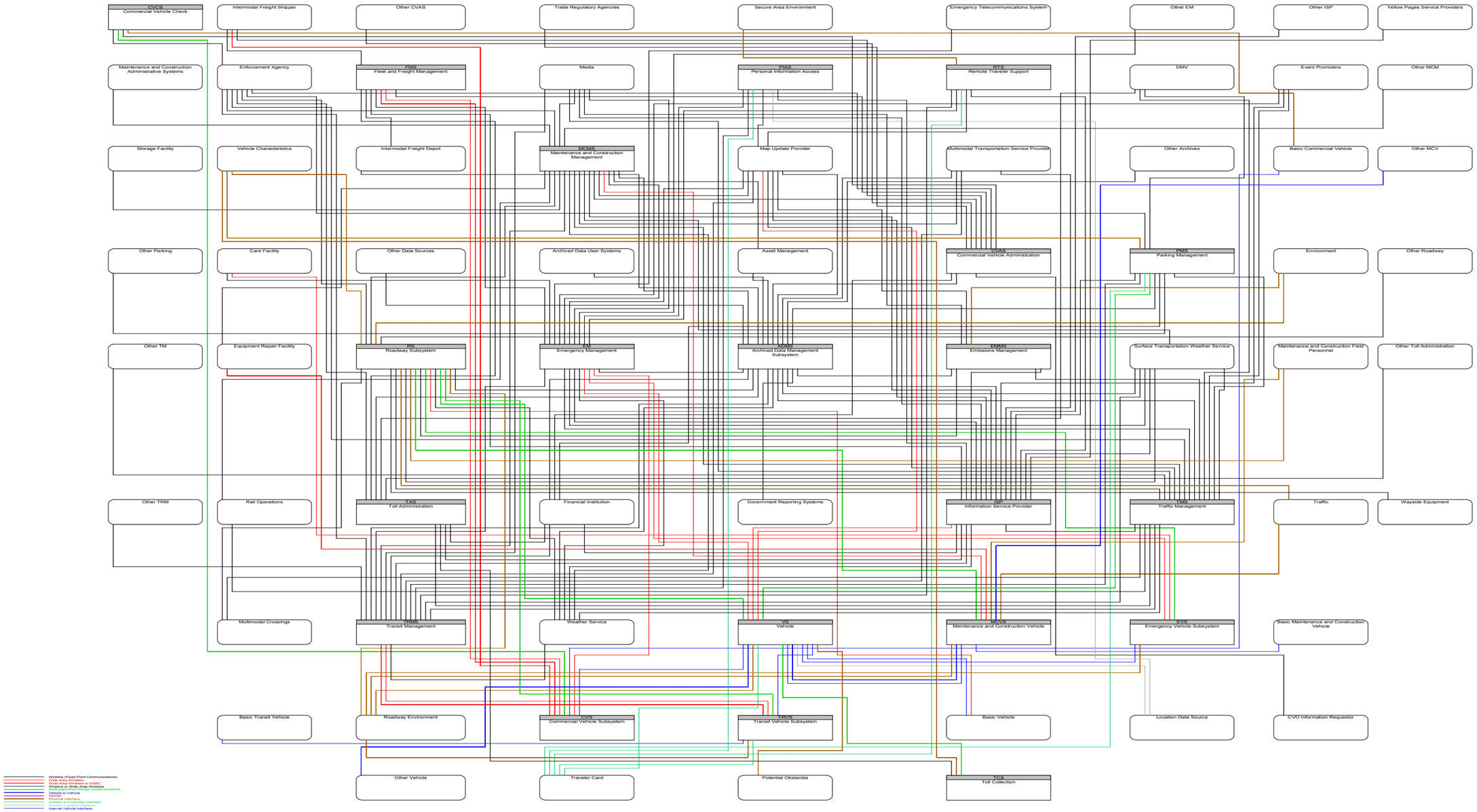


Figure 3-8 Level 0 Architecture Interconnect Diagram for the National ITS Architecture

(Interconnects Between Subsystems & Between Subsystems And Terminators)

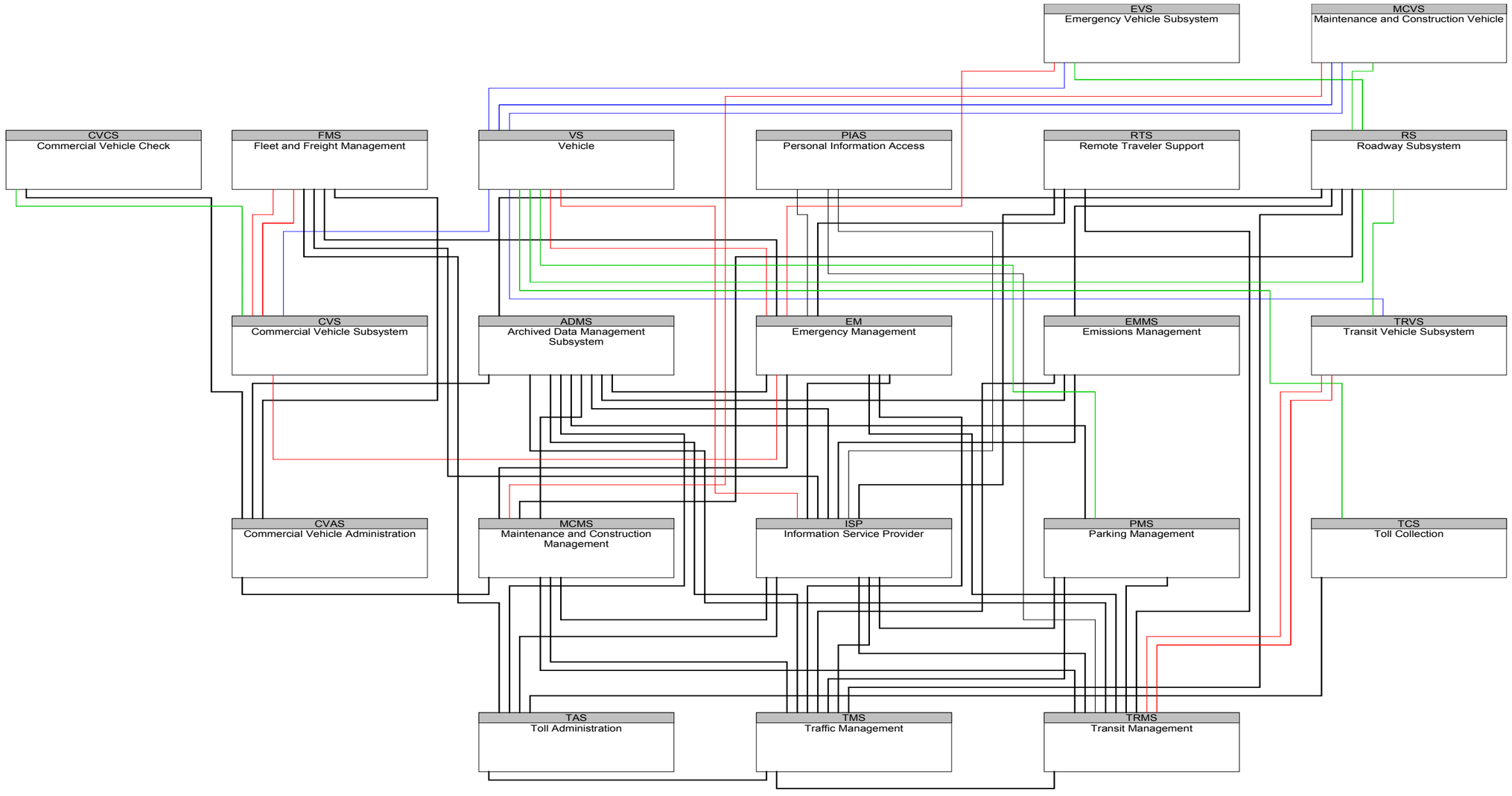

EVS
Emergency Vehicle Subsystem
MCVS
Maintenance and Construction Vehicle
CVCS
Commercial Vehicle Check
FMS
Fleet and Freight Management
VS
Vehicle
PIAS
Personal Information Access
RTS
Remote Traveler Support
RS
Roadway Subsystem
CVS
Commercial Vehicle Subsystem
ADMS
Archived Data Management Subsystem
EM
Emergency Management
EMMS
Emissions Management
TRVS
Transit Vehicle Subsystem
CVAS
Commercial Vehicle Administration
MCMS
Maintenance and Construction Management
ISP
Information Service Provider
PMS
Parking Management
TCS
Toll Collection
TAS
Toll Administration
TMS
Traffic Management
TRMS
Transit Management
Wireline (Fixed Point Communications)
Wide Area Wireless
Wide Area Wireless or DSRC
Wireline or Wide Area Wireless
Dedicated Short Range Communications
Vehicle to Vehicle
Human
Physical Interface
Contact or Proximity Interface
Position Location Interface
Internal Vehicle Interface

Figure 3-9 Level 0 Architecture Interconnect Diagram for the National ITS Architecture

(Interconnects Between Subsystems Only)

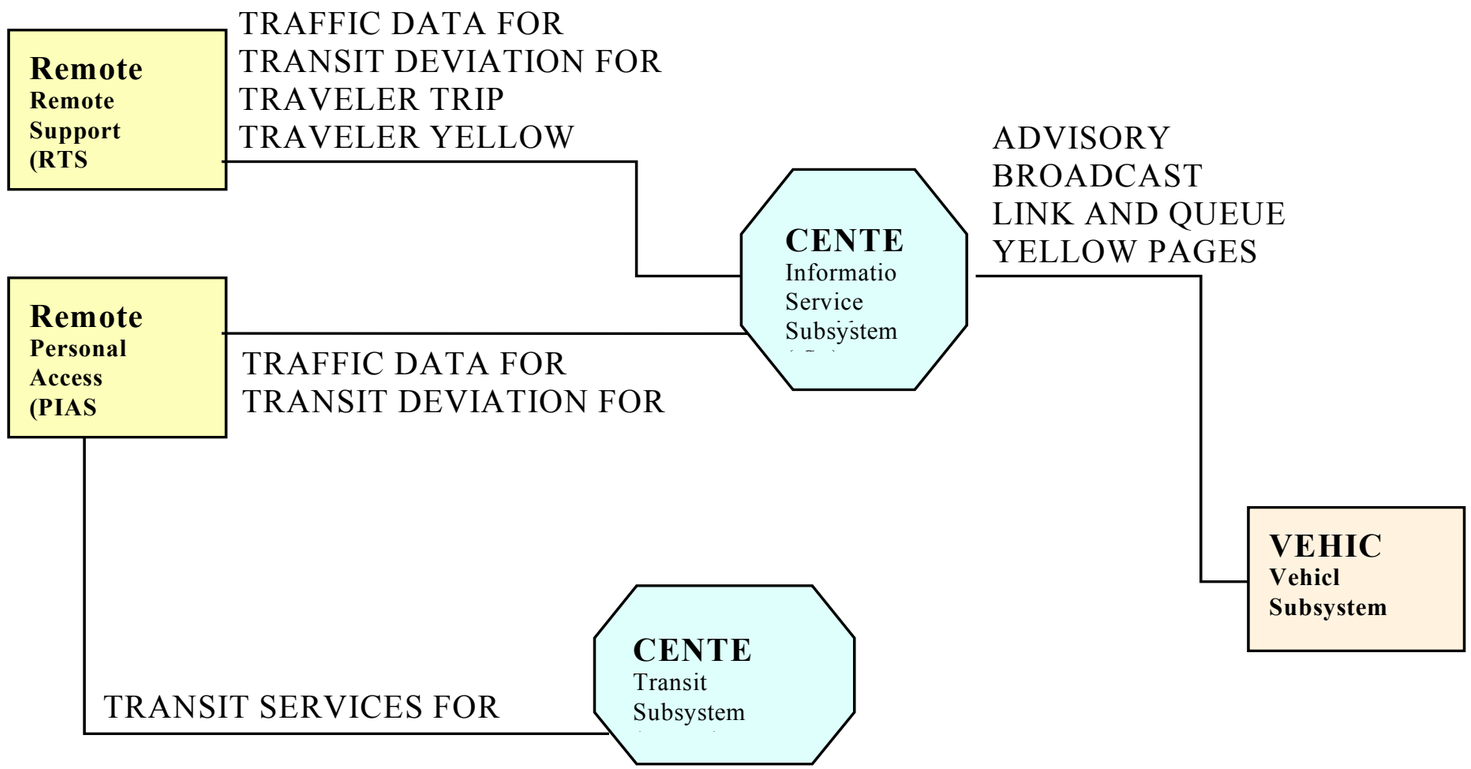


Figure 3-10 Level 0 Architecture Interconnect Diagram for the National ITS Architecture

(Subset showing U1b data flows)

