

Standards Requirements Package 14: Maintenance and Construction Management Interfaces

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1. Introduction to Standards Requirements Documentation

The Standards Requirements Packages are intended to be used in conjunction with the other architecture documents. In particular, the introductory chapters of the Standards Requirements Document provide contextual material and explanations/justifications of some of the methods used to evaluate and rate architecture flows. However, it is recognized that many people may initially only receive a given Standards Requirements Package, without the associated supporting material. To aid these individuals, we offer some generic introductory material to promote understanding of the context and approach used to create a Standards Requirements Package. Ultimately, any standards development organization pursuing an ITS-related standard should ensure that they have access to a complete set of the architecture documents as a reference source.

What's New in this Version?

- This version of the Standards Requirements Package has been updated based on new physical architecture flows and underlying logical data flows recently added to the National ITS Architecture. These new flows provide new material for the standards community to consider.
- This version of the Standards Requirements Package is based on logical data flows whereas previous versions had been based on a separate set of flows called Leveled Data Items. Rather than maintain two sets of information in the architecture, it was felt that these packages could provide the raw material from the logical architecture for the SDOs. If further information is needed to clarify the content or organization of the logical data flows, the architecture team can be contacted for assistance.

For this version of the Standards Requirements Packages, some of the changes from Version 3.0 to Version 4.0 of the National ITS Architecture are reflected in the addenda found on the Version 4.0 CD-ROM and website. Addenda were compiled to reflect the smaller changes to affected Standards Requirements Packages that did not necessitate a wholesale rewrite. Addenda have been created for Standards Requirements Packages 1, 2, 3, 5, 6, 7, 9, 10 and 11.

1.1 Standards Requirements Document Executive Summary

The executive summary of the Standards Requirements Document is reproduced here, to provide a sense of the overall goals and content of the document.

The Standards Requirements Document ("SRD") collects information from the other National ITS Architecture program documents and reorganizes it in a manner intended to support the development of critical ITS standards. The key results in the SRD are a reference model for the National ITS Architecture, a rating scheme for evaluating the standardization issues associated with individual data flows that make up the architecture interfaces, and then a set of priority groupings of interfaces into standards requirements "packages". These results and the major conclusions are summarized below.

The introductory section explains the structure of the SRD and its intended usage. The strategy is that the reference model provides the overall context for a standards development organization ("SDO"). A given SDO can pull a particular package of standards requirements out of the document and then use the reference model as a quick reference to the overall architecture. More detailed needs will require going to the original source documents, such as the Logical or Physical Architectures.

The next section provides the rationale for several different ratings schemes applied to the architecture interconnects and flows. These include interoperability requirements, technology maturity assessments, and stakeholder interest. All architecture interconnects were examined with respect to these measures. The stakeholder interest and interoperability requirements in particular were then used as the basis for

selecting the standards requirements packages. In general, interfaces associated with mobile systems had both the greatest stakeholder interest and the most stringent interoperability requirements. Following close behind were interfaces associated with Traffic Management and Information Service Provider subsystems.

The Architecture Reference Model is provided next as a high level definition of the components that form the National ITS Architecture. It depicts the interconnectivity of the subsystems and terminators, their definitions, and suitable types of communications strategies. This reference model is an important tool for communicating the full breadth of the architecture at an abstracted level. In the SRD it is intended as a contextual reference, but, as a separate document, the reference model has received international circulation through the International Organization of Standards (ISO) as a basis for documenting and comparing ITS architectures.

The “meat” of the SRD is the set of standards requirements packages. Each package is a special grouping of standards requirements and contextual information intended to be used in a nearly standalone fashion by an SDO. Thus, packages have been selected that cover the key ITS priorities, maintain the integrity and vision of the National ITS Architecture, and also are perceived as having an interested stakeholder constituency that will help drive standardization. This is a difficult balancing act, but the following 14 packages were identified as covering the high priority standardization needs for the architecture program:

1. Dedicated Short Range Communications (DSRC)
2. Digital Map Data Exchange and Location Referencing Formats
3. Information Service Provider Wireless Interfaces
4. Inter-Center Data Exchange for Commercial Vehicle Operations
5. Personal, Transit, and HAZMAT Maydays
6. Traffic Management Subsystem to Other Centers (except EMS)
7. Traffic Management Subsystem to Roadside Devices and Emissions Monitoring
8. Signal Priority for Transit and Emergency Vehicles
9. Emergency Management Subsystem to Other Centers
10. Information Service Provider Subsystem to Other Centers (except EMS and TMS)
11. Transit Management Subsystem Interfaces
12. Highway Rail Intersections (HRI)
13. Archived Data Management Subsystem Interfaces
14. Maintenance and Construction Management Interfaces

These 14 areas cover much of the National ITS Architecture and represent the distillation of stakeholder interests and architecture interoperability requirements. If standardization can be achieved in the near term for all or most of these packages, then ITS will be a long way towards achieving the original vision captured in the user service requirements.

1.2 Constructing a Standards Requirements Package

The intent of creating a Standards Requirements Package is to facilitate efforts to standardize some subset of the National ITS Architecture. The “packaging” process involves abstracting and reorganizing information from other documents, primarily the Logical and Physical Architectures.

This Standards Requirements Package has the following main components:

- General introduction to the scope and intent of this package
- Message transaction sets
- Communications considerations
- Architecture flow commonality
- Constraints
- Decomposition of the interfaces
- Data Dictionary Entry definitions

The general introduction is self-explanatory, but the other items require some explanation. We will address them one at a time:

Message Transaction Sets: In order to accomplish a given activity, a series of messages usually have to be exchanged between two or more subsystems. These messages, as a group, constitute a message transaction set. The sequencing of the messages is shown via the physical architecture flow, each representing individual messages.

For version 4.0, we will be referencing portions of the revised Theory of Operations which defines the transactions for each Market Package.

Communications Considerations provides a discussion of the basic nature of the communications modalities that are suitable for supporting the interfaces in the particular standards requirements package. This section identifies some high level requirements, but the primary focus is to provide information that is viewed as useful to the initiation of the standardization process.

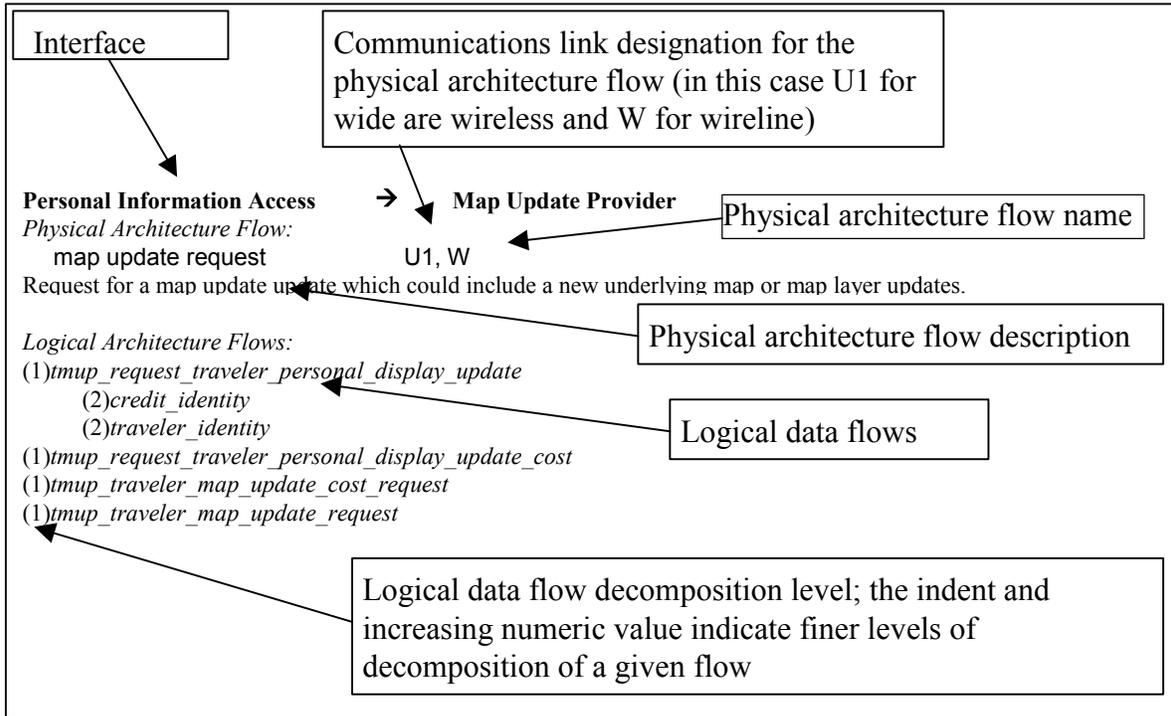
Architecture Flow Commonality discusses the fact that there are many different interfaces in the architecture that carry the same information. These architecture flows are assigned identical, or very similar, names in the hope that they will be standardized in the same way. This section discusses 2 types of flow commonality: architecture flows on like communications link types, and architecture flows on different communications link types.

Constraints lists the architecture flows and any constraints placed upon them.

Decomposition of the Interfaces: This is the hierarchy of items that constitute an interface. It starts with the interface between two subsystems itself, or between a subsystem and a terminator, which is then decomposed into physical architecture flows. Each of the physical architecture flows is then decomposed into a set of Logical Architecture data flows that in turn are decomposed until we reach primitive data elements. The physical architecture flows are labeled with the type of communications technology appropriate for that flow. Figure 1 shows an example of an interface decomposition.

Data Dictionary Elements: These definitions are copied from the Logical Architecture Data Dictionary. Each DDE provides a description of the data flow, and a definition of its composite data elements. For a more in depth examination of each data flow and the functions (or PSpecs) that use it, it is necessary to refer to the logical architecture documentation.

Figure 1. Example of the parts of an interface decomposition



As a final clarification, it is useful to remind readers of the distinction between the layers in the OSI communications reference model and the layers in the National ITS Architecture. For purposes of analysis and discussion, the National ITS Architecture has been portrayed as having three layers: *the transportation, the communications, and the institutional layer*. The first two are of concern here. The transportation layer contains all the functionality of the National ITS Architecture. As a consequence, any discussion of interfaces, messages, data dictionary entries, etc., is drawn from the information in the transportation layer. The communications layer describes the technology required to support the information exchange needs of the transportation layer. These National ITS Architecture layers can be roughly mapped to the OSI reference model; the transportation layer is typically at or above the application layer and the communications layer is most often concerned with the lowest four layers of the OSI reference model. The interested reader is directed to the Communications Analysis Document for a more substantial explanation of this relationship.

This explanation of the layers is offered here because the terminology can be confusing. Every effort has been made to clarify when the “layered model” is the National ITS Architecture and when it is the OSI reference model. In general, when the term “communications layer” is used in the Standards Requirements Document, it refers to the National ITS Architecture “layer”.

2 Introduction to this Standards Package

This standards requirements package captures the requirements for providing interfaces to the Maintenance and Construction Management Subsystem (MCMS) and the Maintenance and Construction Vehicle Subsystem (MCVS).

The MCMS 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 MCVS resides in 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 snowplow, 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.

The subsystems and the physical architecture flows that are applicable to this standards package are shown in Figures 2 through 5.

- Figure 2 shows the interfaces to and from the MCVS.
- Figure 3 shows the interfaces between the MCMS and the terminators.
- Figure 4 shows the interfaces between the MCMS and the other center-type subsystems.
- Figure 5 shows the interfaces to and from the Roadway Subsystem (RS) that relate to Maintenance and Construction Management.