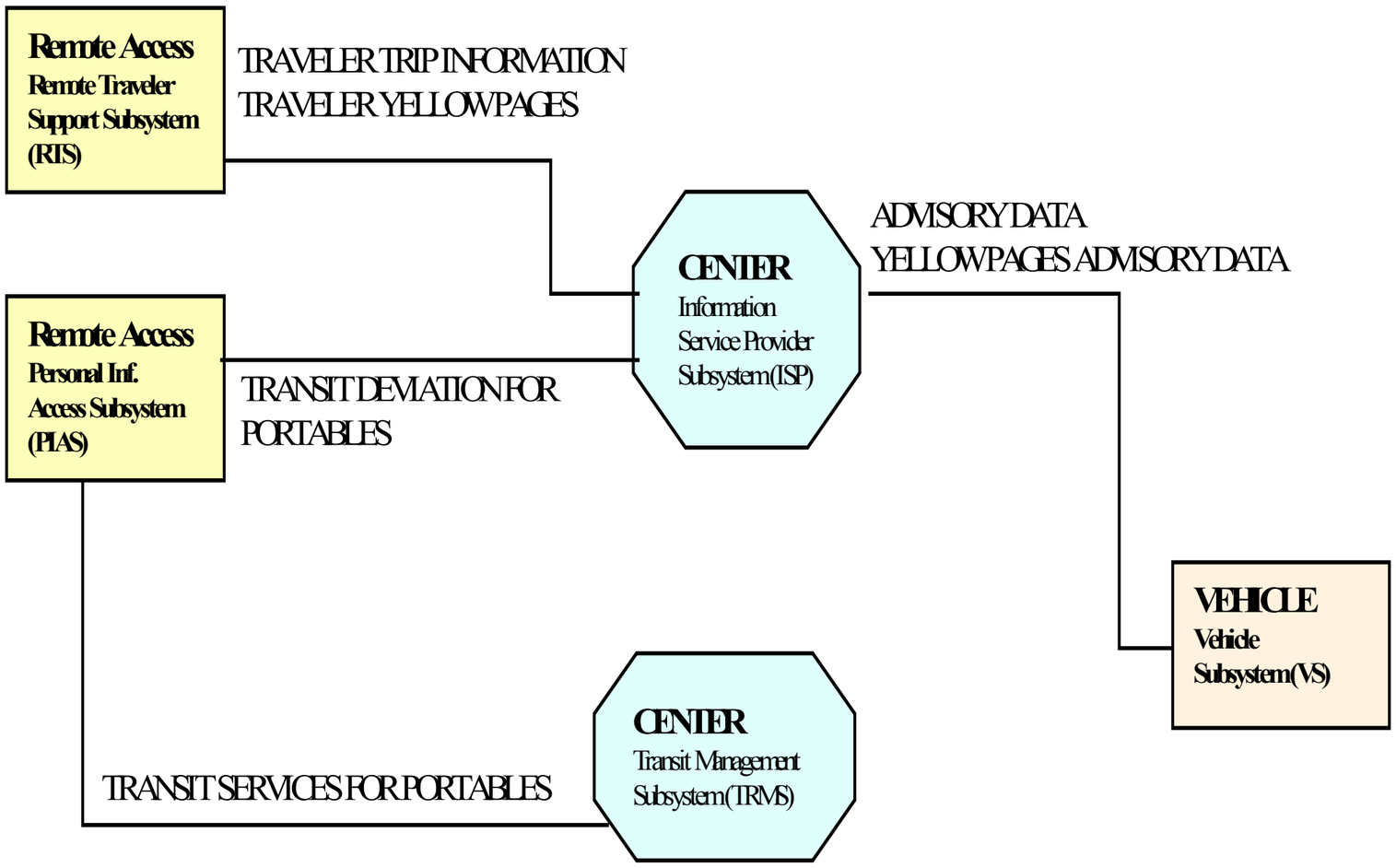


Figure 3-11 Level 0 Architecture Interconnect Diagram for the National ITS Architecture;

(Subset showing data flows using either U1t or U1b)

3.2.3 Architecture Renditions

The next step in the communications architecture design process is the development of the communication Architecture Renditions, as depicted in Figure 3-2. Combining elements from the Generic Communication Model (Figure 3-3) and the ITS Communication Network Reference Model (Figure 3-5) provides a more detailed view of the flow of information between two users. This information includes communication services and operational modes (i.e., circuit switched, packet switched, etc.). The architecture renditions are essentially examples of how to provide connections between users based on the communications network reference model and the evaluations of classes of feasible implementations.

Two levels of renditions are generated. A Level 1 rendition is generated for each of the possible interconnections between services. The Level 0 Rendition (the top level) shows the full connectivity between users over multiple links. The details of the renditions, how they are generated, and those that apply to the different interconnections in the architecture are provided in Appendix C of the Communications Document; an example of a Level-1 rendition and the Level-0 will be provided here to support the subsequent task of AIS generation.

3.2.3.1 Level 1 Rendition

Figure 3-11depicts level 1 renditions for the wide-area wireless communication link (u1) through switched networks. This figure depicts interconnection between tetherless users or tetherless and stationary users, utilizing two distinct classes of wide-area wireless technologies. Several technologies or systems can fit within each rendition. For example, CDPD, RAM, ARDIS and so on are possibilities for implementing the packet-switched wireless data network (shown on the right-hand-side of the diagram in Figure 3-12.

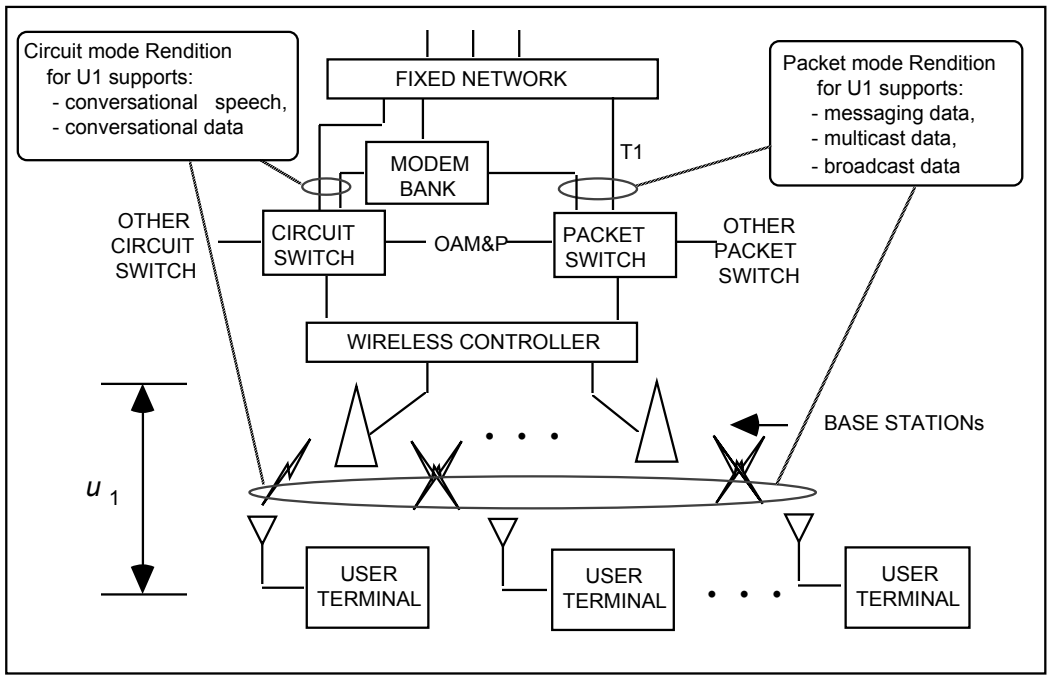


Figure 3-12 Rendition 1 — Wide-Area Wireless (u1) Link Through Switched Networks

3.2.3.2 Level 0 Rendition

Figure 3-13 illustrates the Level 0 rendition. It represents a composition of all the renditions to reflect the combined needs of the architecture. This rendition shows a user communicating to another user, central office or a base station over various communication links such as u1, u2, u3 and w. Again, the details of this mapping are provided in Appendix C.1.1 of the Communications Document.

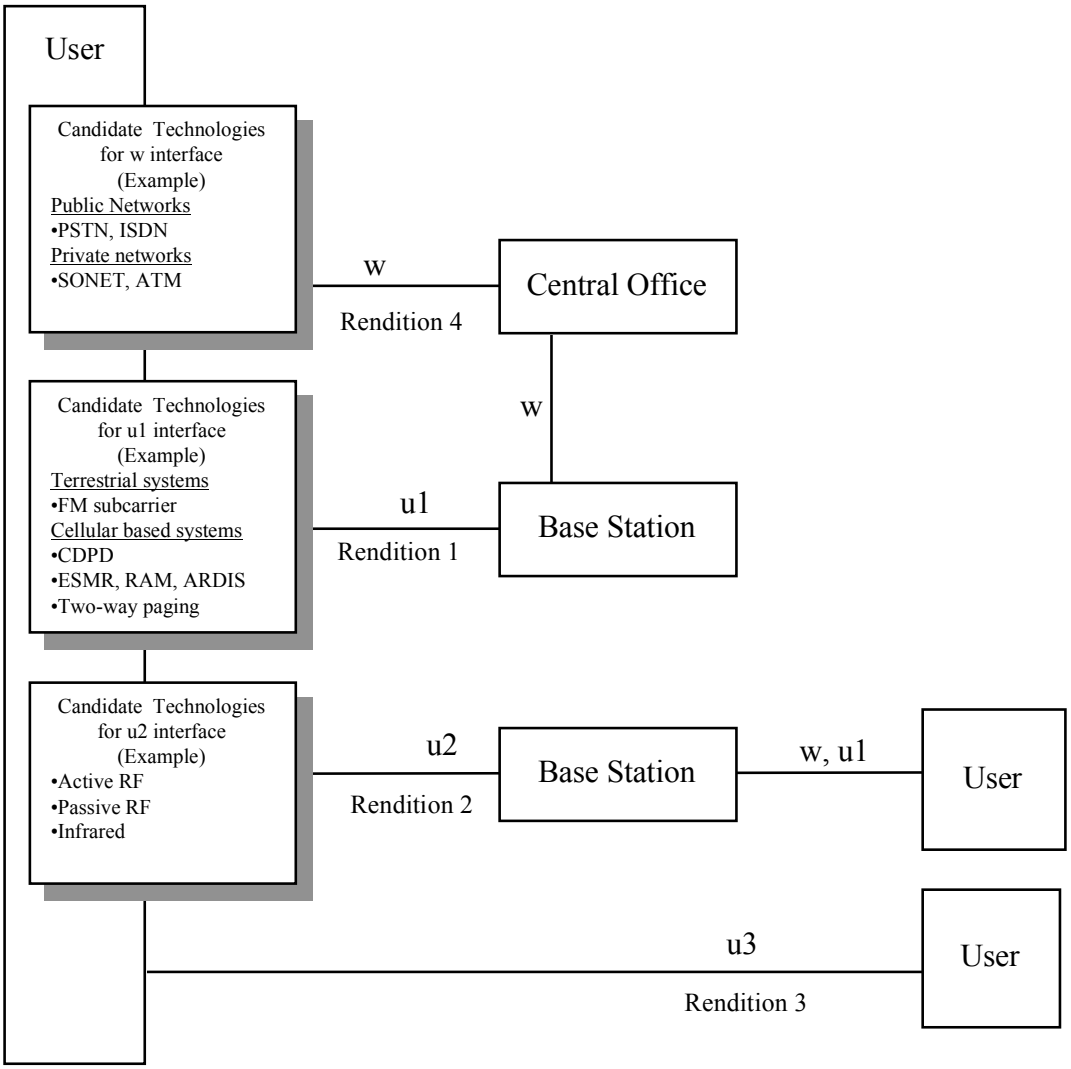


Figure 3-13 Level 0 Rendition

3.2.4 Architecture Interconnect Specifications

The Architecture Interconnect Specifications (AISs) are now developed from the technology assessment and refined by combining the renditions with applicable technologies and evaluating the achievable performance (Figure 3-1). This involves mapping the applicable communication technologies to the renditions.

To facilitate the mapping of the communication technologies to the renditions, the candidate wireless and wireline technologies are surveyed. The candidate technologies are further assessed and their performance is evaluated from the National ITS Architecture standpoint. For example, the assessment includes: short range and wide area, one-way and two-way wireless data communication. Systems analyzed include terrestrial networks (e.g., cellular, ESMR), FM broadcast, and satellite systems for mobile and fixed services. The details of this survey are presented in Appendix D of the Communications Document, with the assessment results summarized in Chapter 7 of the Communications Document.

The results of this assessment are used in identifying the candidate technologies to support level 0 and level 1 renditions. The results of this mapping are summarized below.

It is apparent from the matrices provided the Technology Assessment Section (Section 7.5 of the Communications Document) that for the foreseeable future, wireless data networks (such as CDPD, RAM, etc.) form the class of communication systems most suitable to interactive wide area wireless ITS links (u1t). The infrastructure is already largely available (short, in some areas, of adding the appliqué equipment). Service costs are already low, and equipment costs are coming down. Coverage nationally is excellent with the possible shortcoming that it may not for some tine be available in rural and remote areas. Yet with the advent of innovative solutions like circuit-switched CDPD, which utilizes the AMPS cellular infrastructure in a manner transparent to a CDPD subscriber, this problem would be largely mitigated. In any event, for ITS users how insist on uninterrupted coverage in remote areas, holes in the coverage of terrestrial cell-based systems can be supplemented by satellite communication systems.

Figure 3-14 depicts the use of CDPD in a u1 communication architecture rendition to create an example of Architecture Interconnect Specification.

According to internal market research and analysis, users are concerned with two overshadowing factors: cost and quality. The Architecture Development Team believes that the market will determine the winning technologies which will gain wide scale acceptance.

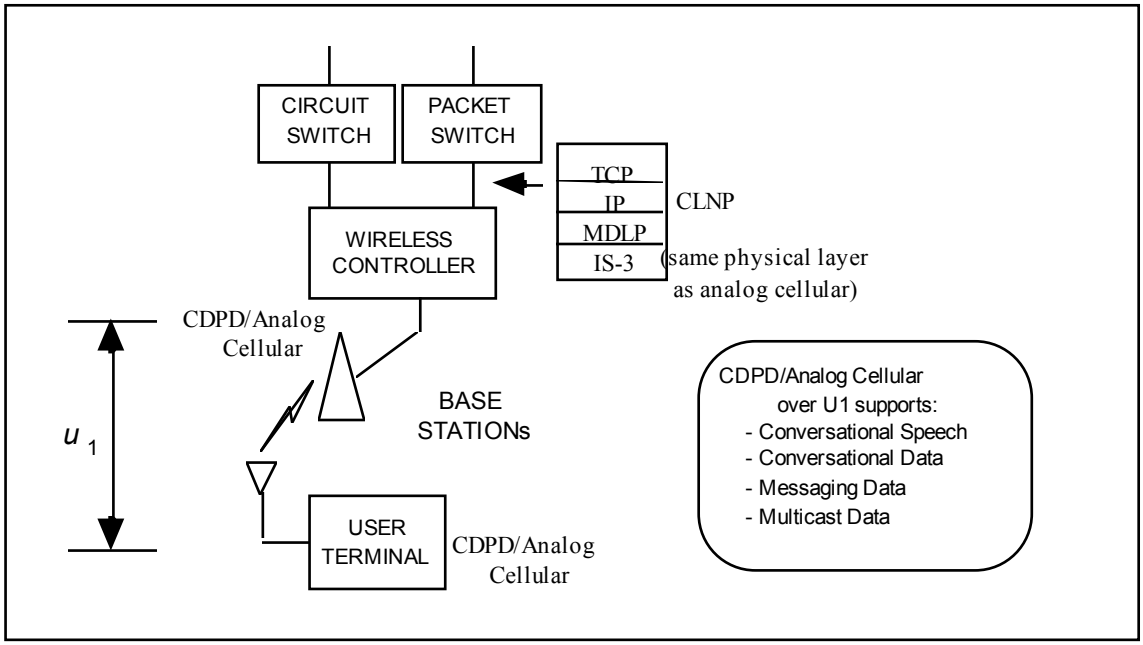


Figure 3-14 AIS Example Using CDPD for Wide Area Wireless (u1)

Table 3.2-1 provides an illustration of candidate technologies for the different wireless data flows within the context of the communication layer of the ITS Architecture. In addition to wireless data networks, for wide area ITS data flows, the short range wireless interface u_2 comprises a distinct set of communication services and supporting radio technologies. In a real world ITS implementation, the system designer makes use of the technology assessments of Chapter 7 of the Communications Document, and the ITS architecture communication renditions presented above, to select the specific communication systems/technologies most appropriate for the deployment at hand.

Table 3.2-1 Examples of Candidate Technologies for Wireless Data Flows

wide-area wireless interface (messaging services; bursty data transfers)		
Source	**Architecture Flow**	**Destination**
CVAS	**Electronic credentials**	FMS
CVAS	**Safety information**	CVCS
CVS	**Driver & vehicle information**	FMS
CVS	**On board vehicle data**	FMS
EM	**emergency dispatch requests**	EVS
EM	**emergency acknowledge**	VS
EM	**emergency acknowledge**	RTS
EM	**emergency acknowledge**	PIAS
EVS	**Emergency vehicle driver status update**	EM
EVS	**Emergency vehicle driver input**	EM
EVS	**Emergency vehicle dispatch acknowledge**	EM
FMS	**fleet to driver update**	CVS
PIAS	**Demand responsive transit request**	TRMS
PIAS	**Traveler information request**	ISP
PIAS	**Emergency notification**	EM
RTS	**Emergency notification**	EM
TRMS	**Demand responsive transit request**	PIAS
TRMS	**Request for vehicle measures**	TRVS
TRMS	**Route assignment**	TRVS
TRVS	**Emergency notification**	TRMS
TRVS	**Vehicle probe data**	TRMS
TRVS	**Traveler information request**	TRMS
VS	**vehicle probe data**	ISP
VS	**emergency notification**	EM
VS	**Traveler information request**	ISP
VS	**map update request**	X23

U1 - Circuit Switched data (Messaging; larger data transactions, e.g., compressed image)		
Source	**Architecture Flow**	**Destination**
ISP	**Traveler information**	PIAS
ISP	**Traveler information**	VS
X23 MAP Update Provider	**Map updates**	PIAS
X23 MAP Update Provider	**Map updates**	VS

U1 - Circuit Switched Voice (live voice interaction; early implementations)		
Source	**Architecture Flow**	**Destination**
EM	**Assigned route**	EVS
EM	**Hazmat information**	EVS
EM	**Emergency dispatch requests**	EVS
EM	**Emergency acknowledge**	RTS
EVS	**Emergency vehicle driver status update**	EM
EVS	**Emergency vehicle driver input**	EM

RTS	**Emergency notification**	EM
VS	**Emergency notification**	EM

U1 - FM Subcarrier Broadcast Services (Broadcast of free services and services that require subscription; e.g., traveler information,)		
source	**Architecture Flow**	**destination**
ISP	**Broadcast information**	PIAS
ISP	**traveler information**	VS
ISP	**broadcast information**	VS
ISP	**broadcast information**	RTS

U1 - Multicast Services (Distribution services that require subscription; e.g., map updates)		
source	**Architecture Flow**	**destination**
ISP	**traveler information**	PIAS
ISP	**traveler information**	VS
ISP	**broadcast information**	VS
ISP	**broadcast information**	RTS
X23 MAP update provider	**map updates**	PIAS
X23 MAP update provider	**map updates**	VS

U2 - RF beacon for close-proximity wireless communication between vehicle and roadside		
Source	Architecture Flow	Destination
CVS	**screening data**	CVCS
CVS	**on board safety data**	CVCS
CVCS	**safety inspection record**	CVS
CVCS	**Pull in message**	CVS
EVS	**Emergency vehicle preemption request**	RS
PMS	**Tag update**	VS
RS	**AHS control data**	VS
RS	**vehicle signage data**	VS
RS	**intersection status**	VS
TCS	**Request tag data**	VS
TRVS	**signal priority request**	RS
VS	**Tag data**	TCS
VS	**AHS vehicle data**	RS
VS	**Tag data**	PMS

Appendix A

Table A.1 Physical Architecture Flows - Interconnects - Interoperability Requirements

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Archived Data Administrator	Archived Data Management Subsystem	archive management requests	H	Human Interface	product	H	
Archived Data Management Subsystem	Archived Data Administrator	archive management data	H	Human Interface	product	H	
Archived Data Management Subsystem	Archived Data User Systems	archive analysis results	W	Messaging data	national	13	
Archived Data Management Subsystem	Archived Data User Systems	archive request confirmation	W	Messaging data	national	13	
Archived Data Management Subsystem	Archived Data User Systems	archived data products	W	Messaging data	national	13	
Archived Data Management Subsystem	Asset Management	archive requests	W	Messaging data	regional	13	
Archived Data Management Subsystem	Asset Management	archive status	W	Messaging data	regional	13	
Archived Data Management Subsystem	Commercial Vehicle Administration	archive requests	W	Messaging data	regional	13	
Archived Data Management Subsystem	Commercial Vehicle Administration	archive status	W	Messaging data	regional	13	
Archived Data Management Subsystem	Emergency Management	archive requests	W	Messaging data	regional	13	
Archived Data Management Subsystem	Emergency Management	archive status	W	Messaging data	regional	13	
Archived Data Management Subsystem	Emissions Management	archive requests	W	Messaging data	regional	13	
Archived Data Management Subsystem	Emissions Management	archive status	W	Messaging data	regional	13	
Archived Data Management Subsystem	Financial Institution	payment request	W	Conversational data, Messaging data	national	E	F
Archived Data Management Subsystem	Government Reporting Systems	government reporting system data	W	Messaging data	national	13	
Archived Data Management Subsystem	Information Service Provider	archive requests	W	Messaging data	regional	13	
Archived Data Management Subsystem	Information Service Provider	archive status	W	Messaging data	regional	13	
Archived Data Management Subsystem	Intermodal Freight Depot	archive requests	W	Messaging data	regional	13	

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Archived Data Management Subsystem	Intermodal Freight Depot	archive status	W	Messaging data	regional	13	
Archived Data Management Subsystem	Maintenance and Construction Management	archive requests	W	Messaging data	regional	13	
Archived Data Management Subsystem	Maintenance and Construction Management	archive status	W	Messaging data	regional	13	
Archived Data Management Subsystem	Map Update Provider	map update request	W	Messaging data	national	13	
Archived Data Management Subsystem	Multimodal Transportation Service Provider	archive requests	W	Messaging data	regional	13	
Archived Data Management Subsystem	Multimodal Transportation Service Provider	archive status	W	Messaging data	regional	13	
Archived Data Management Subsystem	Other Archives	archive coordination	W	Messaging data	national	13	
Archived Data Management Subsystem	Other Data Sources	archive requests	W	Messaging data	national	13	
Archived Data Management Subsystem	Other Data Sources	archive status	W	Messaging data	national	13	
Archived Data Management Subsystem	Parking Management	archive requests	W	Messaging data	regional	13	
Archived Data Management Subsystem	Parking Management	archive status	W	Messaging data	regional	13	
Archived Data Management Subsystem	Roadway Subsystem	data collection and monitoring control	W	Messaging data	product	13	T
Archived Data Management Subsystem	Surface Transportation Weather Service	archive requests	W	Messaging data	regional	13	
Archived Data Management Subsystem	Surface Transportation Weather Service	archive status	W	Messaging data	regional	13	
Archived Data Management Subsystem	Toll Administration	archive requests	W	Messaging data	regional	13	
Archived Data Management Subsystem	Toll Administration	archive status	W	Messaging data	regional	13	
Archived Data Management Subsystem	Traffic Management	archive requests	W	Messaging data	regional	13	
Archived Data Management Subsystem	Traffic Management	archive status	W	Messaging data	regional	13	
Archived Data Management Subsystem	Transit Management	archive requests	W	Messaging data	regional	13	

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Archived Data Management Subsystem	Transit Management	archive status	W	Messaging data	regional	13	
Archived Data Management Subsystem	Weather Service	archive requests	W	Messaging data	regional	13	
Archived Data Management Subsystem	Weather Service	archive status	W	Messaging data	regional	13	
Archived Data User Systems	Archived Data Management Subsystem	archive analysis requests	W	Messaging data	national	13	
Archived Data User Systems	Archived Data Management Subsystem	archived data product requests	W	Messaging data	national	13	
Asset Management	Archived Data Management Subsystem	asset archive data	W	Messaging data	regional	13	
Asset Management	Maintenance and Construction Management	asset inventory	W	Messaging data	regional	14	
Asset Management	Maintenance and Construction Management	asset restrictions	W	Messaging data	regional	14	
Asset Management	Maintenance and Construction Management	maintenance and repair needs	W	Conversational data, Messaging data	regional	14	
Basic Commercial Vehicle	Commercial Vehicle Check	CVO weight and presence	P	Physical Interface	NA	B	
Basic Commercial Vehicle	Commercial Vehicle Check	identification information	P	Physical Interface	NA	B	
Basic Commercial Vehicle	Commercial Vehicle Subsystem	commercial vehicle measures	V	Messaging data	product	I	R
Basic Maintenance and Construction Vehicle	Maintenance and Construction Vehicle	maint and constr material information	V	Messaging data	regional	I	
Basic Maintenance and Construction Vehicle	Maintenance and Construction Vehicle	maint and constr vehicle measures	V	Messaging data	regional	I	
Basic Transit Vehicle	Transit Vehicle Subsystem	transit vehicle measures	V	Messaging data	product	I	R
Basic Vehicle	Vehicle	basic vehicle measures	V	Messaging data	product	I	R
Care Facility	Emergency Management	care facility status	W	Conversational data, Messaging data	regional	09A	E
Care Facility	Emergency Vehicle Subsystem	care facility status	U1t	Conversational data, Messaging data	regional	D	E
Commercial Vehicle Administration	Archived Data Management Subsystem	commercial vehicle archive data	W	Messaging data	regional	13	
Commercial Vehicle Administration	Commercial Vehicle Check	border agency clearance results	W	Conversational data, Messaging data	regional	04	
Commercial Vehicle Administration	Commercial Vehicle Check	credentials information	W,U1t	Conversational data, Messaging data	regional	04	

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Commercial Vehicle Administration	Commercial Vehicle Check	credentials status information	W	Conversational data, Messaging data	regional	04	
Commercial Vehicle Administration	Commercial Vehicle Check	safety inspection report	W,U1t	Conversational data, Messaging data	regional	04	
Commercial Vehicle Administration	Commercial Vehicle Check	safety status information	W	Messaging data	regional	04	
Commercial Vehicle Administration	Commercial Vehicle Check	transportation border clearance assessment	W	Conversational data, Messaging data	regional	04	
Commercial Vehicle Administration	Commercial Vehicle Check	trip declaration identifiers	W	Messaging data	regional	04	
Commercial Vehicle Administration	CVO Information Requestor	credentials information	W	Messaging data	national	04	
Commercial Vehicle Administration	CVO Information Requestor	credentials status information	W	Messaging data	national	04	
Commercial Vehicle Administration	CVO Information Requestor	safety status information	W	Messaging data	national	04	
Commercial Vehicle Administration	Enforcement Agency	accident report	W	Messaging data	national	04	P
Commercial Vehicle Administration	Enforcement Agency	citation	W	Conversational data, Messaging data	regional	04	P
Commercial Vehicle Administration	Enforcement Agency	violation notification	W	Messaging data	regional	04	P
Commercial Vehicle Administration	Financial Institution	payment request	W	Conversational data, Messaging data	national	E	F
Commercial Vehicle Administration	Fleet and Freight Management	accident report	W	Messaging data	national	04	P
Commercial Vehicle Administration	Fleet and Freight Management	border clearance status	W	Conversational data, Messaging data	national	04	
Commercial Vehicle Administration	Fleet and Freight Management	citation	W	Conversational data, Messaging data	regional	04	P
Commercial Vehicle Administration	Fleet and Freight Management	compliance review report	W	Messaging data	national	04	
Commercial Vehicle Administration	Fleet and Freight Management	credentials information	W,U1t	Messaging data	national	04	
Commercial Vehicle Administration	Fleet and Freight Management	credentials status information	W	Messaging data	national	04	
Commercial Vehicle Administration	Fleet and Freight Management	safety inspection report	W	Messaging data	national	04	