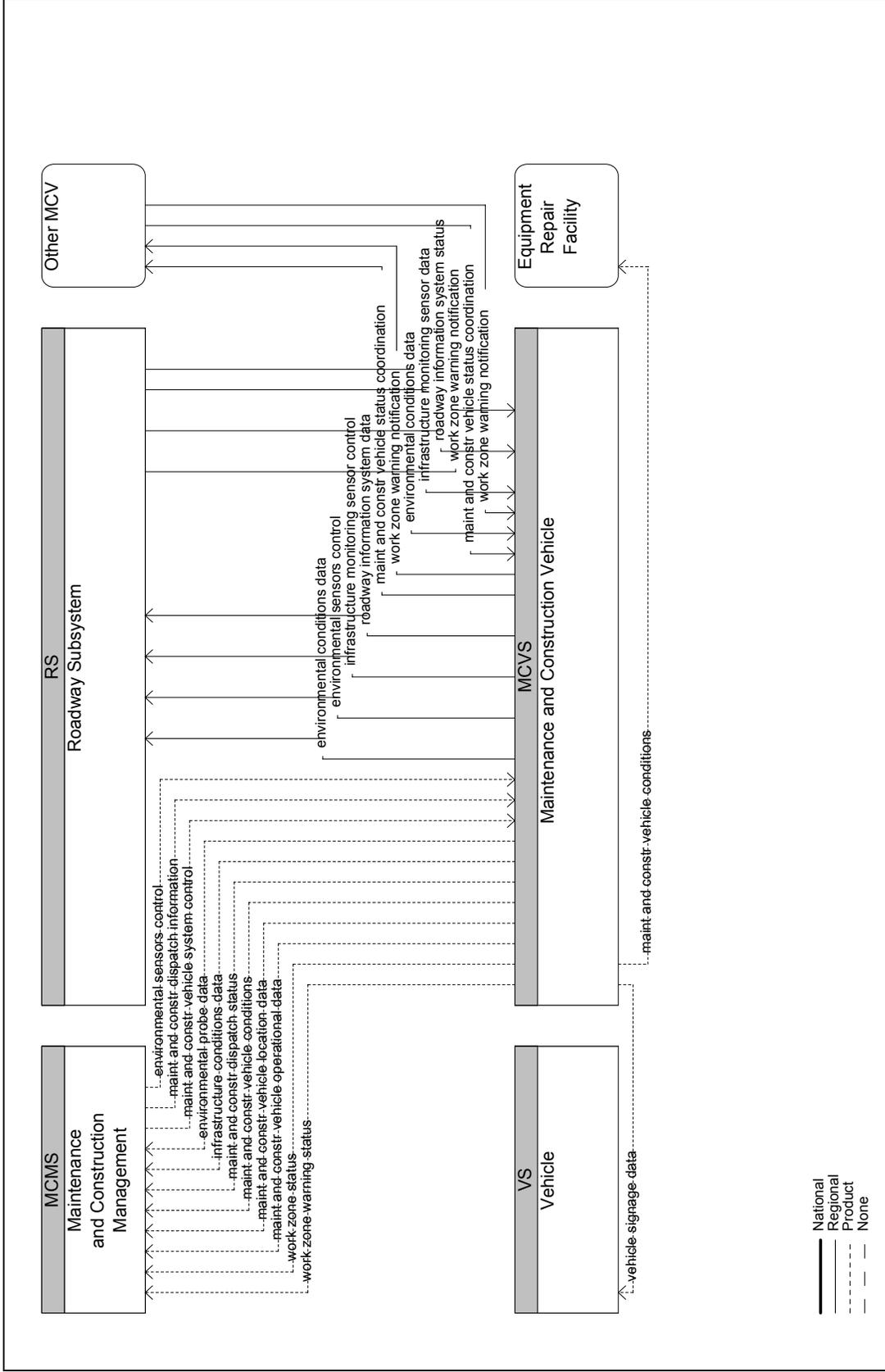


Figure 2. Interfaces for Maintenance and Construction Vehicle Subsystem

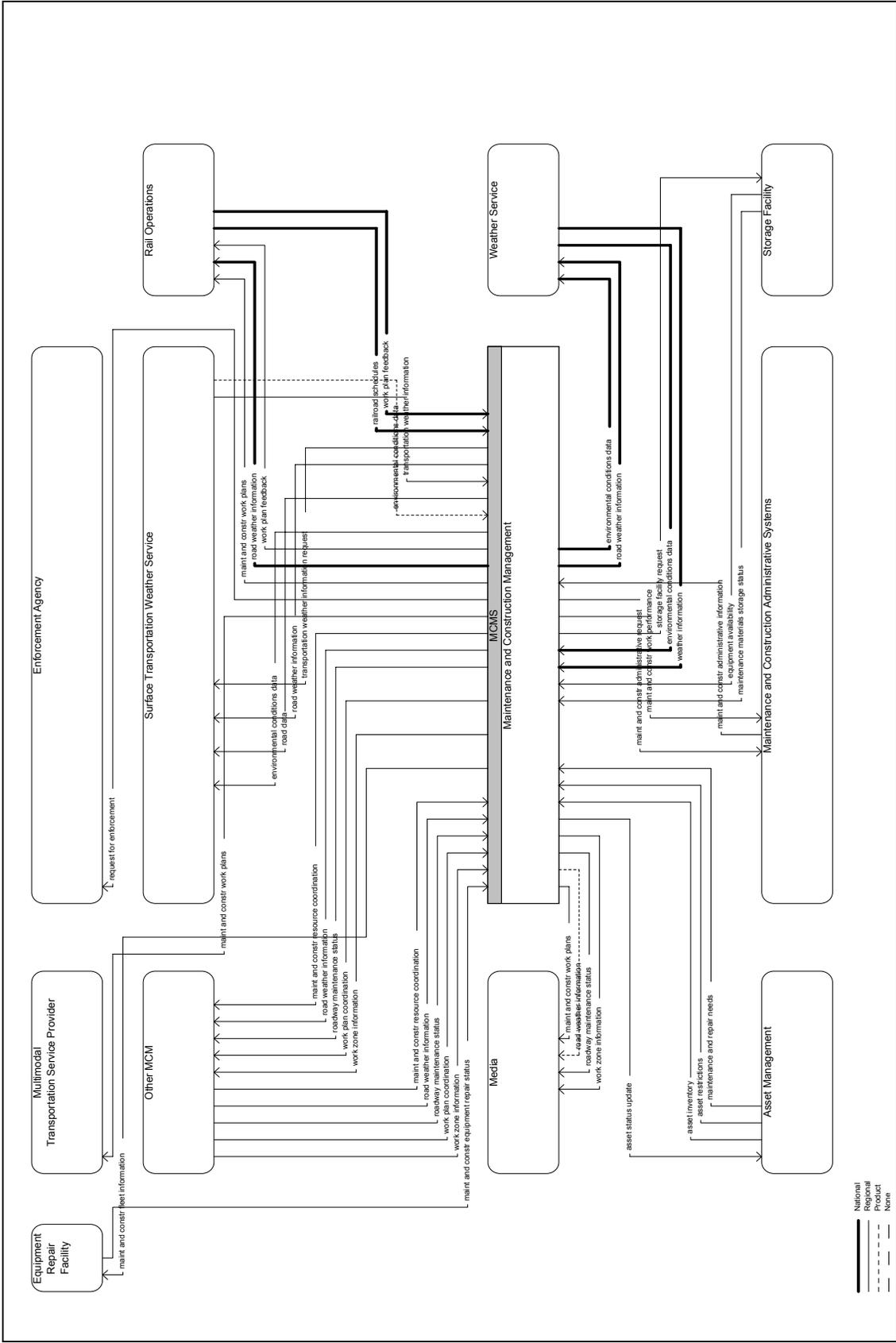


Figure 3. Interfaces between MCMS and the Terminators

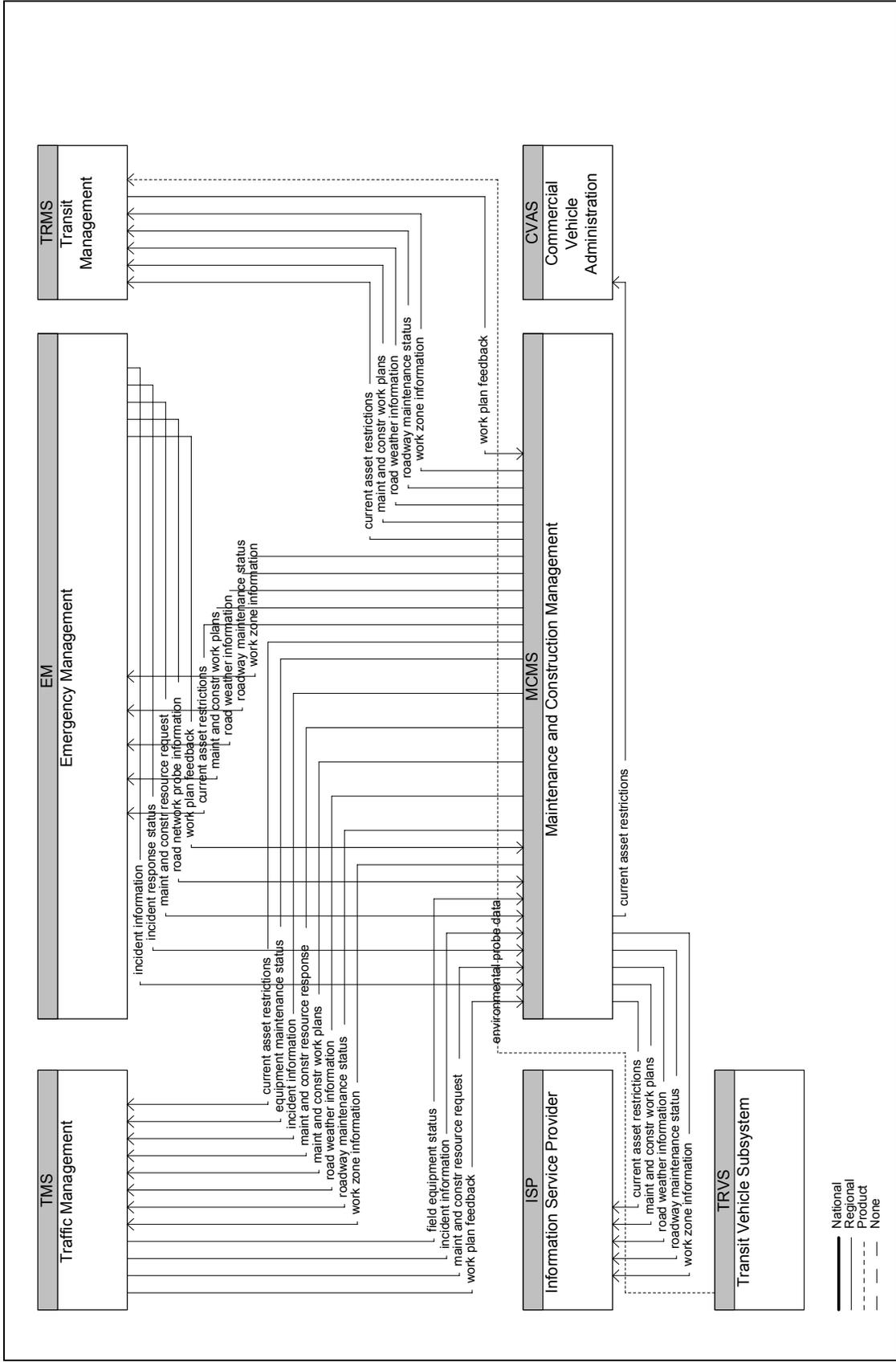


Figure 4. Interfaces between MCMS and Other Centers

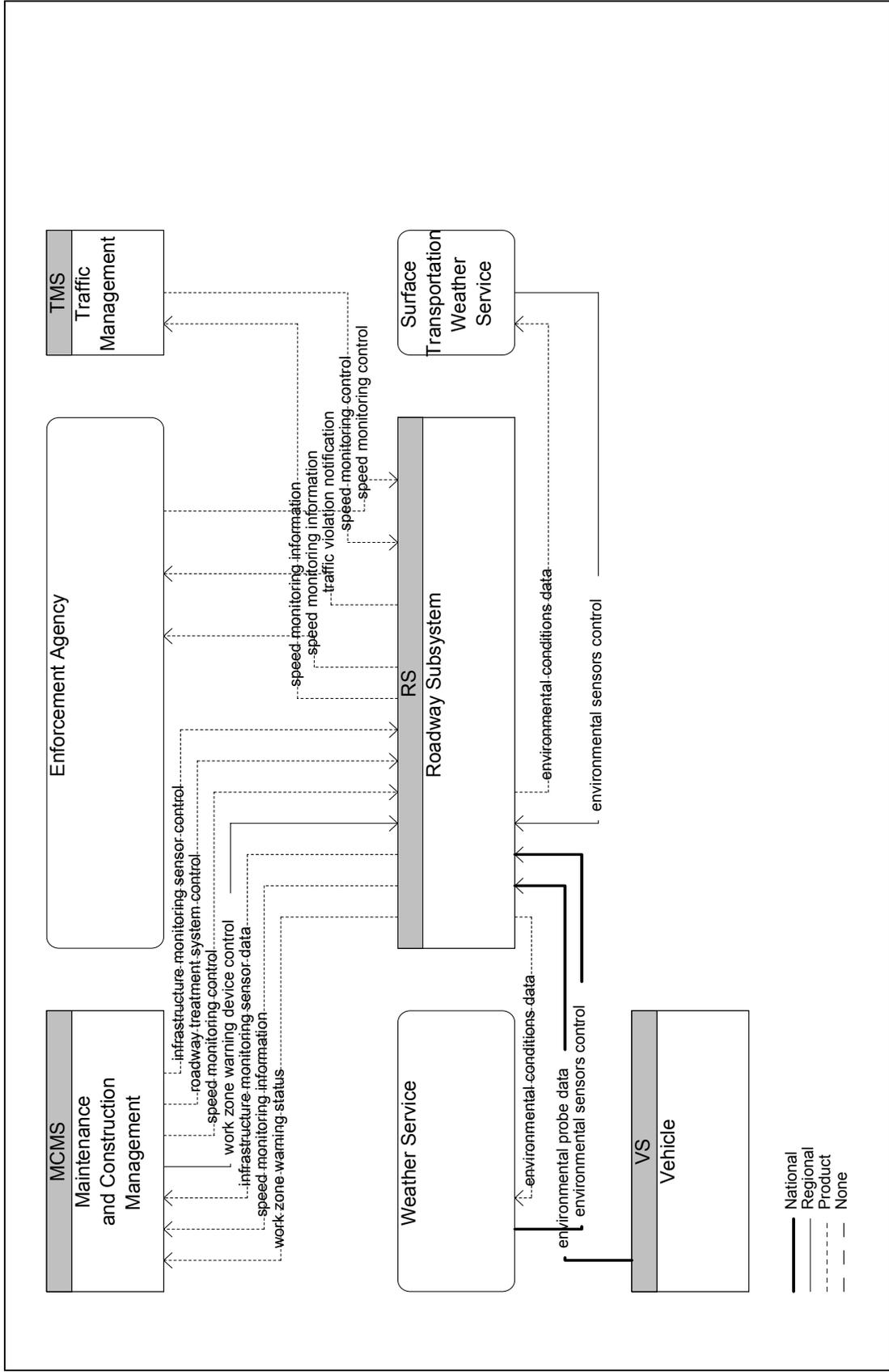


Figure 5. Interfaces for Roadway Subsystem related to Maintenance and Construction

3 Transaction Sets for Maintenance and Construction Management Interfaces

Based on the top-level physical architecture flows presented in the previous section, we can define the sets of architecture flows needed to provide ITS services (called Market Packages in the National ITS Architecture) that relate to Maintenance and Construction Operations. A convenient way to express each set of flows is in a message sequence chart format along the lines of those defined under ISO standardization.

The majority of Maintenance and Construction Interfaces are contained in the 12 Market Packages shown in Table 1. This section will provide message sequence charts (and descriptions of the message sequence) for each of the market packages in Table 1. This information is copied from the Theory of Operations document, which defines the transaction sets for all of the Market Packages defined for the architecture.

Table 1. Market Packages with Maintenance & Construction Interfaces

Market Package	Market Package Name
ATMS08	Incident Management System
ATMS19	Speed Monitoring
EM4	Roadway Service Patrols
MC01	Maintenance and Construction Vehicle Tracking
MC02	Maintenance and Construction Vehicle Maintenance
MC03	Road Weather Data Collection
MC04	Weather Information Processing and Distribution
MC05	Roadway Automated Treatment
MC06	Winter Maintenance
MC07	Roadway Maintenance and Construction
MC08	Work Zone Management
MC09	Work Zone Safety Monitoring
MC10	Maintenance and Construction Activity Coordination

The following table lists each architecture flow that is included in this Standards Requirements Package along with the related Market Package. Following the table are the Theory of Operations diagrams for the market packages related to the new Maintenance and Construction Management Interfaces.