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Commercial Vehicle Administration	Fleet and Freight Management	safety status information	W	Messaging data	national	04	
Commercial Vehicle Administration	Intermodal Freight Shipper	border clearance status	W	Conversational data, Messaging data	national	04	
Commercial Vehicle Administration	Other CVAS	border clearance status	W	Conversational data, Messaging data	national	04	
Commercial Vehicle Administration	Other CVAS	credential fee coordination	W	Messaging data	national	04	
Commercial Vehicle Administration	Other CVAS	credentials information	W	Messaging data	national	04	
Commercial Vehicle Administration	Other CVAS	credentials status information	W	Messaging data	national	04	
Commercial Vehicle Administration	Other CVAS	safety inspection report	W	Messaging data	national	04	
Commercial Vehicle Administration	Other CVAS	safety status information	W	Messaging data	national	04	
Commercial Vehicle Administration	Trade Regulatory Agencies	border clearance status	W	Conversational data, Messaging data	national	04	
Commercial Vehicle Administration	Trade Regulatory Agencies	domestic transportation information	W	Conversational data, Messaging data	national	04	
Commercial Vehicle Administration	Trade Regulatory Agencies	transportation border clearance assessment	W	Conversational data, Messaging data	national	04	
Commercial Vehicle Check	Commercial Vehicle Administration	accident report	W	Messaging data	regional	04	P
Commercial Vehicle Check	Commercial Vehicle Administration	border clearance event	W	Conversational data, Messaging data	regional	04	
Commercial Vehicle Check	Commercial Vehicle Administration	citation	W	Conversational data, Messaging data	regional	04	P
Commercial Vehicle Check	Commercial Vehicle Administration	daily site activity data	W	Messaging data	regional	04	
Commercial Vehicle Check	Commercial Vehicle Administration	safety inspection report	W	Messaging data	regional	04	
Commercial Vehicle Check	Commercial Vehicle Administration	violation notification	W	Messaging data	regional	04	
Commercial Vehicle Check	Commercial Vehicle Driver	CVO pass/pull-in message	H	Human Interface	regional	H	
Commercial Vehicle Check	Commercial Vehicle Subsystem	border clearance data request	U2	Conversational data	national	01A	
Commercial Vehicle Check	Commercial Vehicle Subsystem	border clearance event	U2	Conversational Data	national	01A	T

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Commercial Vehicle Check	Commercial Vehicle Subsystem	driver log request	U2	Messaging data	national	01A	T
Commercial Vehicle Check	Commercial Vehicle Subsystem	electronic lock data request	U2	Conversational Data	national	01A	T
Commercial Vehicle Check	Commercial Vehicle Subsystem	electronic screening request	U2	Conversational data	national	01A	T
Commercial Vehicle Check	Commercial Vehicle Subsystem	on-board safety request	U2	Conversational data	national	01	T
Commercial Vehicle Check	Commercial Vehicle Subsystem	pass/pull-in	U2	Conversational data	national	01	T,R
Commercial Vehicle Check	Commercial Vehicle Subsystem	request tag data	U2	Conversational data	national	01A	
Commercial Vehicle Check	Commercial Vehicle Subsystem	safety inspection record	U2	Conversational Data	national	01	T
Commercial Vehicle Check	Commercial Vehicle Subsystem	safety inspection request	U2	Conversational Data	regional	01A	T
Commercial Vehicle Check	Commercial Vehicle Subsystem	screening event record	U2	Conversational data	national	01A	T
Commercial Vehicle Check	CVO Inspector	CVO inspector information	H	Human Interface	product	H	
Commercial Vehicle Driver	Commercial Vehicle Subsystem	CVO driver initialization	H	Human Interface	product	H	
Commercial Vehicle Driver	Commercial Vehicle Subsystem	trip identification number	H	Human Interface	product	H	
Commercial Vehicle Manager	Fleet and Freight Management	fleet manager inquiry	H	Human Interface	product	H	
Commercial Vehicle Subsystem	Commercial Vehicle Check	border clearance data	U2	Conversational data	national	01A	
Commercial Vehicle Subsystem	Commercial Vehicle Check	driver log	U2	Messaging data	national	01A	T
Commercial Vehicle Subsystem	Commercial Vehicle Check	electronic lock data	U2	Conversational Data	national	01A	T
Commercial Vehicle Subsystem	Commercial Vehicle Check	on-board safety data	U2	Conversational data	national	01A	T
Commercial Vehicle Subsystem	Commercial Vehicle Check	safety inspection record	U2	Conversational Data	national	01A	T
Commercial Vehicle Subsystem	Commercial Vehicle Check	screening event record	U2	Conversational data	national	01A	T
Commercial Vehicle Subsystem	Commercial Vehicle Check	tag data	U2	Conversational data	national	01A	

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Commercial Vehicle Subsystem	Commercial Vehicle Driver	alerts	H	Human Interface	product	H	
Commercial Vehicle Subsystem	Commercial Vehicle Driver	CVO pass/pull-in message	H	Human Interface	product	H	
Commercial Vehicle Subsystem	Commercial Vehicle Driver	trip log information	H	Human Interface	product	H	
Commercial Vehicle Subsystem	Emergency Management	hazmat spill notification	U1t	Messaging data	national	05A	E
Commercial Vehicle Subsystem	Fleet and Freight Management	driver to fleet request	U1t	Messaging data, location data	none	P	
Commercial Vehicle Subsystem	Fleet and Freight Management	on-board safety data	U1t	Conversational data	none	P	
Commercial Vehicle Subsystem	Fleet and Freight Management	on-board vehicle data	U1t,U2	Messaging data	none	P	
Commercial Vehicle Subsystem	Fleet and Freight Management	trip log	U1t	Messaging data	none	P	
Commercial Vehicle Subsystem	Vehicle	commercial vehicle data	V	Messaging data	product	I	
CVO Inspector	Commercial Vehicle Check	CVC override mode	H	Human Interface	product	H	T
CVO Inspector	Commercial Vehicle Check	CVO inspector input	H	Human Interface	product	H	
DMV	Parking Management	registration	W	Messaging data	national	F	
DMV	Toll Administration	registration	W	Messaging data	national	F	P
DMV	Traffic Management	registration	W	Messaging data	national	F	P
Driver	Vehicle	driver inputs	H	Human Interface	product	H	
Driver	Vehicle	request for service	H	Human Interface	product	H	
Emergency Management	Archived Data Management Subsystem	emergency archive data	W	Messaging data	regional	13	
Emergency Management	Care Facility	care facility status request	W	Conversational data, Messaging data	regional	09A	E
Emergency Management	Emergency System Operator	emergency operations status	H	Human Interface	product	H	
Emergency Management	Emergency Telecommunications System	incident notification response	W	Conversational data conversational speech	regional	09	
Emergency Management	Emergency Vehicle Subsystem	emergency dispatch requests	U1t	Conversational speech, Messaging data	regional	D	E

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Emergency Management	Emergency Vehicle Subsystem	incident command information	U1t	Conversational speech, Messaging data	regional	D	E
Emergency Management	Emergency Vehicle Subsystem	suggested route	U1t	Conversational speech, Messaging data	regional	D	E
Emergency Management	Event Promoters	event confirmation	W	Messaging data	regional	09	
Emergency Management	Fleet and Freight Management	hazmat information request	W	Conversational data, Messaging data	national	09,05	E
Emergency Management	Information Service Provider	incident information	W	Conversational speech, Messaging data	regional	09	
Emergency Management	Maintenance and Construction Management	incident information	W	Conversational data, Messaging data	regional	14	E
Emergency Management	Maintenance and Construction Management	incident response status	W	Conversational data, Messaging data	regional	14	E
Emergency Management	Maintenance and Construction Management	maint and constr resource request	W	Conversational data, Messaging data	regional	14	
Emergency Management	Maintenance and Construction Management	road network probe information	W	Messaging data	regional	14	
Emergency Management	Maintenance and Construction Management	work plan feedback	W	Conversational data, Messaging data	regional	14	
Emergency Management	Map Update Provider	map update request	W	Messaging data	national	02	
Emergency Management	Media	incident information for media	W	Messaging data	product	09	
Emergency Management	Other EM	incident report	W	Conversational data, Messaging data	regional	09	E
Emergency Management	Other EM	incident response coordination	W	Conversational data, Messaging data	regional	09	E
Emergency Management	Personal Information Access	emergency acknowledge	W,U1t	Conversational data, Messaging data	national	05	
Emergency Management	Remote Traveler Support	emergency acknowledge	W,U1t	Conversational speech, Messaging data	national	05	
Emergency Management	Remote Traveler Support	secure area monitoring support	W	Conversational data, Messaging data	product	05A	E,T
Emergency Management	Surface Transportation Weather Service	transportation weather information request	W	Conversational data, Messaging data	regional	09A	

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Emergency Management	Traffic Management	emergency traffic control request	W	Conversational data, conversational speech	regional	08,09	E
Emergency Management	Traffic Management	incident information	W	Conversational data, Messaging data	regional	09	
Emergency Management	Traffic Management	incident response status	W	Conversational data, Messaging data	regional	09	
Emergency Management	Traffic Management	remote surveillance control	W	Conversational data, Messaging data	regional	09	
Emergency Management	Traffic Management	resource request	W	Conversational data, Messaging data	regional	09	
Emergency Management	Traffic Management	road network probe information	W	Messaging data	regional	09A	
Emergency Management	Transit Management	transit emergency coordination data	W	Conversational data, Messaging data	regional	09,05	E
Emergency Management	Vehicle	emergency acknowledge	U1t	Conversational data conversational speech	national	05	E
Emergency Management	Vehicle	emergency data request	U1t	Conversational data conversational speech	national	05	E
Emergency Personnel	Emergency Vehicle Subsystem	emergency personnel inputs	H	Human Interface	product	H	E
Emergency System Operator	Emergency Management	emergency operations request	H	Human Interface	product	H	
Emergency Telecommunications System	Emergency Management	incident notification	W	Conversational data, Conversational speech, Location data	regional	09	
Emergency Vehicle Subsystem	Care Facility	care facility status request	U1t	Conversational data, Messaging data	regional	D	E
Emergency Vehicle Subsystem	Care Facility	patient status	U1t	Messaging data	regional	D	E
Emergency Vehicle Subsystem	Emergency Management	emergency dispatch response	U1t	Conversational speech, Messaging data	regional	D	E
Emergency Vehicle Subsystem	Emergency Management	emergency vehicle tracking data	U1t	Conversational speech, Messaging data	regional	D	E

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Emergency Vehicle Subsystem	Emergency Management	environmental probe data	U1t	Messaging data	product	D	
Emergency Vehicle Subsystem	Emergency Management	incident command request	U1t	Conversational speech, Messaging data	regional	D	E
Emergency Vehicle Subsystem	Emergency Management	incident status	U1t	Conversational speech, Messaging data	regional	D	E
Emergency Vehicle Subsystem	Emergency Personnel	dispatch information	H	Human Interface	product	H	E
Emergency Vehicle Subsystem	Emergency Personnel	incident command information presentation	H	Human Interface	product	H	E
Emergency Vehicle Subsystem	Roadway Subsystem	local signal preemption request	U2	Conversational data	regional	01,08	T,E
Emissions Management	Archived Data Management Subsystem	emissions archive data	W	Messaging data	regional	13	
Emissions Management	Information Service Provider	air quality information	W	Messaging data	product	07	
Emissions Management	Map Update Provider	map update request	W	Messaging data	national	02	
Emissions Management	Media	air quality information	W	Messaging data	product	07	
Emissions Management	Roadway Subsystem	vehicle pollution criteria	W	Messaging data	product	07	
Emissions Management	Traffic Management	widearea statistical pollution information	W	Messaging data	product	07	
Emissions Management	Traffic Operations Personnel	pollution data display	H	Human Interface	product	H	
Enforcement Agency	Commercial Vehicle Administration	information on violators	W	Messaging data	regional	04	P
Enforcement Agency	Commercial Vehicle Check	information on violators	W	Messaging data	regional	04	P
Enforcement Agency	Roadway Subsystem	speed monitoring control	W	Conversational data, Messaging data	product	14	
Environment	Emissions Management	pollutant levels	P	Physical Interface	NA	B	
Environment	Roadway Subsystem	pollutant levels	P	Physical Interface	NA	B	
Equipment Repair Facility	Maintenance and Construction Management	maint and constr equipment repair status	W	Messaging data	regional	14	
Event Promoters	Emergency Management	event plans	W	Messaging data, Multicast data	regional	09	
Event Promoters	Information Service Provider	event information	W	Messaging data	regional	10A	
Event Promoters	Traffic Management	event plans	W	Messaging data, Multicast data	regional	06	

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Financial Institution	Archived Data Management Subsystem	transaction status	W	Conversational data, Messaging data	national	E	F
Financial Institution	Commercial Vehicle Administration	transaction status	W	Conversational data, Messaging data	national	E	F
Financial Institution	Information Service Provider	transaction status	W	Conversational data, Messaging data	national	E	F
Financial Institution	Parking Management	transaction status	W	Conversational data, Messaging data	national	E	F
Financial Institution	Toll Administration	transaction status	W	Conversational data, Messaging data	national	E	F
Financial Institution	Transit Management	transaction status	W	Conversational data, Messaging data	national	E	F
Fleet and Freight Management	Commercial Vehicle Administration	audit data	W	Messaging data	national	04	P
Fleet and Freight Management	Commercial Vehicle Administration	credential application	W	Conversational data, Messaging data	national	04	
Fleet and Freight Management	Commercial Vehicle Administration	tax filing	W	Messaging data	national	04	P
Fleet and Freight Management	Commercial Vehicle Manager	fleet status	H	Human Interface	product	H	
Fleet and Freight Management	Commercial Vehicle Subsystem	fleet to driver update	U1t	Messaging data	none	P	
Fleet and Freight Management	Commercial Vehicle Subsystem	on-board safety request	U1t	Messaging data	none	P	
Fleet and Freight Management	Commercial Vehicle Subsystem	on-board vehicle request	U1t	Messaging data	none	P	
Fleet and Freight Management	Commercial Vehicle Subsystem	trip identification number	U1t,U2	Conversational data, Messaging data	none	P	
Fleet and Freight Management	Commercial Vehicle Subsystem	trip log request	U1t	Messaging data	none	P	
Fleet and Freight Management	Emergency Management	hazmat information	W	Conversational data, Messaging data	national	09,05	
Fleet and Freight Management	Information Service Provider	route request	W	Conversational data, Messaging data	none	10	P
Fleet and Freight Management	Information Service Provider	toll data request	W	Messaging data	regional	04	F
Fleet and Freight Management	Intermodal Freight Depot	intermod CVO coord	W	Messaging data	national	04	