Table 2. Maintenance & Construction Management Interfaces and Related Market Packages

Source	Destination	architecture flow	Market Package	Market Package Name
Asset Management	Maintenance and Construction Management	asset inventory	MC07	Roadway Maintenance and Construction
Asset Management	Maintenance and Construction Management	asset restrictions	MC10	Maintenance and Construction Activity Coordination
Asset Management	Maintenance and Construction Management	asset restrictions	MC07	Roadway Maintenance and Construction
Asset Management	Maintenance and Construction Management	maintenance and repair needs	MC07	Roadway Maintenance and Construction
Emergency Management	Maintenance and Construction Management	incident information	ATMS08	Incident Management System
Emergency Management	Maintenance and Construction Management	incident information	EM4	Roadway Service Patrols
Emergency Management	Maintenance and Construction Management	incident response status	ATMS08	Incident Management System

Source	Destination	architecture flow	Market Package	Market Package Name
Emergency Management	Maintenance and Construction Management	maint and constr resource request	MC07	Roadway Maintenance and Construction
Emergency Management	Maintenance and Construction Management	maint and constr resource request	MC06	Winter Maintenance
Emergency Management	Maintenance and Construction Management	maint and constr resource request	ATMS08	Incident Management System
Emergency Management	Maintenance and Construction Management	road network probe information	MC03	Road Weather Data Collection
Emergency Management	Maintenance and Construction Management	work plan feedback	MC10	Maintenance and Construction Activity Coordination
Enforcement Agency	Roadway Subsystem	speed monitoring control	ATMS19	Speed Monitoring
Equipment Repair Facility	Maintenance and Construction Management	maint and constr equipment repair status	MC02	Maintenance and Construction Vehicle Maintenance
Maintenance and Construction Administrative Systems	Maintenance and Construction Management	maint and constr administrative information	MC07	Roadway Maintenance and Construction
Maintenance and Construction Administrative Systems	Maintenance and Construction Management	maint and constr administrative information	MC06	Winter Maintenance
Maintenance and Construction Administrative Systems	Maintenance and Construction Management	maint and constr administrative information	MC08	Work Zone Management
Maintenance and Construction Administrative Systems	Maintenance and Construction Management	maint and constr administrative information	MC10	Maintenance and Construction Activity Coordination
Maintenance and Construction Management	Asset Management	asset status update	MC07	Roadway Maintenance and Construction
Maintenance and Construction Management	Commercial Vehicle Administration	current asset restrictions	CVO04	CV Administrative Processes
Maintenance and Construction Management	Commercial Vehicle Administration	current asset restrictions	MC10	Maintenance and Construction Activity Coordination
Maintenance and Construction Management	Emergency Management	current asset restrictions	MC10	Maintenance and Construction Activity Coordination
Maintenance and Construction Management	Emergency Management	current asset restrictions	EM2	Emergency Routing
Maintenance and Construction Management	Emergency Management	maint and constr work plans	MC10	Maintenance and Construction Activity Coordination
Maintenance and Construction Management	Emergency Management	road weather information	MC04	Weather Information Processing and Distribution
Maintenance and Construction Management	Emergency Management	roadway maintenance status	EM1	Emergency Response
Maintenance and Construction Management	Emergency Management	roadway maintenance status	EM2	Emergency Routing
Maintenance and Construction Management	Emergency Management	roadway maintenance status	MC06	Winter Maintenance
Maintenance and Construction Management	Emergency Management	work zone information	MC08	Work Zone Management
Maintenance and Construction Management	Emergency Management	work zone information	EM1	Emergency Response
Maintenance and Construction Management	Emergency Management	work zone information	EM2	Emergency Routing
Maintenance and Construction Management	Enforcement Agency	request for enforcement	ATMS19	Speed Monitoring
Maintenance and Construction Management	Equipment Repair Facility	maint and constr fleet information	MC02	Maintenance and Construction Vehicle Maintenance
Maintenance and Construction Management	Information Service Provider	current asset restrictions	ATIS2	Interactive Traveler Information
Maintenance and Construction Management	Information Service Provider	current asset restrictions	MC10	Maintenance and Construction Activity Coordination
Maintenance and Construction Management	Information Service Provider	current asset restrictions	ATIS1	Broadcast Traveler Information
Maintenance and Construction Management	Information Service Provider	current asset restrictions	ATIS5	ISP Based Route Guidance
Maintenance and Construction Management	Information Service Provider	maint and constr work plans	MC10	Maintenance and Construction Activity Coordination
Maintenance and Construction Management	Information Service Provider	maint and constr work plans	ATIS2	Interactive Traveler Information
Maintenance and Construction Management	Information Service Provider	maint and constr work plans	ATIS1	Broadcast Traveler Information

Source	Destination	architecture flow	Market Package	Market Package Name
Maintenance and Construction Management	Information Service Provider	road weather information	MC04	Weather Information Processing and Distribution
Maintenance and Construction Management	Information Service Provider	roadway maintenance status	ATIS1	Broadcast Traveler Information
Maintenance and Construction Management	Information Service Provider	roadway maintenance status	ATIS2	Interactive Traveler Information
Maintenance and Construction Management	Information Service Provider	roadway maintenance status	MC06	Winter Maintenance
Maintenance and Construction Management	Information Service Provider	work zone information	ATIS2	Interactive Traveler Information
Maintenance and Construction Management	Information Service Provider	work zone information	MC08	Work Zone Management
Maintenance and Construction Management	Information Service Provider	work zone information	ATIS1	Broadcast Traveler Information
Maintenance and Construction Management	Maintenance and Construction Administrative Systems	maint and constr administrative request	MC06	Winter Maintenance
Maintenance and Construction Management	Maintenance and Construction Administrative Systems	maint and constr administrative request	MC07	Roadway Maintenance and Construction
Maintenance and Construction Management	Maintenance and Construction Administrative Systems	maint and constr administrative request	MC08	Work Zone Management
Maintenance and Construction Management	Maintenance and Construction Administrative Systems	maint and constr administrative request	MC10	Maintenance and Construction Activity Coordination
Maintenance and Construction Management	Maintenance and Construction Administrative Systems	maint and constr work performance	MC06	Winter Maintenance
Maintenance and Construction Management	Maintenance and Construction Administrative Systems	maint and constr work performance	MC07	Roadway Maintenance and Construction
Maintenance and Construction Management	Maintenance and Construction Administrative Systems	maint and constr work performance	MC08	Work Zone Management
Maintenance and Construction Management	Maintenance and Construction Vehicle	environmental sensors control	MC03	Road Weather Data Collection
Maintenance and Construction Management	Maintenance and Construction Vehicle	maint and constr dispatch information	MC07	Roadway Maintenance and Construction
Maintenance and Construction Management	Maintenance and Construction Vehicle	maint and constr dispatch information	MC06	Winter Maintenance
Maintenance and Construction Management	Maintenance and Construction Vehicle	maint and constr vehicle system control	MC06	Winter Maintenance
Maintenance and Construction Management	Maintenance and Construction Vehicle	maint and constr vehicle system control	MC07	Roadway Maintenance and Construction
Maintenance and Construction Management	Media	maint and constr work plans	MC10	Maintenance and Construction Activity Coordination
Maintenance and Construction Management	Media	road weather information	MC04	Weather Information Processing and Distribution
Maintenance and Construction Management	Media	roadway maintenance status	MC06	Winter Maintenance
Maintenance and Construction Management	Media	work zone information	MC08	Work Zone Management
Maintenance and Construction Management	Multimodal Transportation Service Provider	maint and constr work plans	MC10	Maintenance and Construction Activity Coordination
Maintenance and Construction Management	Other MCM	maint and constr resource coordination	ATMS08	Incident Management System
Maintenance and Construction Management	Other MCM	road weather information	MC04	Weather Information Processing and Distribution
Maintenance and Construction Management	Other MCM	roadway maintenance status	MC06	Winter Maintenance
Maintenance and Construction Management	Other MCM	work plan coordination	MC10	Maintenance and Construction Activity Coordination
Maintenance and Construction Management	Other MCM	work zone information	MC08	Work Zone Management
Maintenance and Construction Management	Rail Operations	maint and constr work plans	MC10	Maintenance and Construction Activity Coordination
Maintenance and Construction Management	Rail Operations	road weather information	MC04	Weather Information Processing and Distribution
Maintenance and Construction Management	Rail Operations	work plan feedback	MC10	Maintenance and Construction Activity Coordination

Source	Destination	architecture flow	Market Package	Market Package Name
Maintenance and Construction Management	Roadway Subsystem	infrastructure monitoring sensor control	MC07	Roadway Maintenance and Construction
Maintenance and Construction Management	Roadway Subsystem	roadway treatment system control	MC05	Roadway Automated Treatment
Maintenance and Construction Management	Roadway Subsystem	speed monitoring control	ATMS19	Speed Monitoring
Maintenance and Construction Management	Roadway Subsystem	work zone warning device control	MC09	Work Zone Safety Monitoring
Maintenance and Construction Management	Storage Facility	storage facility request	MC06	Winter Maintenance
Maintenance and Construction Management	Storage Facility	storage facility request	MC07	Roadway Maintenance and Construction
Maintenance and Construction Management	Surface Transportation Weather Service	environmental conditions data	MC03	Road Weather Data Collection
Maintenance and Construction Management	Surface Transportation Weather Service	road data	MC04	Weather Information Processing and Distribution
Maintenance and Construction Management	Surface Transportation Weather Service	road data	MC03	Road Weather Data Collection
Maintenance and Construction Management	Surface Transportation Weather Service	road weather information	MC04	Weather Information Processing and Distribution
Maintenance and Construction Management	Surface Transportation Weather Service	transportation weather information request	MC07	Roadway Maintenance and Construction
Maintenance and Construction Management	Surface Transportation Weather Service	transportation weather information request	MC06	Winter Maintenance
Maintenance and Construction Management	Surface Transportation Weather Service	transportation weather information request	MC04	Weather Information Processing and Distribution
Maintenance and Construction Management	Traffic Management	current asset restrictions	MC10	Maintenance and Construction Activity Coordination
Maintenance and Construction Management	Traffic Management	current asset restrictions	ATMS06	Traffic Information Dissemination
Maintenance and Construction Management	Traffic Management	equipment maintenance status	MC07	Roadway Maintenance and Construction
Maintenance and Construction Management	Traffic Management	incident information	ATMS08	Incident Management System
Maintenance and Construction Management	Traffic Management	maint and constr resource response	MC06	Winter Maintenance
Maintenance and Construction Management	Traffic Management	maint and constr resource response	ATMS08	Incident Management System
Maintenance and Construction Management	Traffic Management	maint and constr resource response	MC07	Roadway Maintenance and Construction
Maintenance and Construction Management	Traffic Management	maint and constr work plans	MC10	Maintenance and Construction Activity Coordination
Maintenance and Construction Management	Traffic Management	road weather information	MC04	Weather Information Processing and Distribution
Maintenance and Construction Management	Traffic Management	roadway maintenance status	MC06	Winter Maintenance
Maintenance and Construction Management	Traffic Management	work zone information	MC08	Work Zone Management
Maintenance and Construction Management	Transit Management	current asset restrictions	APTS3	Demand Response Transit Operations
Maintenance and Construction Management	Transit Management	current asset restrictions	MC10	Maintenance and Construction Activity Coordination
Maintenance and Construction Management	Transit Management	current asset restrictions	APTS2	Transit Fixed-Route Operations
Maintenance and Construction Management	Transit Management	maint and constr work plans	MC10	Maintenance and Construction Activity Coordination
Maintenance and Construction Management	Transit Management	road weather information	MC04	Weather Information Processing and Distribution
Maintenance and Construction Management	Transit Management	roadway maintenance status	APTS2	Transit Fixed-Route Operations
Maintenance and Construction Management	Transit Management	roadway maintenance status	APTS3	Demand Response Transit Operations
Maintenance and Construction Management	Transit Management	roadway maintenance status	MC06	Winter Maintenance

Source	Destination	architecture flow	Market Package	Market Package Name
Maintenance and Construction Management	Transit Management	work zone information	APTS3	Demand Response Transit Operations
Maintenance and Construction Management	Transit Management	work zone information	MC08	Work Zone Management
Maintenance and Construction Management	Transit Management	work zone information	APTS2	Transit Fixed-Route Operations
Maintenance and Construction Management	Weather Service	environmental conditions data	MC03	Road Weather Data Collection
Maintenance and Construction Management	Weather Service	road weather information	MC04	Weather Information Processing and Distribution
Maintenance and Construction Vehicle	Equipment Repair Facility	maint and constr vehicle conditions	MC02	Maintenance and Construction Vehicle Maintenance
Maintenance and Construction Vehicle	Maintenance and Construction Management	environmental probe data	MC03	Road Weather Data Collection
Maintenance and Construction Vehicle	Maintenance and Construction Management	infrastructure conditions data	MC07	Roadway Maintenance and Construction
Maintenance and Construction Vehicle	Maintenance and Construction Management	maint and constr dispatch status	MC06	Winter Maintenance
Maintenance and Construction Vehicle	Maintenance and Construction Management	maint and constr dispatch status	MC07	Roadway Maintenance and Construction
Maintenance and Construction Vehicle	Maintenance and Construction Management	maint and constr vehicle conditions	MC02	Maintenance and Construction Vehicle Maintenance
Maintenance and Construction Vehicle	Maintenance and Construction Management	maint and constr vehicle location data	MC01	Maintenance and Construction Vehicle Tracking
Maintenance and Construction Vehicle	Maintenance and Construction Management	maint and constr vehicle operational data	MC07	Roadway Maintenance and Construction
Maintenance and Construction Vehicle	Maintenance and Construction Management	maint and constr vehicle operational data	MC06	Winter Maintenance
Maintenance and Construction Vehicle	Maintenance and Construction Management	work zone status	MC08	Work Zone Management
Maintenance and Construction Vehicle	Maintenance and Construction Management	work zone warning status	MC09	Work Zone Safety Monitoring
Maintenance and Construction Vehicle	Other MCV	maint and constr vehicle status coordination	MC06	Winter Maintenance
Maintenance and Construction Vehicle	Other MCV	work zone warning notification	MC09	Work Zone Safety Monitoring
Maintenance and Construction Vehicle	Roadway Subsystem	environmental conditions data	MC03	Road Weather Data Collection
Maintenance and Construction Vehicle	Roadway Subsystem	environmental sensors control	MC03	Road Weather Data Collection
Maintenance and Construction Vehicle	Roadway Subsystem	infrastructure monitoring sensor control	MC07	Roadway Maintenance and Construction
Maintenance and Construction Vehicle	Roadway Subsystem	roadway information system data	MC08	Work Zone Management
Maintenance and Construction Vehicle	Vehicle	vehicle signage data	MC09	Work Zone Safety Monitoring
Other MCM	Maintenance and Construction Management	maint and constr resource coordination	ATMS08	Incident Management System
Other MCM	Maintenance and Construction Management	road weather information	MC04	Weather Information Processing and Distribution
Other MCM	Maintenance and Construction Management	roadway maintenance status	MC06	Winter Maintenance
Other MCM	Maintenance and Construction Management	work plan coordination	MC10	Maintenance and Construction Activity Coordination
Other MCM	Maintenance and Construction Management	work zone information	MC08	Work Zone Management
Other MCV	Maintenance and Construction Vehicle	maint and constr vehicle status coordination	MC06	Winter Maintenance
Other MCV	Maintenance and Construction Vehicle	work zone warning notification	MC09	Work Zone Safety Monitoring
Rail Operations	Maintenance and Construction Management	railroad schedules	MC10	Maintenance and Construction Activity Coordination
Rail Operations	Maintenance and Construction Management	work plan feedback	MC10	Maintenance and Construction Activity Coordination

Source	Destination	architecture flow	Market Package	Market Package Name
Roadway Subsystem	Enforcement Agency	speed monitoring information	ATMS19	Speed Monitoring
Roadway Subsystem	Enforcement Agency	traffic violation notification	ATMS19	Speed Monitoring
Roadway Subsystem	Maintenance and Construction Management	infrastructure monitoring sensor data	MC07	Roadway Maintenance and Construction
Roadway Subsystem	Maintenance and Construction Management	speed monitoring information	ATMS19	Speed Monitoring
Roadway Subsystem	Maintenance and Construction Management	work zone warning status	MC09	Work Zone Safety Monitoring
Roadway Subsystem	Maintenance and Construction Vehicle	environmental conditions data	MC03	Road Weather Data Collection
Roadway Subsystem	Maintenance and Construction Vehicle	infrastructure monitoring sensor data	MC07	Roadway Maintenance and Construction
Roadway Subsystem	Maintenance and Construction Vehicle	roadway information system status	MC08	Work Zone Management
Roadway Subsystem	Maintenance and Construction Vehicle	work zone warning notification	MC09	Work Zone Safety Monitoring
Roadway Subsystem	Surface Transportation Weather Service	environmental conditions data	MC03	Road Weather Data Collection
Roadway Subsystem	Traffic Management	speed monitoring information	ATMS19	Speed Monitoring
Roadway Subsystem	Weather Service	environmental conditions data	MC03	Road Weather Data Collection
Storage Facility	Maintenance and Construction Management	equipment availability	MC07	Roadway Maintenance and Construction
Storage Facility	Maintenance and Construction Management	equipment availability	MC06	Winter Maintenance
Storage Facility	Maintenance and Construction Management	maintenance materials storage status	MC07	Roadway Maintenance and Construction
Storage Facility	Maintenance and Construction Management	maintenance materials storage status	MC06	Winter Maintenance
Surface Transportation Weather Service	Maintenance and Construction Management	environmental conditions data	MC03	Road Weather Data Collection
Surface Transportation Weather Service	Maintenance and Construction Management	transportation weather information	MC06	Winter Maintenance
Surface Transportation Weather Service	Maintenance and Construction Management	transportation weather information	MC04	Weather Information Processing and Distribution
Surface Transportation Weather Service	Maintenance and Construction Management	transportation weather information	MC07	Roadway Maintenance and Construction
Surface Transportation Weather Service	Roadway Subsystem	environmental sensors control	MC03	Road Weather Data Collection
Traffic Management	Maintenance and Construction Management	field equipment status	MC07	Roadway Maintenance and Construction
Traffic Management	Maintenance and Construction Management	incident information	ATMS08	Incident Management System
Traffic Management	Maintenance and Construction Management	maint and constr resource request	MC06	Winter Maintenance
Traffic Management	Maintenance and Construction Management	maint and constr resource request	MC07	Roadway Maintenance and Construction
Traffic Management	Maintenance and Construction Management	maint and constr resource request	ATMS08	Incident Management System
Traffic Management	Maintenance and Construction Management	work plan feedback	MC10	Maintenance and Construction Activity Coordination
Traffic Management	Roadway Subsystem	speed monitoring control	ATMS19	Speed Monitoring
Transit Management	Maintenance and Construction Management	work plan feedback	MC10	Maintenance and Construction Activity Coordination
Transit Vehicle Subsystem	Transit Management	environmental probe data	MC03	Road Weather Data Collection
Vehicle	Roadway Subsystem	environmental probe data	MC03	Road Weather Data Collection
Vehicle	Roadway Subsystem	environmental probe data	ATMS12	Virtual TMC and Smart Probe Data
Weather Service	Maintenance and Construction Management	environmental conditions data	MC03	Road Weather Data Collection
Weather Service	Maintenance and Construction Management	weather information	MC06	Winter Maintenance

Source	Destination	architecture flow	Market Package	Market Package Name
Weather Service	Maintenance and Construction Management	weather information	MC04	Weather Information Processing and Distribution
Weather Service	Maintenance and Construction Management	weather information	MC07	Roadway Maintenance and Construction
Weather Service	Roadway Subsystem	environmental sensors control	MC03	Road Weather Data Collection

3.1 Incident Management (ATMS08) Transactions

The transactions for Incident Management are spread over 4 diagrams:

- Setup and Pre-Incident Data Collection
- Real-Time Monitoring
- Incident Coordination
- Resource Coordination to Incidents

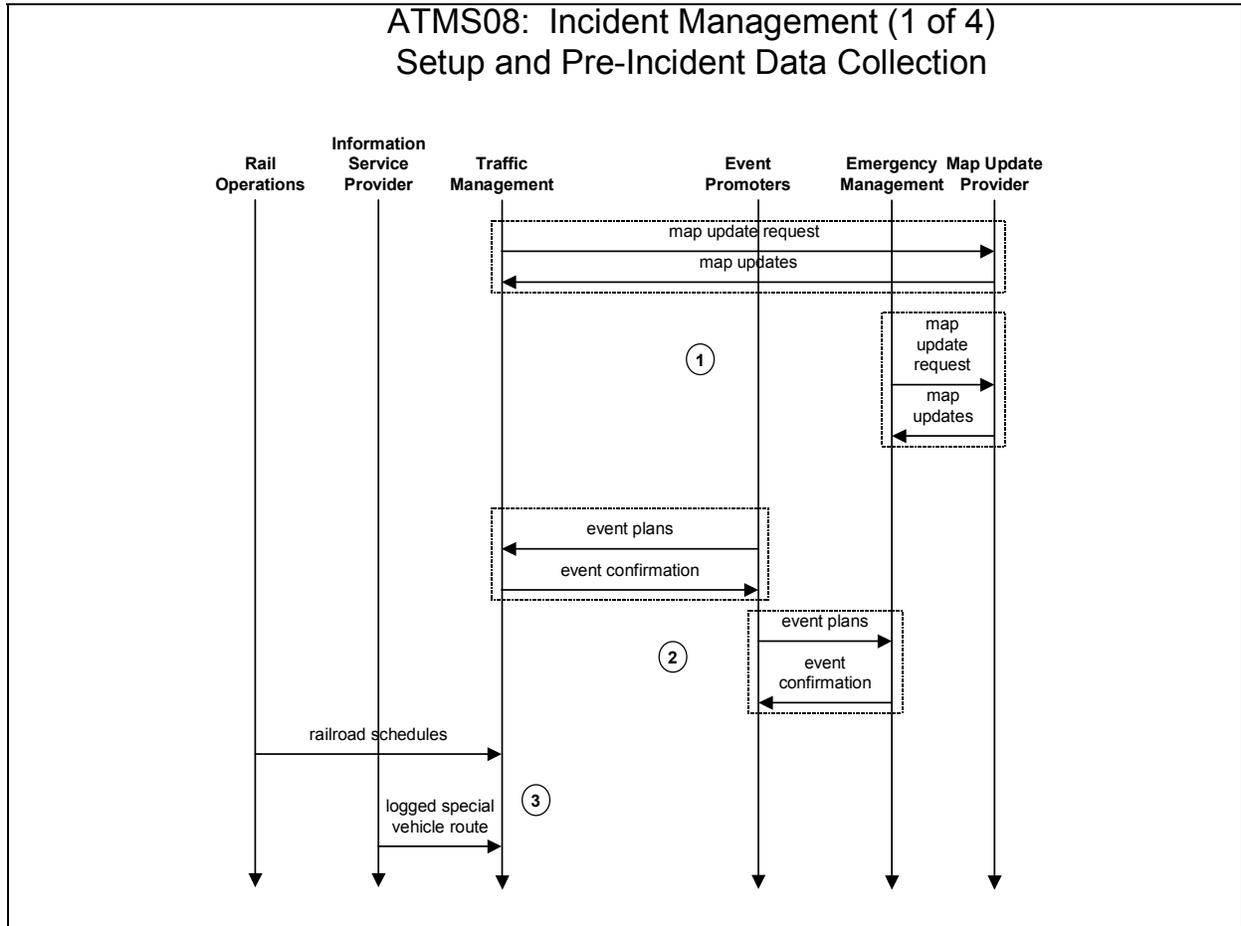


Figure 6. Incident Management Transaction Set (1 of 4)

ATMS08: Incident Management (2 of 4) Real-Time Monitoring

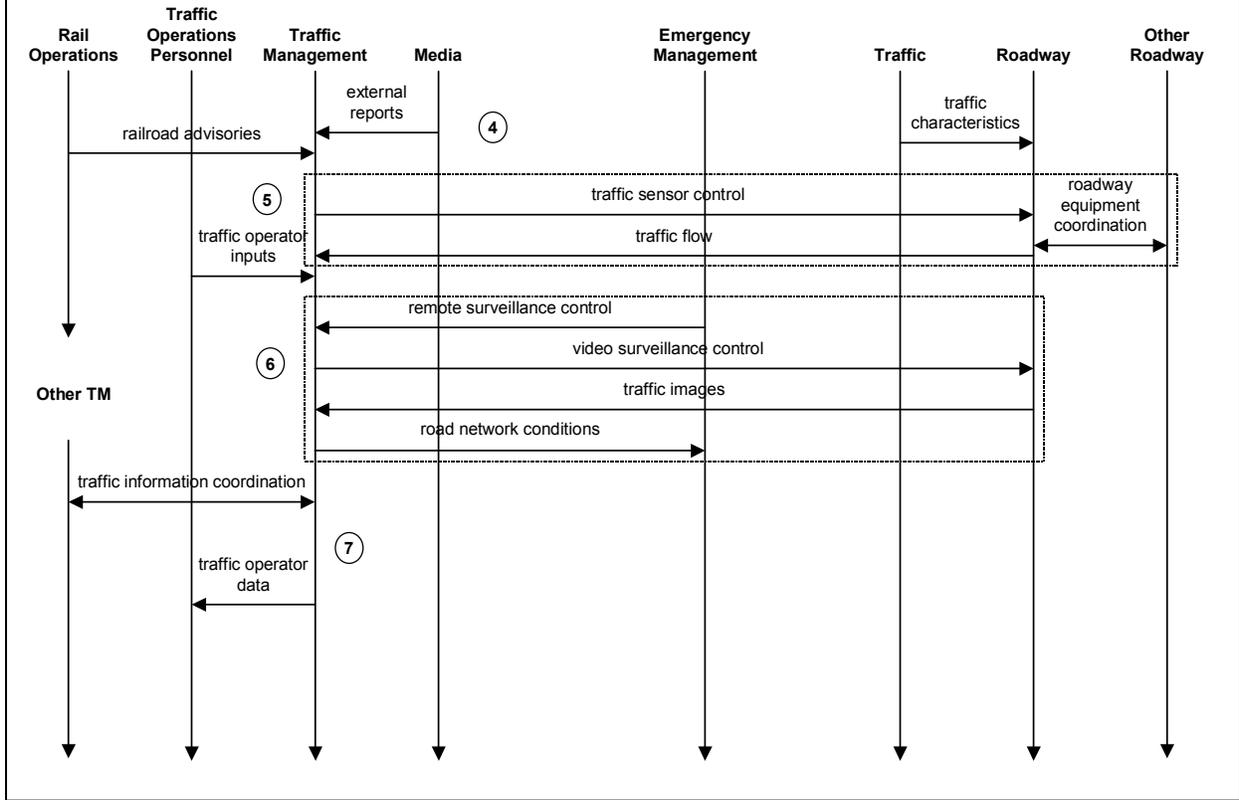


Figure 7. Incident Management Transaction Set (2 of 4)

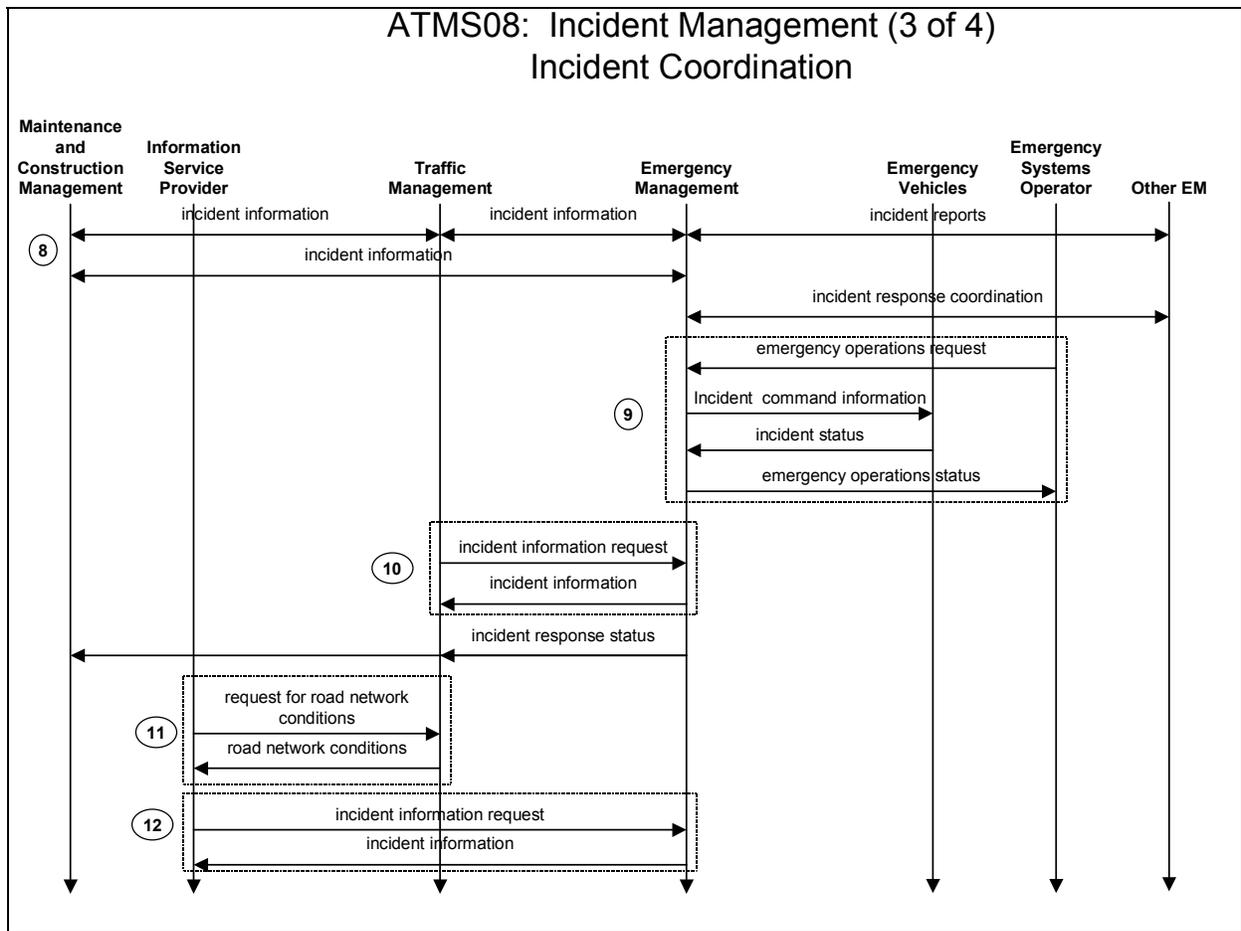


Figure 8. Incident Management Transaction Set (3 of 4)