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Fleet and Freight Management	Intermodal Freight Shipper	intermod CVO coord	W	Messaging data	regional	04	
Fleet and Freight Management	Toll Administration	toll data request	W	Messaging data	national	04	F
Government Reporting Systems	Archived Data Management Subsystem	government reporting data receipt	W	Messaging data	national	13	
Information Service Provider	Archived Data Management Subsystem	traveler archive data	W	Messaging data	regional	13	
Information Service Provider	Emergency Management	incident information request	W	Conversational speech, Messaging data	regional	09	
Information Service Provider	Event Promoters	event information request	W	Messaging data	regional	10A	
Information Service Provider	Financial Institution	payment request	W	Conversational data, Messaging data	national	E	
Information Service Provider	Fleet and Freight Management	road network conditions	W	Messaging data	national	10A	
Information Service Provider	Fleet and Freight Management	route plan	W	Messaging data	none	10	P
Information Service Provider	Fleet and Freight Management	toll data	W	Messaging data	regional	04	F
Information Service Provider	ISP Operator	ISP operating parameters	H	Human Interface	product	H	
Information Service Provider	Maintenance and Construction Management	road network probe information	W	Messaging data	regional	10A	
Information Service Provider	Map Update Provider	map update request	W	Messaging data	national	02	
Information Service Provider	Media	traveler information for media	W	Messaging data	product	10	
Information Service Provider	Multimodal Transportation Service Provider	multimodal information request	W	Conversational data, Messaging data	regional	10	
Information Service Provider	Other ISP	ISP coordination	W	Messaging data	national	10	
Information Service Provider	Parking Management	parking lot data request	W	Messaging data	regional	10	P
Information Service Provider	Parking Management	parking reservations request	W	Messaging data	regional	10	P

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Information Service Provider	Personal Information Access	broadcast information	W,U1b	Messaging data,Broadcast data, Multicast	national	03	
Information Service Provider	Personal Information Access	traveler information	W,U1t	Broadcast data,Multicast data	national	03	P
Information Service Provider	Personal Information Access	trip plan	W,U1t	Conversational data, Messaging data	national	03	P
Information Service Provider	Personal Information Access	yellow pages information	W,U1t	Conversational data, Messaging data	national	03	
Information Service Provider	Remote Traveler Support	broadcast information	W,U1b	Messaging data,Broadcast data, Multicast	product	10	
Information Service Provider	Remote Traveler Support	traveler information	W,U1t	Broadcast data,Multicast data	product	10	P
Information Service Provider	Remote Traveler Support	trip plan	W,U1t	Conversational Data	product	10	P
Information Service Provider	Remote Traveler Support	yellow pages information	W,U1t	Conversational data, Messaging data	national	10	
Information Service Provider	Surface Transportation Weather Service	transportation weather information request	W	Conversational data, Messaging data	regional	10A	
Information Service Provider	Toll Administration	toll data request	W	Messaging data	regional	10	
Information Service Provider	Traffic Management	fare and price information	W	Messaging data	regional	06	
Information Service Provider	Traffic Management	logged special vehicle route	W	Conversational data, Messaging data	regional	06	P
Information Service Provider	Traffic Management	request for road network conditions	W	Messaging data	regional	06A	
Information Service Provider	Traffic Management	road network probe information	W	Messaging data	regional	06A	
Information Service Provider	Transit Management	demand responsive transit request	W	Messaging data	regional	10	P
Information Service Provider	Transit Management	selected routes	W	Conversational data, Messaging data	regional	10	P
Information Service Provider	Transit Management	transit information request	W	Messaging data	regional	10	
Information Service Provider	Vehicle	broadcast information	U1b	Messaging data,Broadcast data, Multicast	national	03	

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Information Service Provider	Vehicle	traveler information	U1t,U1b	Messaging data,Broadcast data, Multicast	national	03	P
Information Service Provider	Vehicle	trip plan	U1t	Conversational data, Messaging data	national	03	P
Information Service Provider	Vehicle	yellow pages information	U1t	Conversational data, Messaging data	national	03	
Information Service Provider	Yellow Pages Service Providers	provider profile confirm	W	Messaging data	national	10	P
Information Service Provider	Yellow Pages Service Providers	travel service request	W	Messaging data	national	10	P
Intermodal Freight Depot	Archived Data Management Subsystem	intermodal freight archive data	W	Messaging data	regional	13	
Intermodal Freight Depot	Fleet and Freight Management	intermod CVO coord	W	Messaging data	national	04	
Intermodal Freight Shipper	Commercial Vehicle Subsystem	trip identification number	U1t,U2	Conversational data, Messaging data	regional	04	
Intermodal Freight Shipper	Fleet and Freight Management	intermod CVO coord	W	Messaging data	regional	04	
ISP Operator	Information Service Provider	ISP operating parameter updates	H	Human Interface	product	H	
Location Data Source	Personal Information Access	position fix	L	Broadcast Data	product	02	
Location Data Source	Vehicle	position fix	L	Broadcast Data	product	02	
Maintenance and Construction Administrative Systems	Maintenance and Construction Management	maint and constr administrative information	W	Conversational data, Messaging data	regional	14	
Maintenance and Construction Center Personnel	Maintenance and Construction Management	maint and constr center personnel inputs	H	Human Interface	product	H	
Maintenance and Construction Field Personnel	Maintenance and Construction Vehicle	crew movements	P	Physical Interface	NA	B	
Maintenance and Construction Field Personnel	Maintenance and Construction Vehicle	maint and constr field personnel inputs	H	Human Interface	product	H	
Maintenance and Construction Field Personnel	Roadway Subsystem	crew movements	P	Physical Interface	NA	B	
Maintenance and Construction Management	Archived Data Management Subsystem	maint and constr archive data	W	Messaging data	regional	13	

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Maintenance and Construction Management	Asset Management	asset status update	W	Conversational data, Messaging data	regional	14	
Maintenance and Construction Management	Commercial Vehicle Administration	current asset restrictions	W	Messaging data	regional	14	
Maintenance and Construction Management	Emergency Management	current asset restrictions	W	Messaging data	regional	14	
Maintenance and Construction Management	Emergency Management	incident information	W	Conversational data, Messaging data	regional	09A	E
Maintenance and Construction Management	Emergency Management	maint and constr resource response	W	Conversational data, Messaging data	regional	09A	
Maintenance and Construction Management	Emergency Management	maint and constr work plans	W	Conversational data, Messaging data	regional	14	
Maintenance and Construction Management	Emergency Management	road weather information	W	Messaging data	regional	14	
Maintenance and Construction Management	Emergency Management	roadway maintenance status	W	Messaging data	regional	14	
Maintenance and Construction Management	Emergency Management	work zone information	W	Messaging data	regional	14	
Maintenance and Construction Management	Enforcement Agency	request for enforcement	W	Conversational data, Messaging data	regional	14	P
Maintenance and Construction Management	Equipment Repair Facility	maint and constr fleet information	W	Conversational data, Messaging data	regional	14	
Maintenance and Construction Management	Information Service Provider	current asset restrictions	W	Messaging data	regional	14	
Maintenance and Construction Management	Information Service Provider	maint and constr work plans	W	Conversational data, Messaging data	regional	14	
Maintenance and Construction Management	Information Service Provider	road weather information	W	Messaging data	regional	14	
Maintenance and Construction Management	Information Service Provider	roadway maintenance status	W	Messaging data	regional	14	
Maintenance and Construction Management	Information Service Provider	work zone information	W	Messaging data	regional	14	
Maintenance and Construction Management	Maintenance and Construction Administrative Systems	maint and constr administrative request	W	Conversational data, Messaging data	regional	14	
Maintenance and Construction Management	Maintenance and Construction Administrative Systems	maint and constr work performance	W	Conversational data, Messaging data	regional	14	

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Maintenance and Construction Management	Maintenance and Construction Center Personnel	maint and constr operations information presentation	H	Human Interface	product	H	
Maintenance and Construction Management	Maintenance and Construction Vehicle	environmental sensors control	U1t	Conversational data, Messaging data	product	14	
Maintenance and Construction Management	Maintenance and Construction Vehicle	maint and constr dispatch information	U1t	Conversational data, Messaging data	product	14	
Maintenance and Construction Management	Maintenance and Construction Vehicle	maint and constr vehicle system control	U1t	Conversational data, Messaging data	product	14	
Maintenance and Construction Management	Map Update Provider	map update request	W	Messaging data,Broadcast data, Multicast	national	02A	
Maintenance and Construction Management	Media	maint and constr work plans	W	Conversational data, Messaging data	regional	14	
Maintenance and Construction Management	Media	road weather information	W	Messaging data	product	14	
Maintenance and Construction Management	Media	roadway maintenance status	W	Messaging data	regional	14	
Maintenance and Construction Management	Media	work zone information	W	Messaging data	regional	14	
Maintenance and Construction Management	Multimodal Transportation Service Provider	maint and constr work plans	W	Conversational data, Messaging data	regional	14	
Maintenance and Construction Management	Other MCM	maint and constr resource coordination	W	Conversational data, Messaging data	regional	14	
Maintenance and Construction Management	Other MCM	road weather information	W	Messaging data	regional	14	
Maintenance and Construction Management	Other MCM	roadway maintenance status	W	Messaging data	regional	14	
Maintenance and Construction Management	Other MCM	work plan coordination	W	Conversational data, Messaging data	regional	14	
Maintenance and Construction Management	Other MCM	work zone information	W	Messaging data	regional	14	
Maintenance and Construction Management	Rail Operations	maint and constr work plans	W	Conversational data, Messaging data	regional	14	
Maintenance and Construction Management	Rail Operations	road weather information	W	Messaging data	national	14	
Maintenance and Construction Management	Rail Operations	work plan feedback	W	Conversational data, Messaging data	regional	14	

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Maintenance and Construction Management	Roadway Subsystem	environmental sensors control	W	Conversational data, Messaging data	product	07A	
Maintenance and Construction Management	Roadway Subsystem	infrastructure monitoring sensor control	W	Messaging data	product	07A,14	
Maintenance and Construction Management	Roadway Subsystem	roadway information system data	W	Messaging data	product	07A	
Maintenance and Construction Management	Roadway Subsystem	roadway treatment system control	W	Conversational data, Messaging data	product	07A,14	
Maintenance and Construction Management	Roadway Subsystem	speed monitoring control	W	Conversational data, Messaging data	product	07A,14	
Maintenance and Construction Management	Roadway Subsystem	video surveillance control	W	Messaging data	product	07A	T
Maintenance and Construction Management	Roadway Subsystem	work zone warning device control	W	Conversational data, Messaging data	regional	07A,14	
Maintenance and Construction Management	Storage Facility	storage facility request	W	Conversational data, Messaging data	regional	14	
Maintenance and Construction Management	Surface Transportation Weather Service	environmental conditions data	W	Messaging data	regional	14	
Maintenance and Construction Management	Surface Transportation Weather Service	road data	W	Messaging data	regional	14	
Maintenance and Construction Management	Surface Transportation Weather Service	road weather information	W	Messaging data	regional	14	
Maintenance and Construction Management	Surface Transportation Weather Service	transportation weather information request	W	Conversational data, Messaging data	regional	14	
Maintenance and Construction Management	Traffic Management	current asset restrictions	W	Messaging data	regional	14	
Maintenance and Construction Management	Traffic Management	equipment maintenance status	W	Messaging data	regional	14	
Maintenance and Construction Management	Traffic Management	incident information	W	Conversational data, Messaging data	regional	09A,14	E
Maintenance and Construction Management	Traffic Management	maint and constr resource response	W	Conversational data, Messaging data	regional	14	
Maintenance and Construction Management	Traffic Management	maint and constr work plans	W	Conversational data, Messaging data	regional	14	
Maintenance and Construction Management	Traffic Management	road weather information	W	Messaging data	regional	14	
Maintenance and Construction Management	Traffic Management	roadway maintenance status	W	Messaging data	regional	14	