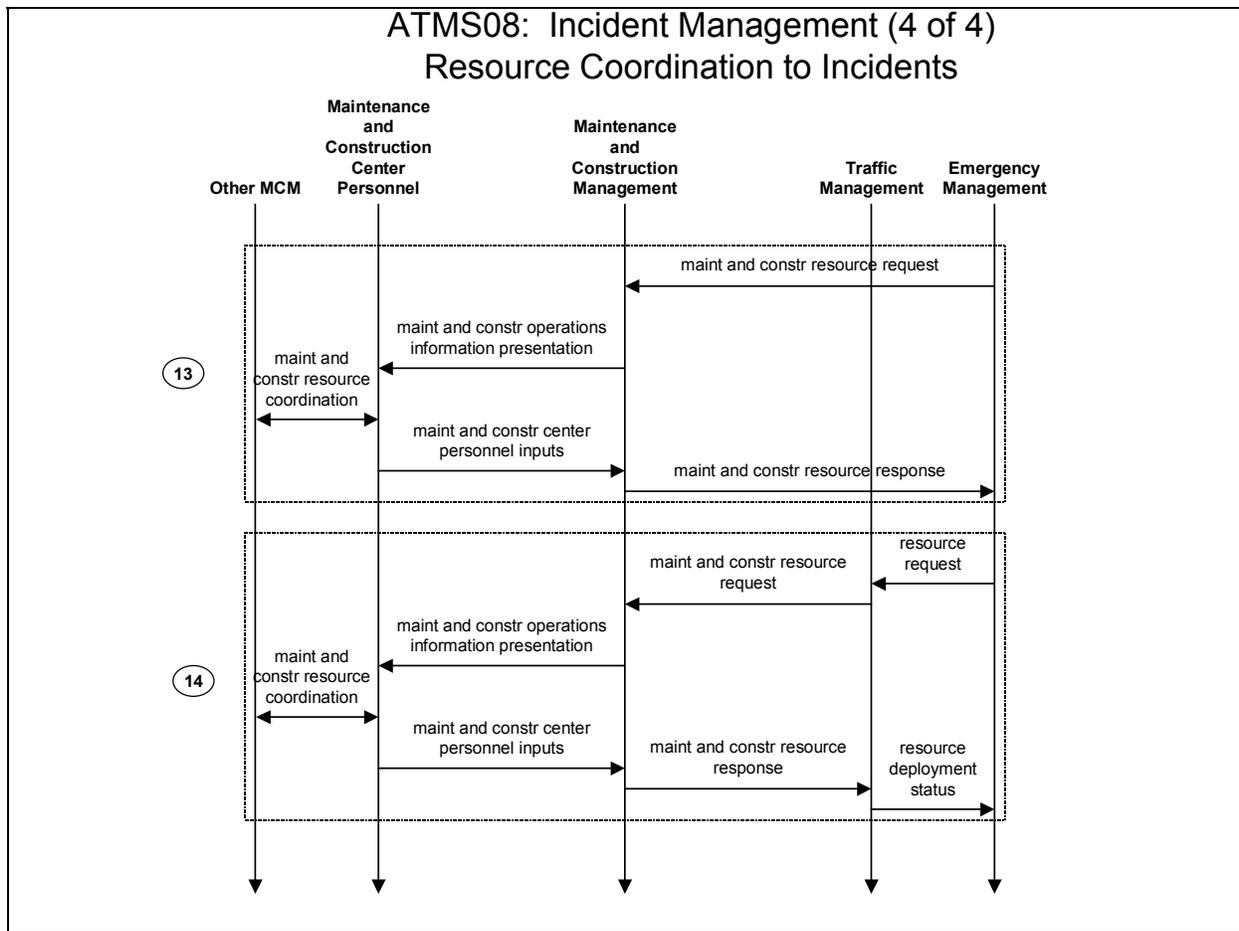


Figure 9. Incident Management Transaction Set (4 of 4)

This market package manages both unexpected incidents and planned events so that the impact to the transportation network and traveler safety is minimized. The market package includes incident detection capabilities through roadside surveillance devices (e.g. CCTV) and through regional coordination with other traffic management, maintenance and construction management and emergency management centers as well as weather service entities and event promoters. Information from these diverse sources are collected and correlated by this market package to detect and verify incidents and implement an appropriate response. This market package supports traffic operations personnel in developing an appropriate response in coordination with emergency management, maintenance and construction management, and other incident response personnel to confirmed incidents.

1. Incident information may be displayed on a map of the transportation network. The Traffic Management Subsystem and the Emergency Management Subsystem may use such maps to manage incidents. To keep the base map up to date, an update (*map updates*) can be acquired from a Map Update Provider. The update can be requested (*map update request*) when one is desired. Otherwise, the Map Update Provider could provide an update on a set schedule or as revisions warrant it.
2. An incident can be a planned event. Event promoters can notify the Traffic Management Subsystem and/or the Emergency Management Subsystem of planned events (*event plans*). The details of the events such as time, location and expected crowd size can be provided to assist in preparing the response. If desired, a confirmation (*event confirmation*) that the event plans were received can be sent.

3. The Traffic Management Subsystem can receive schedules of trains (*railroad schedules*) that have at-grade crossings so that street closures can be anticipated and travelers notified and/or response plans implemented. Additionally, the Traffic Management Subsystem can be notified by an Information Service Provider of routes to be taken by special vehicles such as oversized vehicles or Presidential motorcades (*logged special vehicle route*).
4. Equipment on the Roadway is constantly monitoring traffic conditions (*traffic characteristics*) such as volume, speed, density, etc. and can be analyzing the data to detect incidents. The Media may be monitoring traffic independently and may share information (*external reports*) including the identification of an incident with the Traffic Management Subsystem. Rail Operations may notify the Traffic Management Subsystem of railway-related incidents (*railroad advisories*).
5. To obtain information about traffic conditions, the Traffic Management Subsystem can control (*traffic sensor control*) and monitor (*traffic flow*) sensors in or along the roadway. Roadway equipment can be coordinated (*roadway equipment coordination*) through peer-to-peer, master-slave or other configurations.
6. The Emergency Management Subsystem may need to view and/or control (*remote surveillance control*) surveillance cameras and other equipment during an incident. The Traffic Management Subsystem may place limits on their control (*video surveillance control*). The Traffic Management Subsystem can provide the Emergency Management Subsystem with information on the current traffic conditions (*road network conditions*) and video images of the traffic (*traffic images*) to aid in the response to and management of the incident.
7. The Traffic Management Subsystems will share information (*traffic information coordination*) including information on incidents and the response to them. The entire process is under the asynchronous monitoring (*traffic operator data*) and control (*traffic operator inputs*) of Traffic Operations Personnel.
8. In the event of detecting or being notified of an incident, the Traffic Management Subsystem, the Maintenance and Construction Management Subsystem and the Emergency Management Subsystem will notify (*incident information*) the other subsystems and keep them updated throughout an extended incident. The Emergency Management Subsystem may share confidential details about incidents (*incident reports*) when notifying other Emergency Management Subsystems of incidents. The Emergency Management Subsystems may coordinate the response to incidents (*incident response coordination*.)
9. Emergency Systems Operator dispatches (*emergency operations request* and *incident command information*) the appropriate Emergency Vehicles to respond to an incident. The Emergency Management Subsystem monitors and manages the incident with feedback (*incident status*) from Emergency Vehicles on the screen. With the Emergency Management Subsystem, the Emergency Systems Operator monitors (*emergency operations status*) the incident response.
10. During an incident, the Traffic Management Subsystem may request (*incident information request*) updates on the incident (*incident information*) from the Emergency Management Subsystem. The Emergency Management Subsystem may inform the Traffic Management Subsystem and the Maintenance and Construction Management Subsystem of their response (*incident response status*.)
11. The Traffic Management Subsystem can share information on incidents (*road network conditions*) with an Information Service Provider (ISP). This information can be requested (*request for road network conditions*) when desired. Otherwise, it can be provided on a set update interval or when conditions change.
12. The ISP may request (*incident information request*) information on current incidents (*incident information*) from the Emergency Management Subsystem so that travelers can be notified and routed

around incidents. This information can be provided on a set update interval or when conditions change.

13. To respond to an incident, the Emergency Management Subsystem may request resources (*maint and constr resource request*) such as cones, barricades, sand and help clearing roadway from the Maintenance and Construction Management Subsystem (MCMS). With input from Maintenance and Construction Center Personnel (*maint and constr operatons information persentation* and *maint and constr center personnel inputs*) and other MCMSs (*maint and constr resource coordination*), a response to the resource request (*maint and constr center resource response*) can be sent to the Emergency Management Subsystem.
14. In responding to an incident, the Emergency Management Subsystem may need assistance (*resource request*) from the Traffic Management Subsystem such as verifying incident location, implementing special traffic control, etc. If required, the Traffic Management Subsystem may request resources from the Maintenance and Construction Management Subsystem. Traffic Management Subsystem may respond (*resource deployment status*) to the Emergency Management Subsystem on when the resource will be implemented or arrive on the screen.

3.2 Speed Monitoring (ATMS19) Transactions

The transactions for Speed Monitoring are spread over 3 diagrams:

- Maintenance and Construction Controlled
- Traffic Management Controlled
- Enforcement Agency Controlled

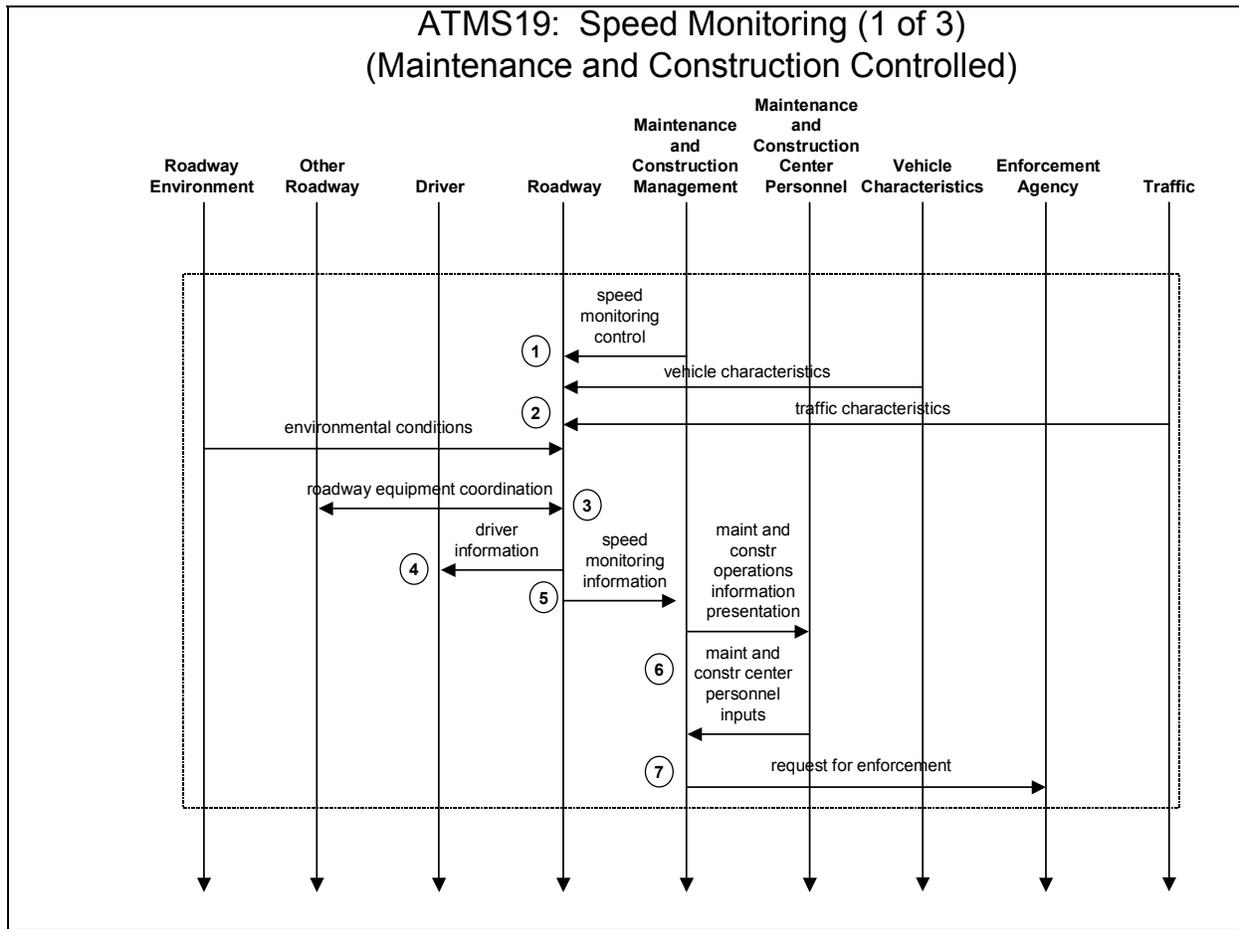


Figure 10. Speed Monitoring Transaction Set (1 of 3)

ATMS19: Speed Monitoring (2 of 3) (Traffic Management Controlled)