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Maintenance and Construction Management	Traffic Management	work zone information	W	Messaging data	regional	14	
Maintenance and Construction Management	Transit Management	current asset restrictions	W	Messaging data	regional	14	
Maintenance and Construction Management	Transit Management	maint and constr work plans	W	Conversational data, Messaging data	regional	14	
Maintenance and Construction Management	Transit Management	road weather information	W	Messaging data	regional	14	
Maintenance and Construction Management	Transit Management	roadway maintenance status	W	Messaging data	regional	14	
Maintenance and Construction Management	Transit Management	work zone information	W	Messaging data	regional	14	
Maintenance and Construction Management	Weather Service	environmental conditions data	W	Messaging data	national	14	
Maintenance and Construction Management	Weather Service	road weather information	W	Messaging data	national	14	
Maintenance and Construction Vehicle	Basic Maintenance and Construction Vehicle	maint and constr vehicle control	V	Conversational data, Messaging data	product	I	
Maintenance and Construction Vehicle	Driver	driver information	H	Human Interface	national	H	
Maintenance and Construction Vehicle	Equipment Repair Facility	maint and constr vehicle conditions	U1t, U2	Conversational data, Messaging data	product	14	
Maintenance and Construction Vehicle	Maintenance and Construction Field Personnel	maint and constr field personnel information presentation	H	Human Interface	product	H	
Maintenance and Construction Vehicle	Maintenance and Construction Field Personnel	maint and constr vehicle condition presentation	H	Human Interface	product	H	
Maintenance and Construction Vehicle	Maintenance and Construction Field Personnel	work zone warning	H	Human Interface	product	H	
Maintenance and Construction Vehicle	Maintenance and Construction Management	environmental probe data	U1t	Messaging data	product	14	
Maintenance and Construction Vehicle	Maintenance and Construction Management	infrastructure conditions data	U1t	Messaging data	product	14	
Maintenance and Construction Vehicle	Maintenance and Construction Management	maint and constr dispatch status	U1t	Conversational data, Messaging data	product	14	
Maintenance and Construction Vehicle	Maintenance and Construction Management	maint and constr vehicle conditions	U1t	Conversational data, Messaging data	product	14	
Maintenance and Construction Vehicle	Maintenance and Construction Management	maint and constr vehicle location data	U1t	Conversational data, Messaging data	product	14	

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Maintenance and Construction Vehicle	Maintenance and Construction Management	maint and constr vehicle operational data	U1t	Conversational data, Messaging data	product	14	
Maintenance and Construction Vehicle	Maintenance and Construction Management	work zone status	U1t	Conversational data, Messaging data	product	14	
Maintenance and Construction Vehicle	Maintenance and Construction Management	work zone warning status	U1t	Conversational data, Messaging data	product	14	
Maintenance and Construction Vehicle	Other MCV	maint and constr vehicle status coordination	U3	Conversational data, Messaging data	regional	14	
Maintenance and Construction Vehicle	Other MCV	work zone warning notification	U3	Conversational data, Messaging data	regional	14	
Maintenance and Construction Vehicle	Roadway Subsystem	environmental conditions data	U2	Messaging data	regional	01A,14	
Maintenance and Construction Vehicle	Roadway Subsystem	environmental sensors control	U2	Conversational data, Messaging data	regional	01A,14	
Maintenance and Construction Vehicle	Roadway Subsystem	infrastructure monitoring sensor control	U2	Messaging data	regional	01A,14	
Maintenance and Construction Vehicle	Roadway Subsystem	roadway information system data	U2	Messaging data	regional	01A,14	
Maintenance and Construction Vehicle	Vehicle	vehicle signage data	U3	Messaging data	product	01A,14	T
Map Update Provider	Archived Data Management Subsystem	map updates	W	Messaging data,Broadcast data, Multicast	national	13	
Map Update Provider	Emergency Management	map updates	W	Messaging data, Multicast data	national	02	
Map Update Provider	Emissions Management	map updates	W	Messaging data	national	02	
Map Update Provider	Information Service Provider	map updates	W	Messaging data, Multicast data	national	02	
Map Update Provider	Maintenance and Construction Management	map updates	W	Messaging data,Broadcast data, Multicast	national	02A	
Map Update Provider	Personal Information Access	map updates	W,U1t	Messaging data, Multicast data	national	02	
Map Update Provider	Remote Traveler Support	map updates	W	Messaging data	national	02	
Map Update Provider	Traffic Management	map updates	W	Messaging data, Multicast data	national	02	
Map Update Provider	Transit Management	map updates	W	Messaging data, Multicast data	national	02	

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Map Update Provider	Vehicle	map updates	U1t	Messaging data, Multicast data	national	02	
Media	Emergency Management	media information request	W	Conversational Data, Messaging data	product	09	
Media	Information Service Provider	external reports	W	Messaging data, Multicast data	product	10	
Media	Information Service Provider	media information request	W	Conversational data, Messaging data	product	10	
Media	Traffic Management	external reports	W	Messaging data, Multicast data	product	06	
Media	Traffic Management	media information request	W	Conversational Data, Messaging data	product	06	
Media	Transit Management	media information request	W	Conversational Data, Messaging data	product	11	
Multimodal Crossings	Roadway Subsystem	multimodal crossing status	W	Conversational data, Messaging data	national	G	R
Multimodal Crossings	Traffic Management	multimodal crossing status	W	Conversational data, Messaging data	national	G	R
Multimodal Transportation Service Provider	Archived Data Management Subsystem	multimodal archive data	W	Messaging data	regional	13	
Multimodal Transportation Service Provider	Information Service Provider	multimodal information	W	Messaging data	regional	10	
Multimodal Transportation Service Provider	Transit Management	multimodal service data	W	Messaging data	regional	11A	
Other Archives	Archived Data Management Subsystem	archive coordination	W	Messaging data	national	13	
Other CVAS	Commercial Vehicle Administration	border clearance status	W	Conversational data, Messaging data	national	04	
Other CVAS	Commercial Vehicle Administration	credential fee coordination	W	Messaging data	national	04	
Other CVAS	Commercial Vehicle Administration	credentials information	W	Messaging data	national	04	
Other CVAS	Commercial Vehicle Administration	credentials status information	W	Messaging data	national	04	
Other CVAS	Commercial Vehicle Administration	safety inspection report	W	Messaging data	national	04	
Other CVAS	Commercial Vehicle Administration	safety status information	W	Messaging data	national	04	

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Other Data Sources	Archived Data Management Subsystem	other data source archive data	W	Messaging data	national	13	
Other EM	Emergency Management	incident report	W	Conversational data, Messaging data	regional	09	E
Other EM	Emergency Management	incident response coordination	W	Conversational data, Messaging data	regional	09	E
Other ISP	Information Service Provider	ISP coordination	W	Messaging data	national	10	
Other MCM	Maintenance and Construction Management	maint and constr resource coordination	W	Conversational data, Messaging data	regional	14	
Other MCM	Maintenance and Construction Management	road weather information	W	Messaging data	regional	14	
Other MCM	Maintenance and Construction Management	roadway maintenance status	W	Messaging data	regional	14	
Other MCM	Maintenance and Construction Management	work plan coordination	W	Conversational data, Messaging data	regional	14	
Other MCM	Maintenance and Construction Management	work zone information	W	Messaging data	regional	14	
Other MCV	Maintenance and Construction Vehicle	maint and constr vehicle status coordination	U3	Conversational data, Messaging data	regional	14	
Other MCV	Maintenance and Construction Vehicle	work zone warning notification	U3	Conversational data, Messaging data	regional	14	
Other Parking	Parking Management	parking coordination	W	Messaging data	regional	J	
Other Roadway	Roadway Subsystem	roadway equipment coordination	W	Conversational data, Messaging data	product	07A	
Other TM	Traffic Management	traffic control coordination	W	Messaging data	regional	06	
Other TM	Traffic Management	traffic information coordination	W	Messaging data	regional	06	
Other Toll Administration	Toll Administration	toll coordination	W	Messaging data	national	J	
Other TRM	Transit Management	TRMS coord	W	Messaging data	regional	11	
Other Vehicle	Vehicle	vehicle to vehicle coordination	U3	Conversational data	national	A	T,R
Parking Management	Archived Data Management Subsystem	parking archive data	W	Messaging data	regional	13	
Parking Management	DMV	license request	W	Messaging data	national	F	
Parking Management	Driver	roadside transaction status	H	Human Interface	product	H	
Parking Management	Enforcement Agency	payment violation notification	W	Messaging data	regional	J	

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Parking Management	Financial Institution	payment request	W	Conversational data, Messaging data	national	E	
Parking Management	Information Service Provider	parking information	W	Messaging data	regional	10	
Parking Management	Information Service Provider	parking lot reservation confirmation	W	Messaging data	regional	10	
Parking Management	Other Parking	parking coordination	W	Messaging data	regional	J	
Parking Management	Parking Operator	parking status	H	Human Interface	product	H	
Parking Management	Traffic Management	parking availability	W	Messaging data	regional	06	
Parking Management	Traffic Management	parking demand management response	W	Messagind data	regional	06	
Parking Management	Transit Management	transit parking coordination	W	Messaging data	regional	11	
Parking Management	Traveler Card	request for payment	S	Conversational data	national	C	F
Parking Management	Vehicle	request tag data	U2	Conversational data	national	01	T,R
Parking Management	Vehicle	tag update	U2	Conversational data	national	01	T,R
Parking Operator	Parking Management	parking operator inputs	H	Human Interface	product	H	
Parking Operator	Parking Management	request for performance data	H	Human Interface	product	H	
Pedestrians	Roadway Subsystem	crossing call	H	Human Interface	national	H	
Personal Information Access	Emergency Management	emergency notification	U1t	Conversational data, Messaging data	national	05	E
Personal Information Access	Information Service Provider	traveler profile	W,U1t	Conversational data, Messaging data	national	03	P
Personal Information Access	Information Service Provider	traveler request	W,U1t	Conversational data, Messaging data	national	03	P
Personal Information Access	Information Service Provider	trip confirmation	W,U1t	Conversational Data, Messaging data	national	03	P
Personal Information Access	Information Service Provider	trip request	W,U1t	Conversational Data, Messaging data	national	03	P
Personal Information Access	Information Service Provider	yellow pages request	W,U1t	Conversational Data, Messaging data	national	03	P
Personal Information Access	Map Update Provider	map update request	W,U1t	Messaging data	national	02	
Personal Information Access	Transit Management	transit information user request	W,U1t	Messaging data	national	11	
Personal Information Access	Traveler	traveler interface updates	H	Human Interface	product	H	P
Personal Information Access	Traveler Card	request for payment	S	Conversational Data	national	C	

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Personal Information Access	Traveler Card	traveler card update	S	Conversational data	national	C	
Potential Obstacles	Vehicle	physical presence	P	Physical Interface	NA	B	
Rail Operations	Maintenance and Construction Management	railroad schedules	W	Conversational data, Messaging data	national	14	
Rail Operations	Maintenance and Construction Management	work plan feedback	W	Conversational data, Messaging data	national	14	
Rail Operations	Traffic Management	railroad advisories	W	Conversational data, Messaging data	national	12	
Rail Operations	Traffic Management	railroad schedules	W	Conversational data, Messaging data	national	12	
Remote Traveler Support	Emergency Management	emergency notification	W,U1t	Conversational speech, Messaging data, location data	national	05	E
Remote Traveler Support	Emergency Management	secure area surveillance data	W	Conversational data, Messaging Data	product	05A	E,T
Remote Traveler Support	Information Service Provider	traveler request	W	Messaging data	product	10	P
Remote Traveler Support	Information Service Provider	trip confirmation	W	Messaging data	product	10	P
Remote Traveler Support	Information Service Provider	trip request	W	Conversational Data	product	10	P
Remote Traveler Support	Information Service Provider	yellow pages request	W	Conversational data, Messaging Data	product	10	P
Remote Traveler Support	Map Update Provider	map update request	W	Messaging data	national	02	
Remote Traveler Support	Transit Management	emergency notification	W	Conversational data, Messaging Data	product	05,11	E
Remote Traveler Support	Transit Management	secure area surveillance data	W	Conversational data, Messaging Data	product	11	E,T
Remote Traveler Support	Transit Management	transit fare payment requests	W	Conversational data, Messaging data	product	11	F
Remote Traveler Support	Transit Management	transit information user request	W	Messaging data	product	11	P
Remote Traveler Support	Transit User	transit user fare status	H	Human Interface	product	H	
Remote Traveler Support	Transit User	transit user outputs	H	Human Interface	product	H	
Remote Traveler Support	Traveler	traveler interface updates	H	Human Interface	product	H	P
Remote Traveler Support	Traveler Card	request for payment	S	Conversational Data	national	C	F
Remote Traveler Support	Traveler Card	traveler card update	S	Conversational data	national	C	
Roadway Environment	Emergency Vehicle Subsystem	environmental conditions	P	Physical Interface	NA	B	

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Roadway Environment	Maintenance and Construction Vehicle	environmental conditions	P	Physical Interface	NA	B	
Roadway Environment	Maintenance and Construction Vehicle	roadway characteristics	P	Physical Interface	NA	B	
Roadway Environment	Roadway Subsystem	environmental conditions	P	Physical Interface	NA	B	
Roadway Environment	Transit Vehicle Subsystem	environmental conditions	P	Physical Interface	NA	B	
Roadway Environment	Vehicle	environmental conditions	P	Physical Interface	NA	B	
Roadway Environment	Vehicle	roadway characteristics	P	Physical Interface	NA	B	
Roadway Subsystem	Archived Data Management Subsystem	roadside archive data	W	Messaging data	product	13	T
Roadway Subsystem	Basic Vehicle	broadcast advisories	U1b	Conversational speech	national	E	
Roadway Subsystem	Driver	driver information	H	Human Interface	national	H	T, R
Roadway Subsystem	Emissions Management	pollution data	W	Messaging data	product	07	
Roadway Subsystem	Enforcement Agency	speed monitoring information	W	Conversational data, Messaging data	product	14	
Roadway Subsystem	Enforcement Agency	traffic violation notification	W	Messaging data	product	14	
Roadway Subsystem	Maintenance and Construction Field Personnel	work zone warning	H	Human Interface, Conversational data	product	H	
Roadway Subsystem	Maintenance and Construction Management	environmental conditions data	W	Messaging data	product	07A	
Roadway Subsystem	Maintenance and Construction Management	field device status	W	Messaging data	product	07A	
Roadway Subsystem	Maintenance and Construction Management	infrastructure monitoring sensor data	W	Messaging data	product	07A,14	
Roadway Subsystem	Maintenance and Construction Management	roadway information system status	W	Messaging data	product	07A	
Roadway Subsystem	Maintenance and Construction Management	roadway treatment system status	W	Conversational data, Messaging data	product	07A	
Roadway Subsystem	Maintenance and Construction Management	speed monitoring information	W	Conversational data, Messaging data	product	07A,14	
Roadway Subsystem	Maintenance and Construction Management	traffic images	W	Messaging data	product	07A	T
Roadway Subsystem	Maintenance and Construction Management	work zone warning status	W	Conversational data, Messaging data	product	07A,14	
Roadway Subsystem	Maintenance and Construction Vehicle	environmental conditions data	U2	Messaging data	regional	07A,14	

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Roadway Subsystem	Maintenance and Construction Vehicle	infrastructure monitoring sensor data	U2	Messaging data	regional	07A,14	
Roadway Subsystem	Maintenance and Construction Vehicle	roadway information system status	U2	Messaging data	regional	07A,14	
Roadway Subsystem	Maintenance and Construction Vehicle	work zone warning notification	U2	Conversational data, Messaging data	regional	07A,14	
Roadway Subsystem	Multimodal Crossings	highway control status	W	Conversational data, Messaging data	national	G	R
Roadway Subsystem	Other Roadway	roadway equipment coordination	W	Conversational data, Messaging data	product	07A	
Roadway Subsystem	Pedestrians	crossing permission	H	Human Interface	national	H	
Roadway Subsystem	Surface Transportation Weather Service	environmental conditions data	W	Messaging data	product	07A,14	
Roadway Subsystem	Traffic Management	AHS status	W	Messaging data	product	07	
Roadway Subsystem	Traffic Management	emissions data	W	Messaging data	product	07	
Roadway Subsystem	Traffic Management	environmental conditions data	W	Messaging data	product	07A	
Roadway Subsystem	Traffic Management	environmental probe data	W	Messaging data	product	07A	
Roadway Subsystem	Traffic Management	freeway control status	W	Messaging data	product	07	
Roadway Subsystem	Traffic Management	hov data	W	Messaging data	product	07	
Roadway Subsystem	Traffic Management	hri status	W	Conversational data, Messaging data	product	12	R
Roadway Subsystem	Traffic Management	intersection blockage notification	W	Messaging data	product	12	T, R
Roadway Subsystem	Traffic Management	request for right-of-way	W	Conversational data, Messaging data	product	08,07	R
Roadway Subsystem	Traffic Management	reversible lane status	W	Messaging data	product	07	
Roadway Subsystem	Traffic Management	roadway information system status	W	Messaging data	product	07	
Roadway Subsystem	Traffic Management	signal control status	W	Messaging data	product	07	
Roadway Subsystem	Traffic Management	speed monitoring information	W	Conversational data, Messaging data	product	07A,14	
Roadway Subsystem	Traffic Management	traffic flow	W	Messaging data	product	07	T, R
Roadway Subsystem	Traffic Management	traffic images	W	Messaging data	product	07	T
Roadway Subsystem	Traffic Management	vehicle probe data	W	Messaging data	product	07	
Roadway Subsystem	Vehicle	AHS control data	U2	Messaging data	national	01	T, R
Roadway Subsystem	Vehicle	intersection status	U2	Messaging data	national	01	T, R

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Roadway Subsystem	Vehicle	request tag data	U2	Messaging data	national	01	T
Roadway Subsystem	Vehicle	vehicle signage data	U2	Messaging data	national	01	T
Roadway Subsystem	Wayside Equipment	hri operational status	W	Conversational data, Messaging data	product	12	R
Roadway Subsystem	Wayside Equipment	intersection blockage notification	W	Messaging data	product	12	T, R
Roadway Subsystem	Weather Service	environmental conditions data	W	Messaging data	product	07A,14	
Secure Area Environment	Remote Traveler Support	secure area characteristics	P	Physical Interface	NA	B	
Storage Facility	Maintenance and Construction Management	equipment availability	W	Conversational data, Messaging data	regional	14	
Storage Facility	Maintenance and Construction Management	maintenance materials storage status	W	Messaging data	regional	14	
Surface Transportation Weather Service	Archived Data Management Subsystem	transportation weather information	W	Messaging data,Broadcast data, Multicast	national	13	
Surface Transportation Weather Service	Emergency Management	transportation weather information	W	Messaging data,Broadcast data, Multicast	national	09A	
Surface Transportation Weather Service	Information Service Provider	transportation weather information	W	Messaging data,Broadcast data, Multicast	national	10A	
Surface Transportation Weather Service	Maintenance and Construction Management	environmental conditions data	W	Messaging data	product	14	
Surface Transportation Weather Service	Maintenance and Construction Management	transportation weather information	W	Messaging data,Broadcast data, Multicast	regional	14	
Surface Transportation Weather Service	Roadway Subsystem	environmental sensors control	W	Conversational data, Messaging data	regional	07A,14	
Surface Transportation Weather Service	Traffic Management	environmental conditions data	W	Messaging data	product	06A	
Surface Transportation Weather Service	Traffic Management	transportation weather information	W	Messaging data,Broadcast data, Multicast	national	06A	
Surface Transportation Weather Service	Transit Management	transportation weather information	W	Messaging data,Broadcast data, Multicast	national	11A	
Toll Administration	Archived Data Management Subsystem	toll archive data	W	Messaging data	regional	13	

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Toll Administration	DMV	license request	W	Messaging data	national	F	
Toll Administration	Enforcement Agency	payment violation notification	W	Messaging data	regional	J	
Toll Administration	Financial Institution	payment request	W	Conversational data, Messaging data	national	E	
Toll Administration	Fleet and Freight Management	toll data	W	Messaging data	regional	04	
Toll Administration	Information Service Provider	probe data	W	Messaging data	regional	10	
Toll Administration	Information Service Provider	toll data	W	Messaging data	regional	10	
Toll Administration	Other Toll Administration	toll coordination	W	Messaging data	national	J	
Toll Administration	Toll Administrator	toll revenues and summary reports	H	Human Interface	product	H	
Toll Administration	Toll Collection	toll instructions	W	Messaging data	regional	J	
Toll Administration	Traffic Management	probe data	W	Messaging data	regional	06	
Toll Administration	Traffic Management	toll demand management response	W	Messaging data	regional	06	
Toll Administrator	Toll Administration	toll administration requests	H	Human Interface	product	H	
Toll Collection	Driver	roadside transaction status	H	Human Interface	product	H	
Toll Collection	Toll Administration	toll transactions	W	Messaging data	regional	J	
Toll Collection	Toll Operator	toll transaction reports	H	Human Interface	product	H	
Toll Collection	Vehicle	request tag data	U2	Conversational data	national	01	T,R
Toll Collection	Vehicle	tag update	U2	Conversational Data	national	01	T,R
Toll Operator	Toll Collection	toll operator requests	H	Human Interface	product	H	
Trade Regulatory Agencies	Commercial Vehicle Administration	declaration information	W	Conversational data, Messaging data	national	04	
Trade Regulatory Agencies	Commercial Vehicle Administration	domestic transportation information	W	Conversational data, Messaging data	national	04	
Traffic	Maintenance and Construction Vehicle	traffic characteristics	P	Physical Interface	NA	B	
Traffic	Roadway Subsystem	traffic characteristics	P	Physical Interface	NA	B	
Traffic Management	Archived Data Management Subsystem	traffic archive data	W	Messaging data	regional	13	
Traffic Management	DMV	license request	W	Messaging data	national	F	
Traffic Management	Emergency Management	emergency traffic control response	W	Conversational data, conversational speech	regional	09	
Traffic Management	Emergency Management	incident information	W	Messaging data	regional	09	E
Traffic Management	Emergency Management	incident information	W	Messaging data	regional	09	E

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
		request					
Traffic Management	Emergency Management	resource deployment status	W	Messaging data	regional	09	
Traffic Management	Emergency Management	road network conditions	W	Messaging data	regional	09A	
Traffic Management	Emissions Management	pollution state data request	W	Messaging data	product	07	
Traffic Management	Enforcement Agency	request for enforcement	W	Conversational data, Messaging data	regional	06A	
Traffic Management	Enforcement Agency	traffic violation notification	W	Messaging data	regional	06A	
Traffic Management	Event Promoters	event confirmation	W	Messaging data	regional	06	
Traffic Management	Information Service Provider	request fare and price information	W	Messaging data	regional	06	
Traffic Management	Information Service Provider	road network conditions	W	Messaging data	regional	06A	
Traffic Management	Maintenance and Construction Management	field equipment status	W	Conversational data, Messaging data	regional	06A,14	
Traffic Management	Maintenance and Construction Management	incident information	W	Conversational data, Messaging data	regional	09A,14	E
Traffic Management	Maintenance and Construction Management	maint and constr resource request	W	Conversational data, Messaging data	regional	14	
Traffic Management	Maintenance and Construction Management	road network conditions	W	Messaging data	regional	06A	
Traffic Management	Maintenance and Construction Management	work plan feedback	W	Conversational data, Messaging data	regional	14	
Traffic Management	Map Update Provider	map update request	W	Messaging data	national	02	
Traffic Management	Media	road network conditions	W	Messaging data	product	06A	
Traffic Management	Other TM	traffic control coordination	W	Messaging data	regional	06	
Traffic Management	Other TM	traffic information coordination	W	Messaging data	regional	06	
Traffic Management	Parking Management	parking demand management request	W	Messaging data	regional	06	
Traffic Management	Parking Management	parking instructions	W	Messaging data	regional	06	
Traffic Management	Rail Operations	hri advisories	W	Conversational Data, Messaging data	national	12	T,R
Traffic Management	Roadway Subsystem	AHS control information	W	Messaging data	product	07	
Traffic Management	Roadway Subsystem	environmental sensors control	W	Conversational data, Messaging data	product	07A	
Traffic Management	Roadway Subsystem	freeway control data	W	Messaging data	product	07	T
Traffic Management	Roadway Subsystem	hri control data	W	Messaging data	product	12	R

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Traffic Management	Roadway Subsystem	hri request	W	Conversational data, Messaging data	product	12	R
Traffic Management	Roadway Subsystem	roadway information system data	W	Messaging data	product	07	
Traffic Management	Roadway Subsystem	signal control data	W	Messaging data	product	07	T
Traffic Management	Roadway Subsystem	speed monitoring control	W	Conversational data, Messaging data	product	07A,14	
Traffic Management	Roadway Subsystem	traffic sensor control	W	Conversational data, Messaging data	product	07A	T
Traffic Management	Roadway Subsystem	video surveillance control	W	Conversational data, Messaging data	product	07A	T
Traffic Management	Surface Transportation Weather Service	environmental conditions data	W	Messaging data	regional	06A	
Traffic Management	Surface Transportation Weather Service	transportation weather information request	W	Conversational data, Messaging data	regional	06A	
Traffic Management	Toll Administration	toll demand management request	W	Messaging data	regional	06	
Traffic Management	Traffic Operations Personnel	traffic operator data	H	Human Interface	product	H	
Traffic Management	Transit Management	request transit information	W	Conversational data, Messaging data	regional	06	
Traffic Management	Transit Management	road network conditions	W	Messaging data	regional	06A	
Traffic Management	Transit Management	traffic control priority status	W	Conversational data, Messaging data	regional	06,08	
Traffic Management	Transit Management	transit demand management request	W	Messaging data	regional	06	
Traffic Management	Weather Service	environmental conditions data	W	Messaging data	national	06A	
Traffic Operations Personnel	Emissions Management	pollution data parameters	H	Human Interface	product	H	
Traffic Operations Personnel	Traffic Management	traffic operator inputs	H	Human Interface	product	H	
Transit Driver	Transit Management	transit driver availability	H	Human Interface	product	H	
Transit Driver	Transit Vehicle Subsystem	transit driver inputs	H	Human Interface	product	H	
Transit Fleet Manager	Transit Management	transit fleet manager inputs	H	Human Interface	product	H	
Transit Maintenance Personnel	Transit Management	maintenance status	H	Human Interface	product	H	
Transit Management	Archived Data Management Subsystem	transit archive data	W	Messaging data	regional	13	

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Transit Management	Emergency Management	transit emergency data	W	Conversational data, Messaging data	regional	05,09	E
Transit Management	Enforcement Agency	payment violation notification	W	Messaging data	regional	11A	
Transit Management	Financial Institution	payment request	W	Conversational data, Messaging data	national	E	
Transit Management	Information Service Provider	demand responsive transit plan	W	Conversational data, Messaging data	regional	10	P
Transit Management	Information Service Provider	transit and fare schedules	W	Messaging data	regional	10	
Transit Management	Information Service Provider	transit incident information	W	Messaging data	regional	10	
Transit Management	Information Service Provider	transit request confirmation	W	Messaging data	regional	10	P
Transit Management	Maintenance and Construction Management	road network probe information	W	Messaging data	regional	11A	
Transit Management	Maintenance and Construction Management	work plan feedback	W	Conversational data, Messaging data	regional	14	
Transit Management	Map Update Provider	map update request	W	Messaging data	national	02	
Transit Management	Media	transit incidents for media	W	Messaging data	product	11	
Transit Management	Media	transit information for media	W	Messaging data	product	11	
Transit Management	Multimodal Transportation Service Provider	transit multimodal information	W	Messaging data	regional	11	
Transit Management	Other TRM	TRMS coord	W	Messaging data	regional	11	
Transit Management	Parking Management	transit parking lot response	W	Messaging data,Broadcast data, Multicast	regional	11	
Transit Management	Personal Information Access	personal transit information	W,U1t	Messaging data	national	11	
Transit Management	Remote Traveler Support	emergency acknowledge	W	Conversational data, Messaging data	product	05,11	
Transit Management	Remote Traveler Support	secure area monitoring support	W	Conversational data, Messaging data	product	11	E,T
Transit Management	Remote Traveler Support	transit fare payment responses	W	Conversational data, Messaging data	product	11	F
Transit Management	Remote Traveler Support	transit traveler information	W	Messaging data, Multicast data	product	11	
Transit Management	Surface Transportation Weather Service	transportation weather information request	W	Conversational data, Messaging data	regional	11A	
Transit Management	Traffic Management	request for road network conditions	W	Messaging data	regional	06A	