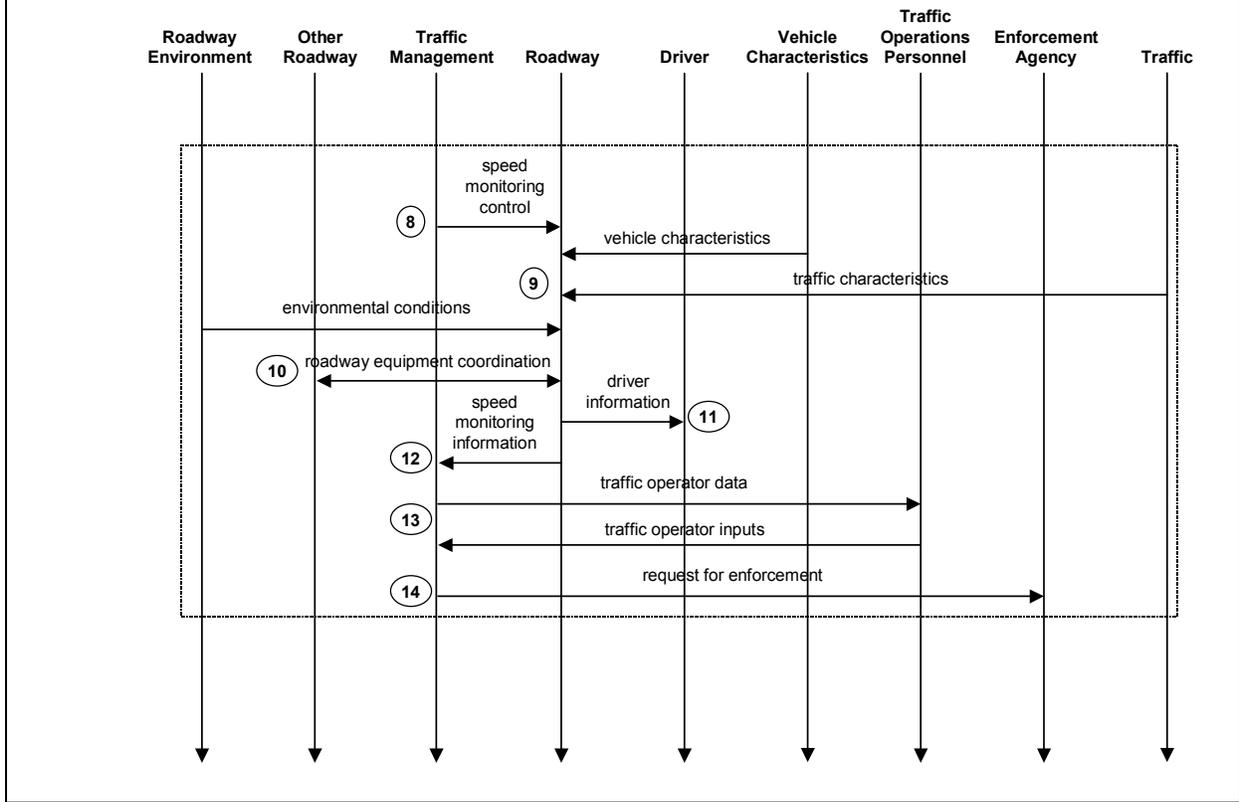


Figure 11. Speed Monitoring Transaction Set (2 of 3)

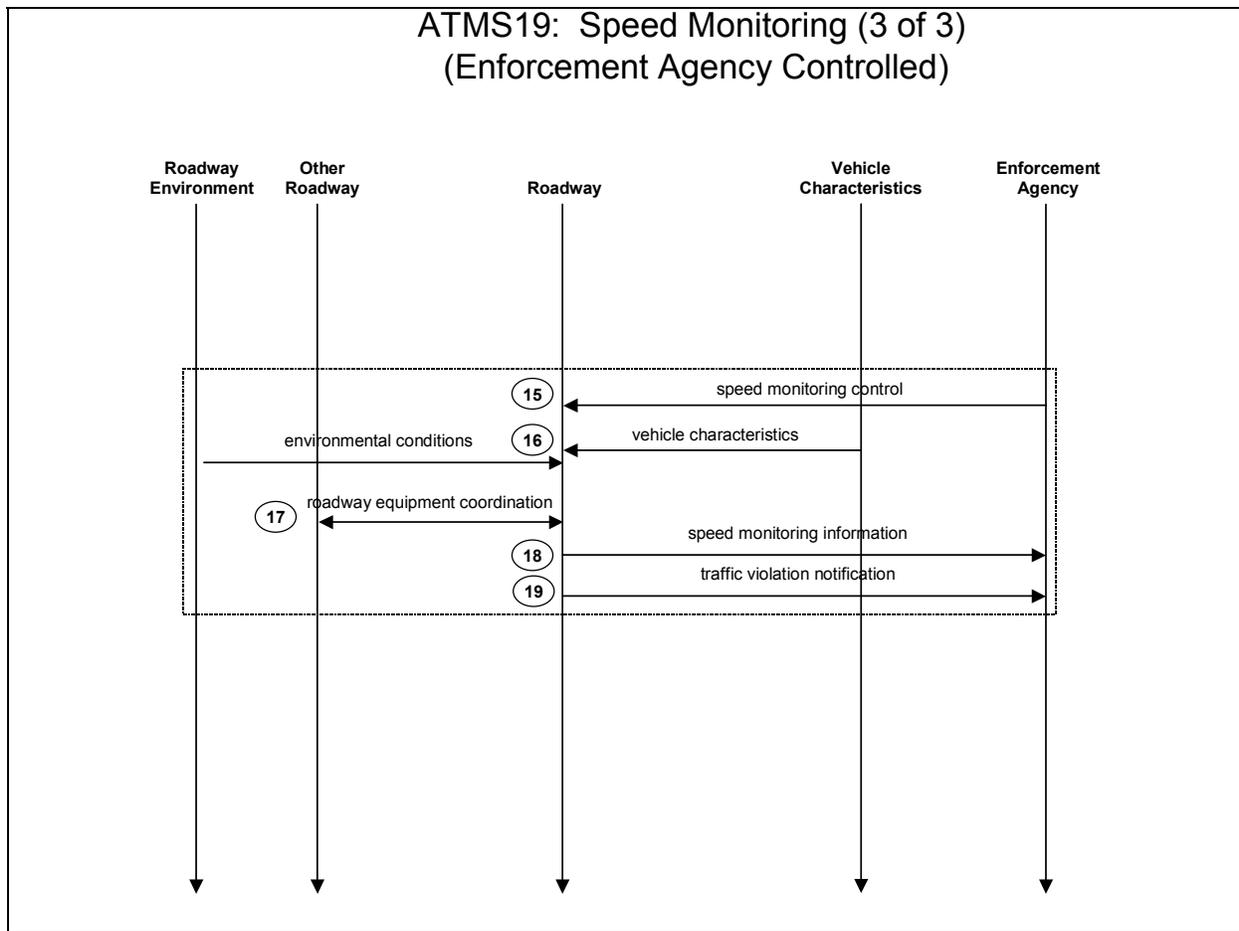


Figure 12. Speed Monitoring Transaction Set (3 of 3)

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

1. The Maintenance and Construction Management Subsystem (MCMS) can monitor vehicle speeds on a roadway. Speed monitoring is critically important in construction zones where maintenance personnel are working. The MCMS configures and controls automated speed monitoring, speed warning, and speed enforcement systems (*speed monitoring control*) on the Roadway.
2. Equipment on the Roadway measures traffic volume, speed, density and other characteristics (*traffic characteristics*). Equipment can identify specific vehicles and their speeds (*vehicle characteristics*). The current weather and roadway conditions (*environmental conditions*) which impact the proper speed limit are also monitored.
3. The equipment on the Roadway used for speed monitoring and enforcement can be coordinated (*roadway equipment coordination*) through peer-to-peer, master-slave or other configurations.
4. Drivers can be notified (*driver information*) en-route of their speed through signs, signals or other equipment on the Roadway.

5. The MCMS monitors the speed monitoring system status including current operational state and logged information including measured speeds, warning messages displayed, and violation records (*speed monitoring information*).
6. The entire process is under the monitoring (*maint and constr operations information presentation*) and control (*maint and constr center personnel inputs*) of Maintenance and Construction Center Personnel.
7. The MCMS can request speed enforcement (*request for enforcement*) from the Enforcement Agency when needed to address safety issues in a work zone or other special situations.
8. The Traffic Management Subsystem can also monitor speeds on roadways. The Traffic Management Subsystem would configure and control automated speed monitoring, speed warning, and speed enforcement systems (*speed monitoring control*) on the Roadway.
9. Equipment on or along the Roadway measures traffic volume, speed, density and other characteristics (*traffic characteristics*). Equipment can identify specific vehicles and their speeds (*vehicle characteristics*). The current weather and roadway conditions (*environmental conditions*) which impact the proper speed limit are also monitored.
10. The equipment on the Roadway used for speed monitoring and enforcement can be coordinated (*roadway equipment coordination*) through peer-to-peer, master-slave or other configurations.
11. Drivers can be notified (*driver information*) en-route of their speed through signs, signals or other equipment on the Roadway.
12. The Traffic Management Subsystem monitors the speed monitoring system status including current operational state and logged information including measured speeds, warning messages displayed, and violation records (*speed monitoring information*).
13. The entire process is under the monitoring (*traffic operator data*) and control (*traffic operator inputs*) of Traffic Operations Personnel.
14. The Traffic Management Subsystem can request speed enforcement (*request for enforcement*) from the Enforcement Agency when needed to address safety issues or other special situations.
15. Speed monitoring can also be performed by an Enforcement Agency. The Enforcement Agency would configure and control automated speed monitoring, speed warning, and speed enforcement systems (*speed monitoring control*) on the Roadway.
16. Equipment can identify specific vehicles and their speeds (*vehicle characteristics*). The current weather and roadway conditions (*environmental conditions*) which impact the proper speed limit are also monitored.
17. The equipment on the Roadway used for speed monitoring and enforcement can be coordinated (*roadway equipment coordination*) through peer-to-peer, master-slave or other configurations.
18. The Enforcement Agency monitors the speed monitoring system status including current operational state and logged information including measured speeds, warning messages displayed, and violation records (*speed monitoring information*).
19. The Enforcement Agency would be notified when a speed violation (*traffic violation notification*) was detected by equipment on the Roadway.

3.3 Roadway Service Patrols (EM4) Transactions

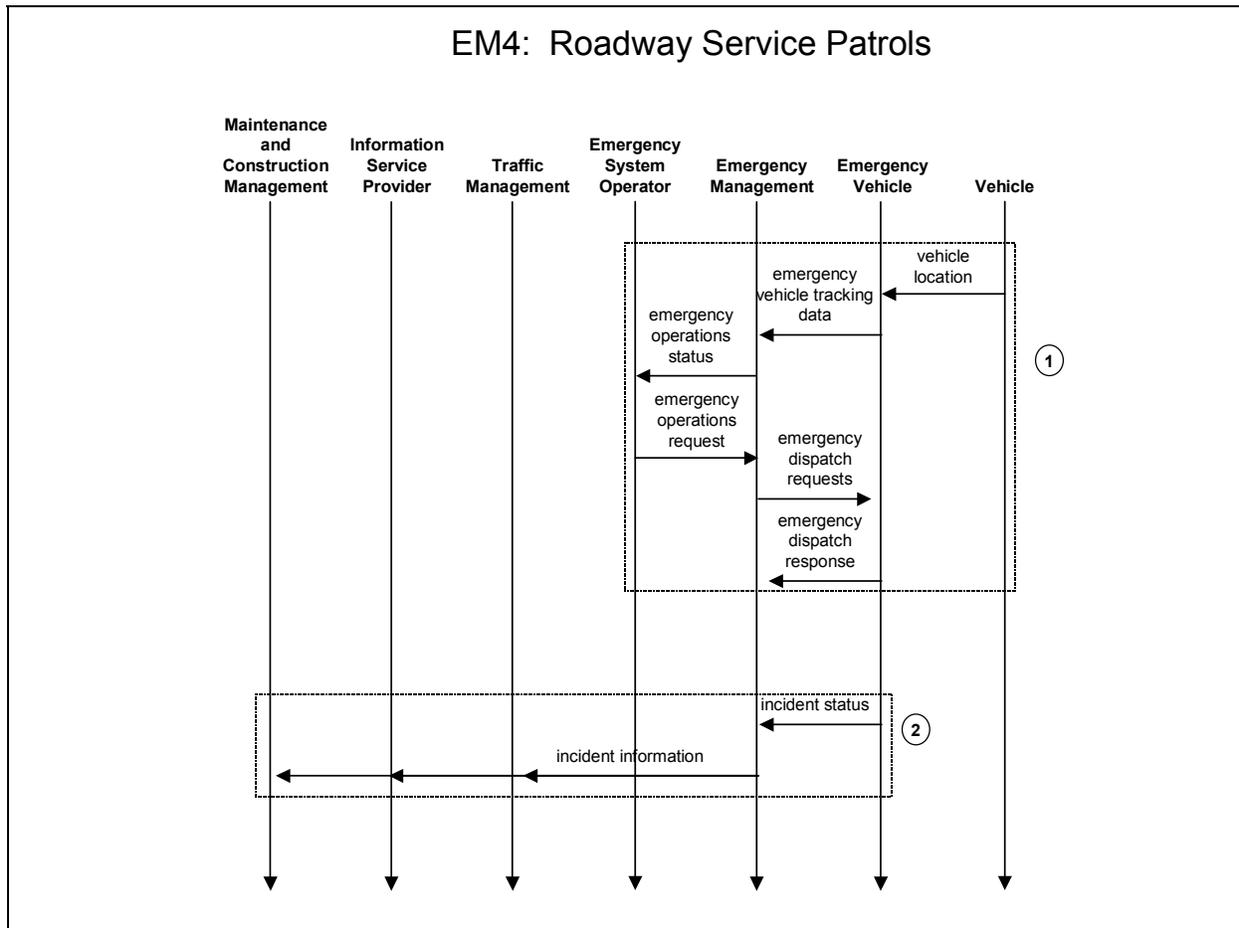


Figure 13. Roadway Service Patrols Transaction Set

This market package models the tracking and dispatch of Roadway Service Patrol Vehicles, as well as using their field reports to manage incidents.

1. The Emergency Vehicle (i.e. the *service patrol* vehicle) reports its position to the Emergency Management dispatch function, which reports the position of the vehicle (or fleet of operational vehicles) to the Emergency System Operator. When necessary, the Emergency System Operator can send an emergency dispatch request to an appropriate Emergency Vehicle. The dispatched vehicle can acknowledge the dispatch request.
2. At the scene of an incident, an Emergency Vehicle can report the incident status to the Emergency Management dispatch function, which can relay the status as incident information to Traffic Management (e.g. reporting the severity and estimated duration of an incident), Information Service Providers (e.g. to report the incident information to their clients) and Maintenance and Construction Management (e.g. for incident cleanup) as appropriate.