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Transit Management	Traffic Management	road network probe information	W	Messaging data	regional	11A	
Transit Management	Traffic Management	traffic control priority request	W	Messaging data	regional	06A,11A	
Transit Management	Traffic Management	transit demand management response	W	Messaging data	regional	06	
Transit Management	Traffic Management	transit system data	W	Messaging data	regional	06	
Transit Management	Transit Driver	route assignment	H	Human Interface	product	H	
Transit Management	Transit Fleet Manager	transit operations planning data	H	Human Interface	product	H	
Transit Management	Transit Maintenance Personnel	transit work schedule	H	Human Interface	product	H	
Transit Management	Transit System Operators	transit operator display	H	Human Interface	product	H	
Transit Management	Transit Vehicle Subsystem	bad tag list	U1t	Messaging data	product	11	
Transit Management	Transit Vehicle Subsystem	driver instructions	U1t	Messaging data	product	11A	
Transit Management	Transit Vehicle Subsystem	emergency acknowledge	U1t	Conversational data, Messaging data	product	05,11	
Transit Management	Transit Vehicle Subsystem	fare management information	U1t	Messaging data	product	11	
Transit Management	Transit Vehicle Subsystem	request for vehicle measures	U1t,U2	Messaging data	product	11	
Transit Management	Transit Vehicle Subsystem	transit schedule information	U1t	Messaging data	product	11	
Transit Management	Transit Vehicle Subsystem	transit traveler information	U1t	Messaging data	product	11	P
Transit System Operators	Transit Management	transit operator management data	H	Human Interface	product	H	
Transit User	Remote Traveler Support	transit user inputs	H	Human Interface	product	H	
Transit User	Transit Vehicle Subsystem	emergency request	H	Human Interface	product	H	
Transit User	Transit Vehicle Subsystem	transit user inputs	H	Human Interface	product	H	
Transit Vehicle Subsystem	Roadway Subsystem	local signal priority request	U2	Conversational data	regional	01,08	T
Transit Vehicle Subsystem	Transit Driver	transit driver display	H	Human Interface	product	H	
Transit Vehicle Subsystem	Transit Management	emergency notification	U1t	Messaging data	product	11,05	E
Transit Vehicle Subsystem	Transit Management	environmental probe data	U1t	Messaging data	product	14	
Transit Vehicle Subsystem	Transit Management	fare and payment status	U1t,U2	Conversational data, Messaging data	product	11	F,T
Transit Vehicle Subsystem	Transit Management	request for bad tag list	U1t,U2	Conversational data, Messaging data	product	11	F,T
Transit Vehicle Subsystem	Transit Management	transit traveler request	U1t	Conversational data, Messaging data	product	11	P

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Transit Vehicle Subsystem	Transit Management	transit vehicle conditions	U1t,U2	Messaging data	product	11	
Transit Vehicle Subsystem	Transit Management	transit vehicle location data	U1t,U2	Conversational data, Messaging data, location data	product	11	
Transit Vehicle Subsystem	Transit Management	transit vehicle passenger and use data	U1t,U2	Conversational data, Messaging data	product	11	
Transit Vehicle Subsystem	Transit Management	transit vehicle schedule performance	U1t,U2	Conversational data, Messaging data	product	11	
Transit Vehicle Subsystem	Transit User	transit user fare status	H	Human Interface	product	H	
Transit Vehicle Subsystem	Transit User	transit user outputs	H	Human Interface	product	H	
Transit Vehicle Subsystem	Traveler Card	request for payment	S	Conversational Data	national	C	F
Transit Vehicle Subsystem	Vehicle	traveler advisory request	V	Messaging data	product	I	
Traveler	Personal Information Access	traveler inputs	H	Human Interface	product	H	
Traveler	Remote Traveler Support	traveler inputs	H	Human Interface	product	H	
Traveler Card	Parking Management	payment	S	Conversational data	national	C	F
Traveler Card	Personal Information Access	payment	S	Conversational Data	national	C	F
Traveler Card	Personal Information Access	traveler card information	S	Conversational data	national	C	
Traveler Card	Remote Traveler Support	payment	S	Conversational Data	national	C	F
Traveler Card	Remote Traveler Support	traveler card information	S	Conversational data,	national	C	
Traveler Card	Transit Vehicle Subsystem	payment	S	Conversational Data	national	C	F
Traveler Card	Vehicle	payment	S	Conversational Data	national	C	F
Vehicle	Basic Vehicle	vehicle control	V	Conversational Data	product	I	R
Vehicle	Commercial Vehicle Subsystem	commercial vehicle data request	V	Messaging data	product	I	
Vehicle	Commercial Vehicle Subsystem	vehicle location	V	Messaging data	product	04	
Vehicle	Driver	driver updates	H	Human Interface	product	H	
Vehicle	Driver	in-vehicle transaction status	H	Human Interface	product	H	F
Vehicle	Emergency Management	emergency notification	U1t	Conversational speech, Messaging data, location data	national	05	E
Vehicle	Emergency Vehicle Subsystem	vehicle location	V	Broadcast data	product	I	
Vehicle	Information Service Provider	environmental probe data	U1t	Messaging data	national	03A	P
Vehicle	Information Service Provider	traveler profile	U1t	Conversational data, Messaging data	national	03	P

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Vehicle	Information Service Provider	traveler request	U1t	Conversational data, Messaging data	national	03	P
Vehicle	Information Service Provider	trip confirmation	U1t	Conversational data, Messaging data	national	03	P
Vehicle	Information Service Provider	trip request	U1t	Conversational data, Messaging data	national	03	P
Vehicle	Information Service Provider	vehicle probe data	U1t	Messaging data, location data	national	03	P
Vehicle	Information Service Provider	yellow pages request	U1t	Conversational data, Messaging data	national	03	P
Vehicle	Maintenance and Construction Vehicle	safety system status	V	Conversational data, Messaging data	product	I	
Vehicle	Maintenance and Construction Vehicle	vehicle location	V	Conversational data, Messaging data	product	I	
Vehicle	Map Update Provider	map update request	U1t	Messaging data	national	02	
Vehicle	Other Vehicle	vehicle to vehicle coordination	U3	Conversational data	national	A	T,R
Vehicle	Parking Management	tag data	U2	Conversational data	national	01	T,P
Vehicle	Roadway Subsystem	AHS vehicle data	U2	Conversational data	national	01	T,R
Vehicle	Roadway Subsystem	environmental probe data	U2	Messaging data	national	01A,14	T,P
Vehicle	Roadway Subsystem	vehicle probe data	U2	Messaging data	national	01	T,P
Vehicle	Toll Collection	tag data	U2	Conversational data	national	01	T,P
Vehicle	Transit Vehicle Subsystem	vehicle location	V	Broadcast data	product	I	
Vehicle	Traveler Card	request for payment	S	Conversational Data	national	C	F
Vehicle Characteristics	Parking Management	vehicle characteristics	P	Physical Interface	NA	B	
Vehicle Characteristics	Roadway Subsystem	vehicle characteristics	P	Physical Interface	NA	B	
Vehicle Characteristics	Toll Collection	vehicle characteristics	P	Physical Interface	NA	B	
Wayside Equipment	Roadway Subsystem	arriving train information	W	Messaging data	product	12	T, R
Wayside Equipment	Roadway Subsystem	track status	W	Messaging data	product	12	T,R
Weather Service	Archived Data Management Subsystem	weather information	W	Messaging data	national	13	
Weather Service	Emergency Management	weather information	W	Messaging data,Broadcast data, Multicast	national	09	
Weather Service	Information Service Provider	weather information	W	Messaging data,Broadcast data, Multicast	national	10	

Communications Layer

Source	Destination	Architecture Flow	Interconnects	Communication Service	Interoperability	Standards Requirements Package	Special Constraints
Weather Service	Maintenance and Construction Management	environmental conditions data	W	Messaging data	national	14	
Weather Service	Maintenance and Construction Management	weather information	W	Messaging data,Broadcast data, Multicast	national	14	
Weather Service	Roadway Subsystem	environmental sensors control	W	Conversational data, Messaging data	national	07A,14	
Weather Service	Traffic Management	environmental conditions data	W	Messaging data	national	06A	
Weather Service	Traffic Management	weather information	W	Messaging data,Broadcast data, Multicast	national	06	
Weather Service	Transit Management	weather information	W	Messaging data,Broadcast data, Multicast	national	11	
Yellow Pages Service Providers	Information Service Provider	provider profile data	W	Messaging data	national	10	
Yellow Pages Service Providers	Information Service Provider	travel service info	W	Messaging data	national	10	

*** Interconnect Types as defined in Table A.2 (Communications Document Chapter 3)**
Communication Services Types in Table A.3 (Communications Document Chapter 3)
Interoperability Types in Table A.4 (Standards Development Plan Chapter 1)
Standards Packages in Table A.5 (Standards Requirements Document)
Special Constraints in Table A.6 (Physical Architecture Chapter 2.23)

Table A.4 Interoperability Types

Interoperability	Description
National	Interfaces to the mobile subsystems (Vehicle Subsystems, Personal Information Access Subsystems) in the architecture support national interoperability since the same mobile subsystem should be able to roam the nation and use the local infrastructure to support ITS services. National interoperability is specified for all interfaces to mobile subsystems except where both the mobile subsystem and interfacing infrastructure are owned and operated by the same user. Examples of these include the Information Service Provider to Personal Information Access Subsystem, Toll Collection Subsystem to Vehicle Subsystem, and the Commercial Vehicle Subsystem to Commercial Vehicle Check Subsystem.
Regional	Interfaces connecting subsystems that may be operated by different agencies (interfaces that can span jurisdictional and/or regional boundaries) can be standardized to facilitate the sharing of information between agencies. National standards mitigate issues that may arise as boundaries change and new requirements for information sharing develop over time. Regional interoperability is specified where the underlying coordination issues are regional, rather than national, in scope. For instance, there is no real requirement for a Traffic Management Subsystem in California to be able to communicate and coordinate with a Traffic Management Subsystem in New York. Two different regional dialects for Traffic Management Subsystem communications could be implemented in the two geographically isolated subsystems, without significant impact to national interoperability goals. Examples of these include the Traffic Management Subsystem to Transit Management Subsystem, Traffic Management Subsystem to Information Service Provider, and Traffic Management Subsystem to Traffic Management Subsystem.
Product	Interfaces between subsystems that are operated and maintained by a single stakeholder (e.g. company or agency) do not require standardization to achieve national interoperability. The data formats and communications mechanisms that are used for these interfaces are largely transparent to the remainder of the architecture. In some cases, national standards are still very beneficial (and hence still attainable through the consensus standard process) since they may consolidate a market to achieve economy of scale efficiencies (e.g. Traffic Management Subsystem to Roadway Subsystem). Such standards may also support an optional level of interoperability by enabling various cooperative control options to be implemented based on regional preference.
None	In other cases, the sheer range of application-specific interfaces precludes efficient national standardization and no standard is suggested. For instance, a national standard is not recommended for the interface between the Fleet Management and Commercial Vehicle subsystems since the nature of the interface is so dependent on fleet type. From the National Architecture perspective, standardization for these interfaces is not suggested. Examples include the Fleet Management Subsystem to Commercial Vehicle Subsystem.

Table A.5 Standards Packages

Number	Requirement Package Name
01	Dedicate Short Range Communications (DSRC)
02	Digital Map Data Exchange and Location Referencing
03	Information Service Provider Wireless Interfaces
04	Inter-Center Data Exchange for Commercial Vehicle Operations
05	Personal and HAZMAT Maydays
06	Traffic Management Subsystems to Other Centers (Except EM)
07	Traffic Management Subsystems to Roadway Devices and Emissions Sensing/Management
08	Signal Priority for Transit and Emergency Vehicles
09	Emergency Management to Other Centers
10	Information Service Provider to Other Centers (except EM and TMS)
11	Transit Management to Transit Vehicle
12	Highway Rail Intersection
13	Archived Data Management Interfaces
14	Maintenance and Construction Management Interfaces
A	AHS Standards
E	Existing Standards
I	Internal and probably proprietary
P	Proprietary Standards
H	Human Interfaces

Table A.6 Special Constraints

Constraint Abbreviation	Constraint Name	Description
R	Reliability	Failure of the communication medium may result in severe accident. This communication channel may require redundant paths or extra attention paid to potential failure modes. For wireline cases, this may indicate alternate phone or other connections are required. For wireless cases (for AHS applications), special attention will be paid to the transmitters, receivers, and potential interference for these connections
F	Financial Security	Data contains financial information and must be protected accordingly. This data is specifically called out between the user's card and the infrastructure and between the infrastructure and financial institutions. Protections currently exist for the latter. Financial data transmitted over the air must be recognized as private data with an additional reliability requirement. Financial data may exist between other subsystems as part of normal messaging. It is assumed that such data will be treated with the same constraints as the interfaces specifically identified
P	Personal Privacy	Data contains personal information. Traveler requests and traveler location are private and should be protected. Subsystems aggregate these data and forward specific data with the traveler's permission.
E	Emergency Priority	Communication channel requires priority in emergencies. These data channels require that they be operational even when there is an emergency which might place other loads on the interface. A private communication channel or frequency may be required to satisfy the requirement.
T	Performance (Timing)	Timing is critical. Timing for most ITS communication services is based on the response to a request for data. Because of this, common communication media designed to handle voice data will likely support these requirements. The beacon interface has special requirements of identifying the vehicle as well as exchanging information before the vehicle gets out of range. This is more of a problem with vehicles traveling at speed. The architecture constrains such time critical access to data such that the data is available at the beacon site. This obviates the need for explicit specification of other timing information to support data transfer over a short range beacon.