3.4 Maintenance and Construction Vehicle Tracking (MC01) Transactions

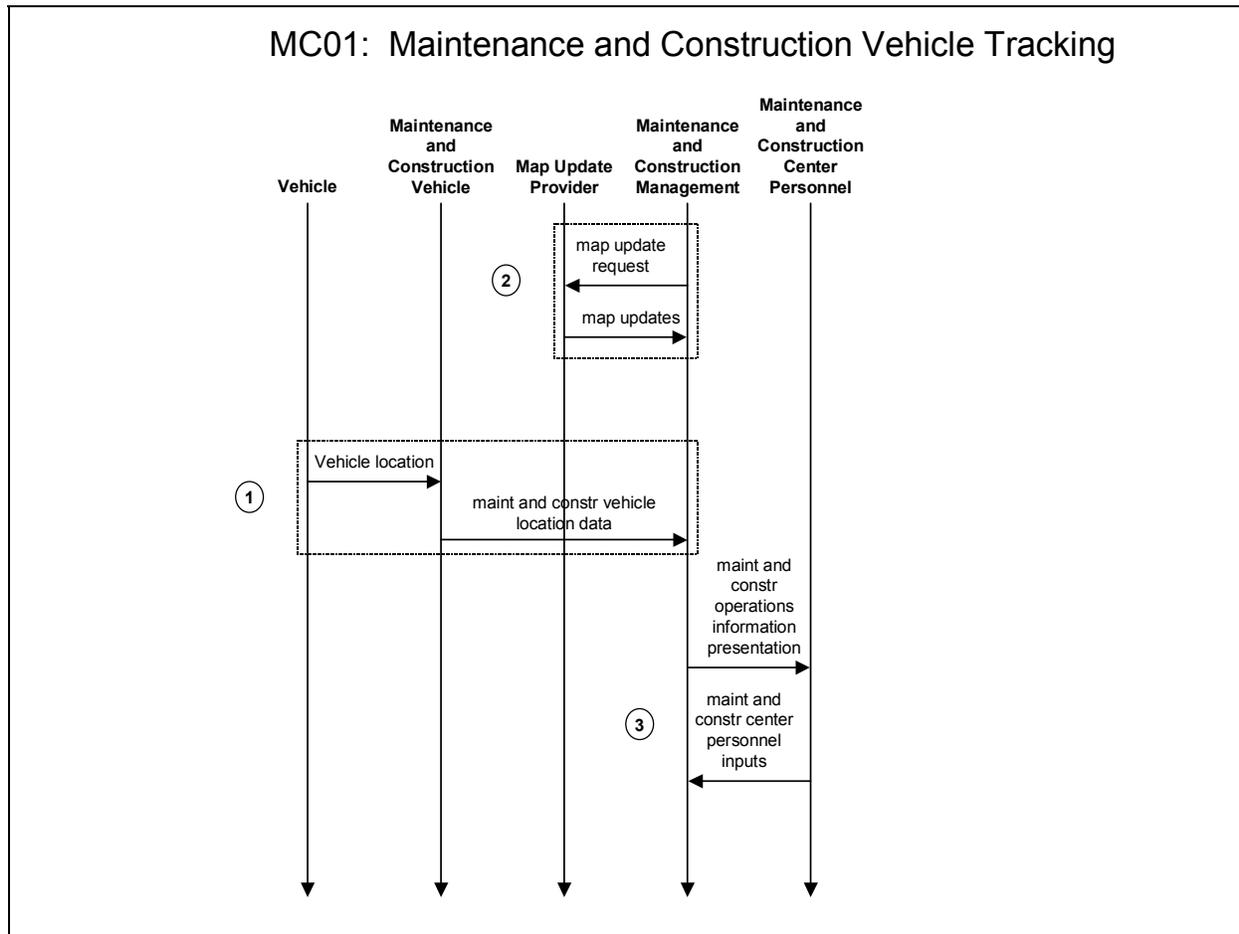


Figure 14. Maintenance and Construction Vehicle Tracking Transaction Set

This market package will track the location of maintenance and construction vehicles and other equipment to ascertain the progress of their activities.

1. Vehicle tracking in the National ITS Architecture for all manners of fleet vehicles (including the maintenance and construction vehicle) has been assigned to the Vehicle Subsystem. This is because the basic function-- determining vehicle location-- is the same no matter what type of vehicle is considered. Therefore the output of the vehicle tracking function in the Vehicle Subsystem (*vehicle location*) is sent to the Maintenance and Construction Vehicle Subsystem (MCVS) and that location information is passed along to the Maintenance and Construction Management Subsystem (MCMS) via the architecture flow *maint and const vehicle location data*.
2. As part of vehicle tracking the MCMS will convert the location data received from the MCVS into some map-based representation. An interface to a Map Update Provider is available to keep this map-based representation of the transportation network current. The implied operation of this interface is for the MCMS to request a map update (*map update request*), and the Map Update Provider to electronically provide the update (*map updates*).
3. The entire process is under the asynchronous monitoring (*maint and const operations information presentation*) and control (*maint and const center personnel inputs*) of Maintenance and Construction Center Personnel.

maintenance (*maint and const fleet information*).

3. The entire process is under the asynchronous monitoring (*maint and const operations information presentation*) and control (*maint and const center personnel inputs*) of Maintenance and Construction Center Personnel.

MC03: Road Weather Data Collection (2 of 4)
Data Collection by Weather Entities

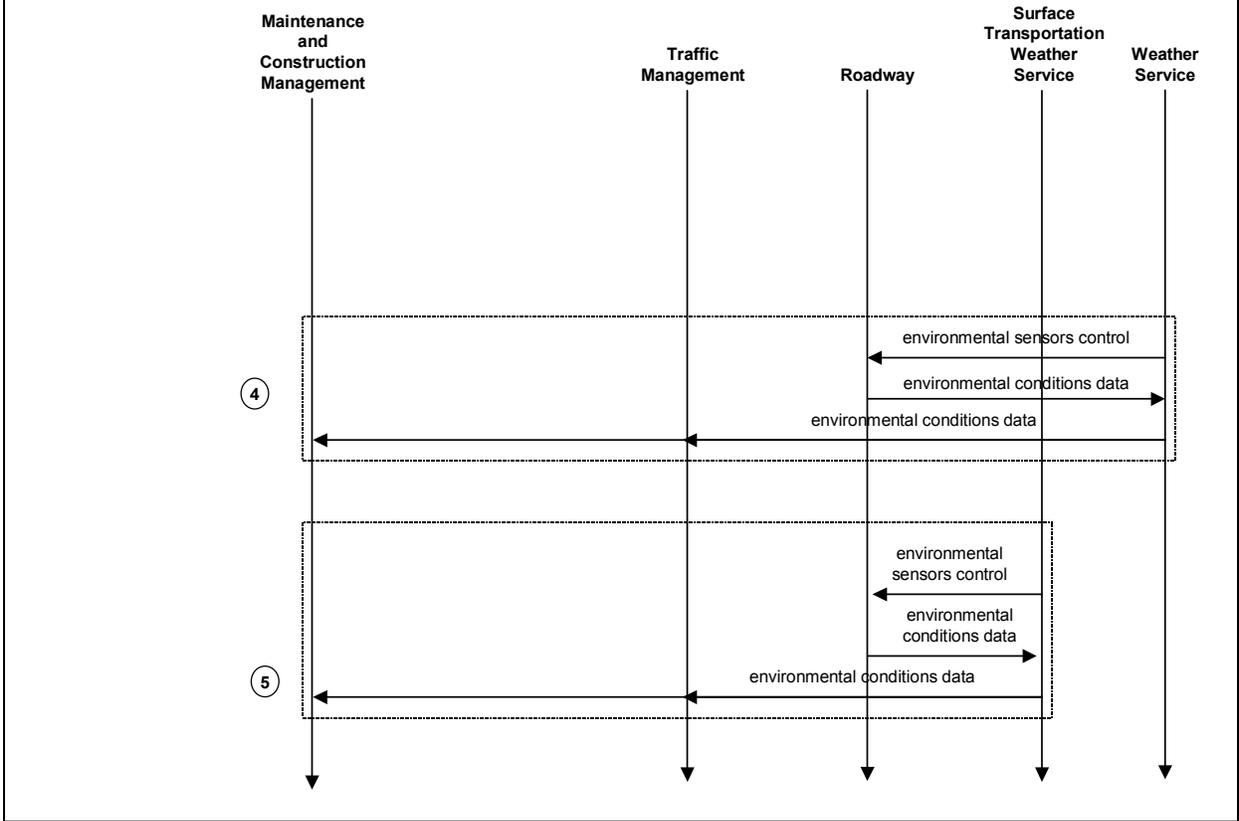


Figure 17. Road Weather Data Collection Transaction Set (2 of 4)

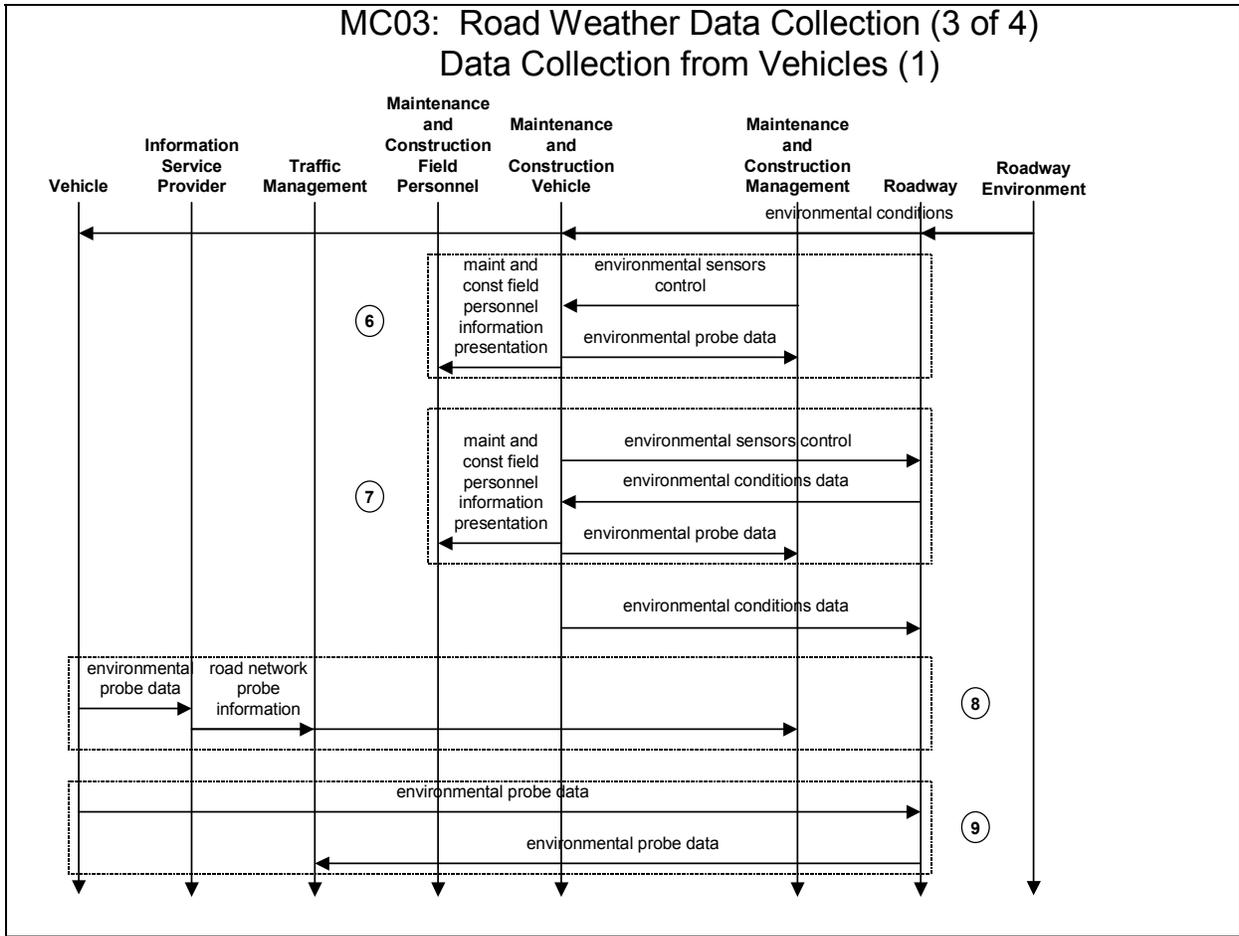


Figure 18. Road Weather Data Collection Transaction Sets (3 of 4)

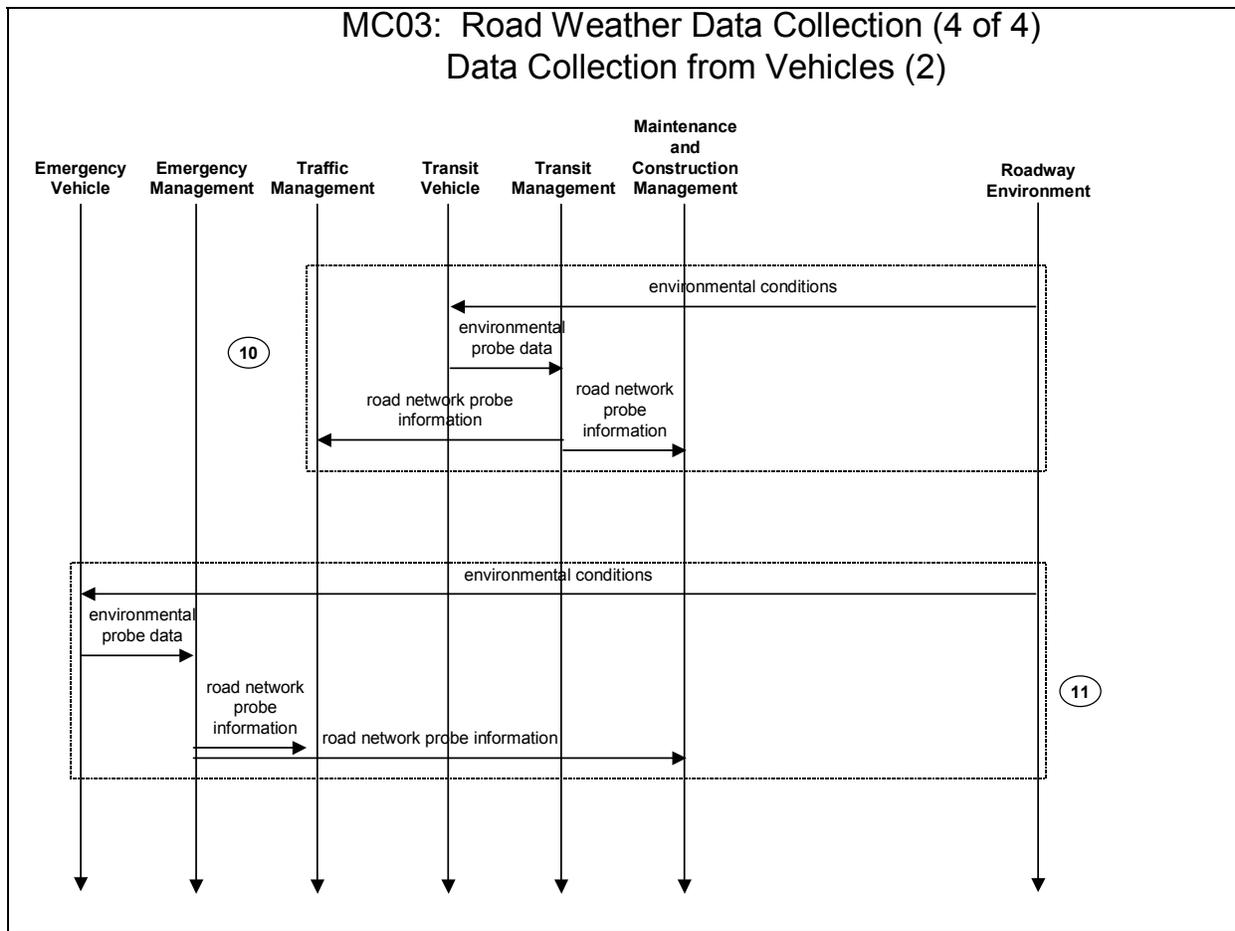


Figure 19. Road Weather Data Collection Transaction Sets (4 of 4)

This market package collects current road and weather conditions using data collected from environmental sensors deployed on and about the roadway (or guideway in the case of transit related rail systems). In addition to fixed sensor stations at the roadside, sensing of the roadway environment can also occur from sensor systems located on Maintenance and Construction Vehicles and on-board sensors located on other fleet or private vehicles. There are a number of different options for collecting the road and weather sensor data as described below.

1. The Maintenance and Construction Management Subsystem (MCMS) can control (*environmental sensors control*) and monitor (*environmental conditions data*) road and weather condition sensors at the Roadway. The *environmental conditions* architecture flow represents the road conditions that are measured by an environmental sensor at the Roadway. The MCMS may pass this *environmental conditions data* along to the Weather Service or Surface Transportation Weather Service. Note that asynchronously to this the MCMS provides road facility and treatment information that supports road conditions forecasts (*road data*).
2. Within the MCMS the above process is under the asynchronous monitoring (*maint and const operations information presentation*) and control (*maint and const center personnel inputs*) of Maintenance and Construction Center Personnel.
3. The Traffic Management Subsystem (TMS) can also control (*environmental sensors control*) and monitor (*environmental conditions data*) road and weather condition sensors at the Roadway. The TMS may pass this *environmental conditions data* along to the Weather Service or Surface Transportation Weather Service.

4. In some cases the Weather Service is the entity that manages these environmental sensors. In this case the Weather Service would control (*environmental sensors control*) and monitor (*environmental conditions data*) the road and weather condition sensors at the Roadway. The Weather Service may then pass this *environmental conditions data* along either to the MCMS or the TMS (or both).
5. In other cases the Surface Transportation Weather Service is the entity managing the environmental sensors. In this case the Surface Transportation Weather Service would control (*environmental sensors control*) and monitor (*environmental conditions data*) the road and weather condition sensors at the Roadway. The Surface Transportation Weather Service may then pass this *environmental conditions data* along either to the MCMS or the TMS (or both).
6. This data collection alternative covers the case where the environmental sensors are on-board the Maintenance and Construction Vehicle Subsystem. The *environmental conditions* architecture flow represents the road conditions that are measured by an environmental sensor on the vehicle. The on-board sensor can be managed by the MCMS. In this case the MCMS controls (*environmental sensor control*) and monitors (*environmental probe data*) the road and weather condition sensors on board the vehicle. Alternately the control could originate with the Maintenance and Construction Field Personnel on-board the vehicle and the sensor data would be presented to them (*maint and const field personnel information presentation*). Note the control by Field Personnel is not explicitly shown in the diagram, but would certainly be an option.
7. This data collection alternative involves control (*environmental sensors control*) and monitoring (*environmental conditions data*) of sensors at the Roadway from the MCVS. The road and weather condition collected from the roadway is forwarded to the MCMS (*environmental probe data*). In addition the *environmental conditions data* collected on board the vehicle could be sent via a wireless link to devices that are part of the Roadway Subsystem for aggregation with other field or vehicle based sensors.
8. Many modern vehicles contain temperature sensors. If we extrapolate this functionality out some years it is very possible for private vehicles to have expanded weather sensor capability (*environmental probe data*), which they can share with an Information Service Provider (ISP). The ISP could aggregate the probe data from many vehicles and provide this information (*road network probe information*) to either the TMS or MCMS.
9. A vehicle equipped with weather sensor capability, could also share that data (*environmental probe data*) with receivers in the Roadway Subsystem, which can then provide the data (*environmental probe data*) to the TMS.
10. A transit vehicle may also be equipped with weather sensors, providing this data (environmental probe data) to the Transit Management Subsystem, who can use the data as part of transit operations, and send an aggregated view of the data (*road network probe information*) to either the TMS or MCMS.
11. Finally, an emergency vehicle can have a similar capability as described above for the transit vehicle. An emergency vehicle equipped with weather sensors can provide this data (environmental probe data) to the Emergency Management Subsystem, who can use the data as part of its operations, and send an aggregated view of the data (*road network probe information*) to either the TMS or MCMS.

3.7 Weather Information Processing and Distribution (MC04) Transactions

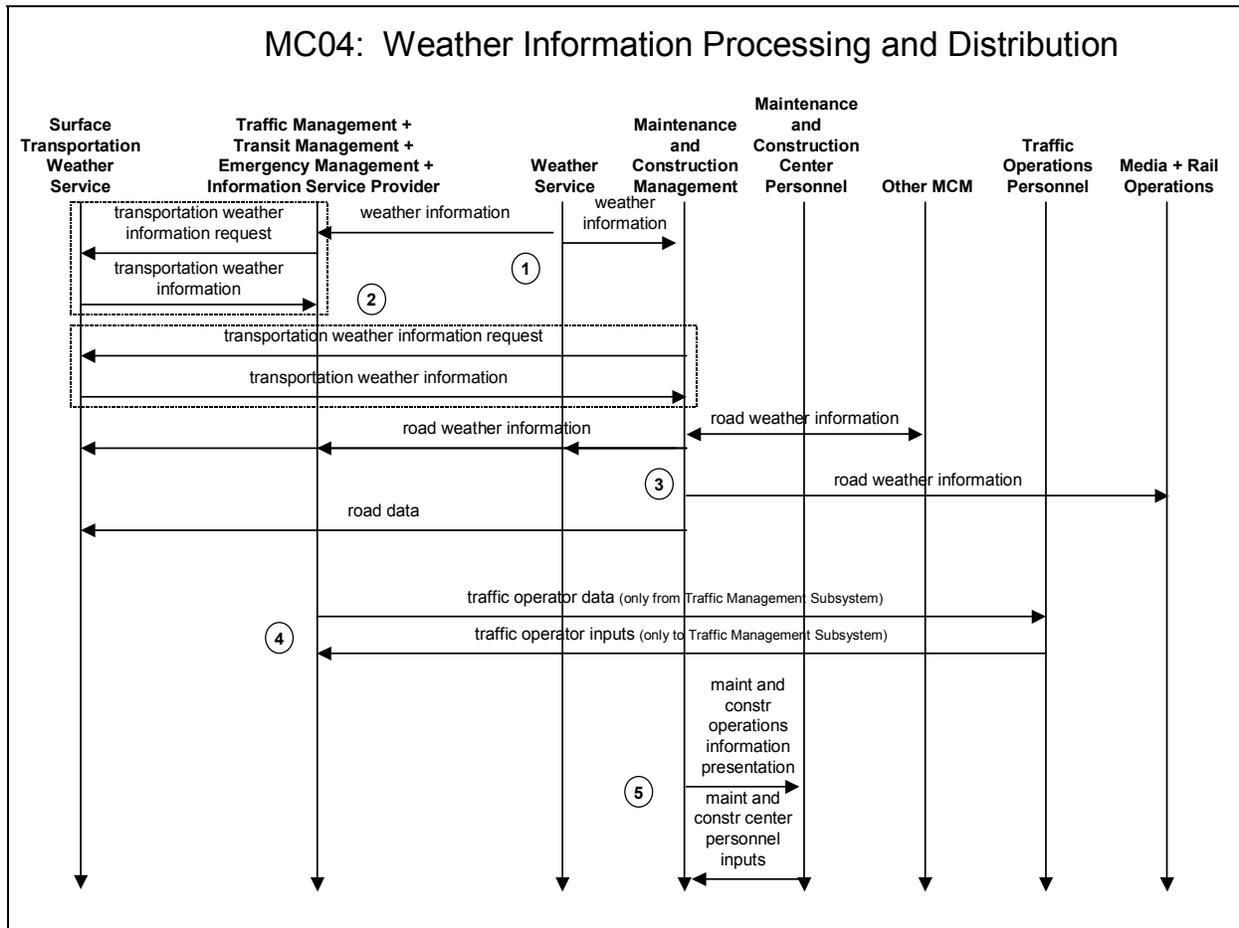


Figure 20. Weather Information Processing & Distribution Transaction Set

This market package processes and distributes the environmental information. The information may be generated by the Maintenance and Construction Management Subsystem (MCMS), the Traffic Management Subsystem (TMS), the Weather Service or the Surface Transportation Weather Service. The information is widely distributed to various ITS entities.

1. The Weather Service is a primary source of weather information, both current observations and forecasts. In the National ITS Architecture this *weather information* is provided by the Weather Service to the following center subsystems:
 - Emergency Management
 - Information Service Provider
 - Maintenance and Construction Management
 - Traffic Management
 - Transit Management
2. The Surface Transportation Weather Service provides tailored weather products to the transportation community. Because the products could be tailored to different transportation entities, each of the previous five centers sends a *transportation weather information request* to identify the type of

information they require. The Surface Transportation Weather Service would then send *transportation weather information* including observations and forecasts tailored to the recipient's needs.

3. The MCMS takes its sensor inputs (from the MC03 Road Weather Data Collection market package) along with the inputs above to create road conditions and weather information that are made available by road maintenance operations to other transportation system operators (*road weather information*). The MCMS can also receive *road weather information* from maintenance operations centers in adjacent geographic areas (the Other MCM terminator). In addition, on an asynchronous basis the MCMS provides road facility and treatment information that supports road conditions forecasts (*road data*) to the Surface Transportation Weather Service to assist that entity in creating tailored weather products.
4. On an asynchronous basis, the weather information collected by the TMS is provided to the Traffic Operations Personnel (*traffic operator data*), who exert control over the collection and processing of the data (*traffic operator inputs*).
5. Finally, also on an asynchronous basis, the weather information collected by the MCMS is provided to the Maintenance and Construction Center Personnel (*maint and const operations information presentation*), who exert control over the collection and processing of the data (*maint and const center personnel inputs*).

3.8 Roadway Automated Treatment (MC05) Transactions

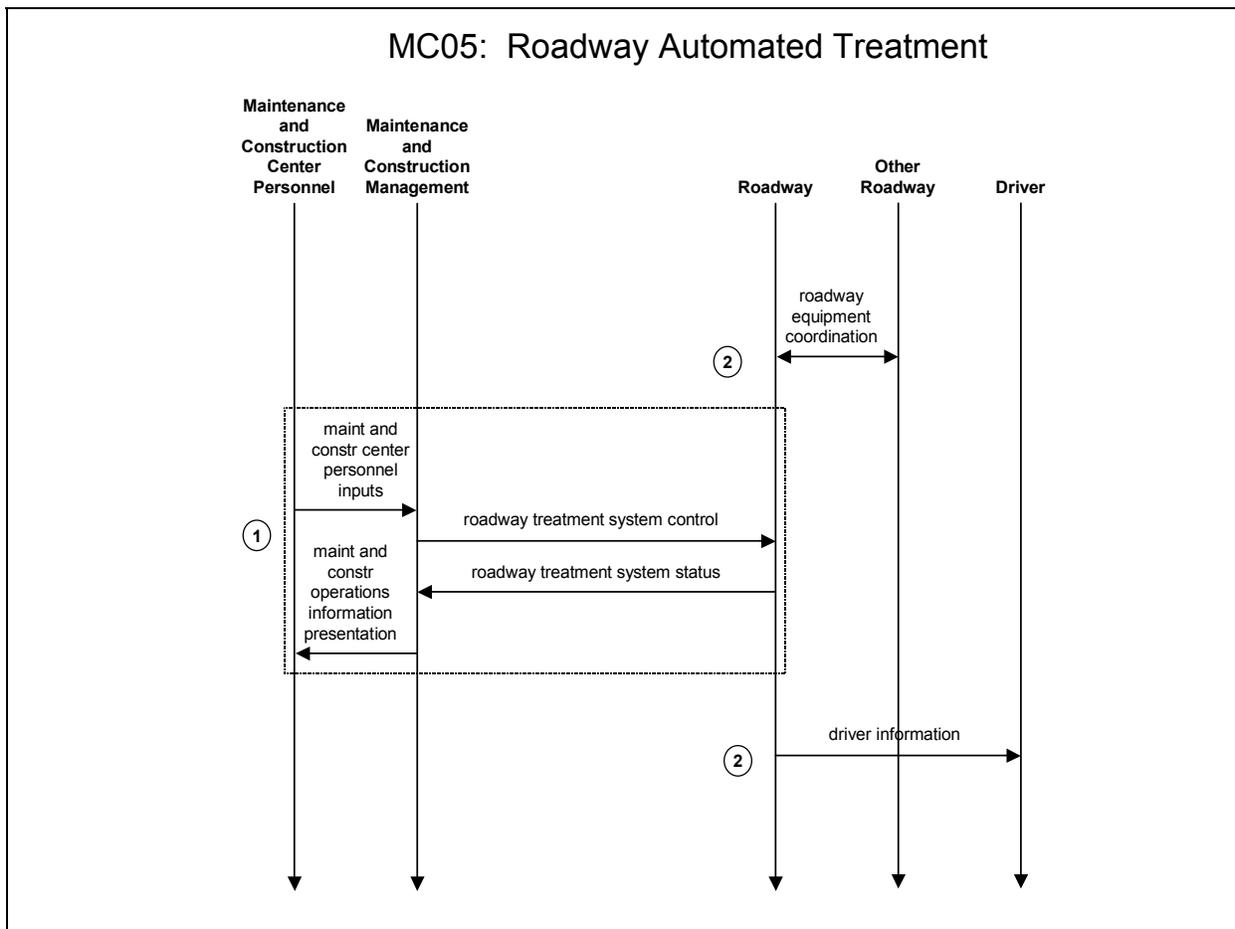


Figure 21. Roadway Automated Treatment Transaction Set

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

1. The Maintenance and Construction Center Personnel can initiate control of the automated roadway treatment system (*maint and const center personnel input*) and send a control signal to the Roadway Subsystem (*roadway treatment sensor control*). They also monitor the status of the system (*roadway treatment system status* and *maint and const operations information presentation*).
2. The automated roadway treatment system may also contain environmental sensors, or sensors at the Roadway that provides the environmental data (*roadway equipment coordination* from Other RS to the Roadway Subsystem). In addition, the system could provide *driver information* to Drivers by including an electronic sign (such as a Dynamic Message Sign) or the system could interface with a separate device that performs this function (*roadway equipment coordination* from the Roadway Subsystem to the Other RS).

3.9 Winter Maintenance (MC06) Transactions

The Winter Maintenance transactions are spread across 3 diagrams:

- Non-Fleet Operations Activities
- Administrative Activities
- Fleet Activities

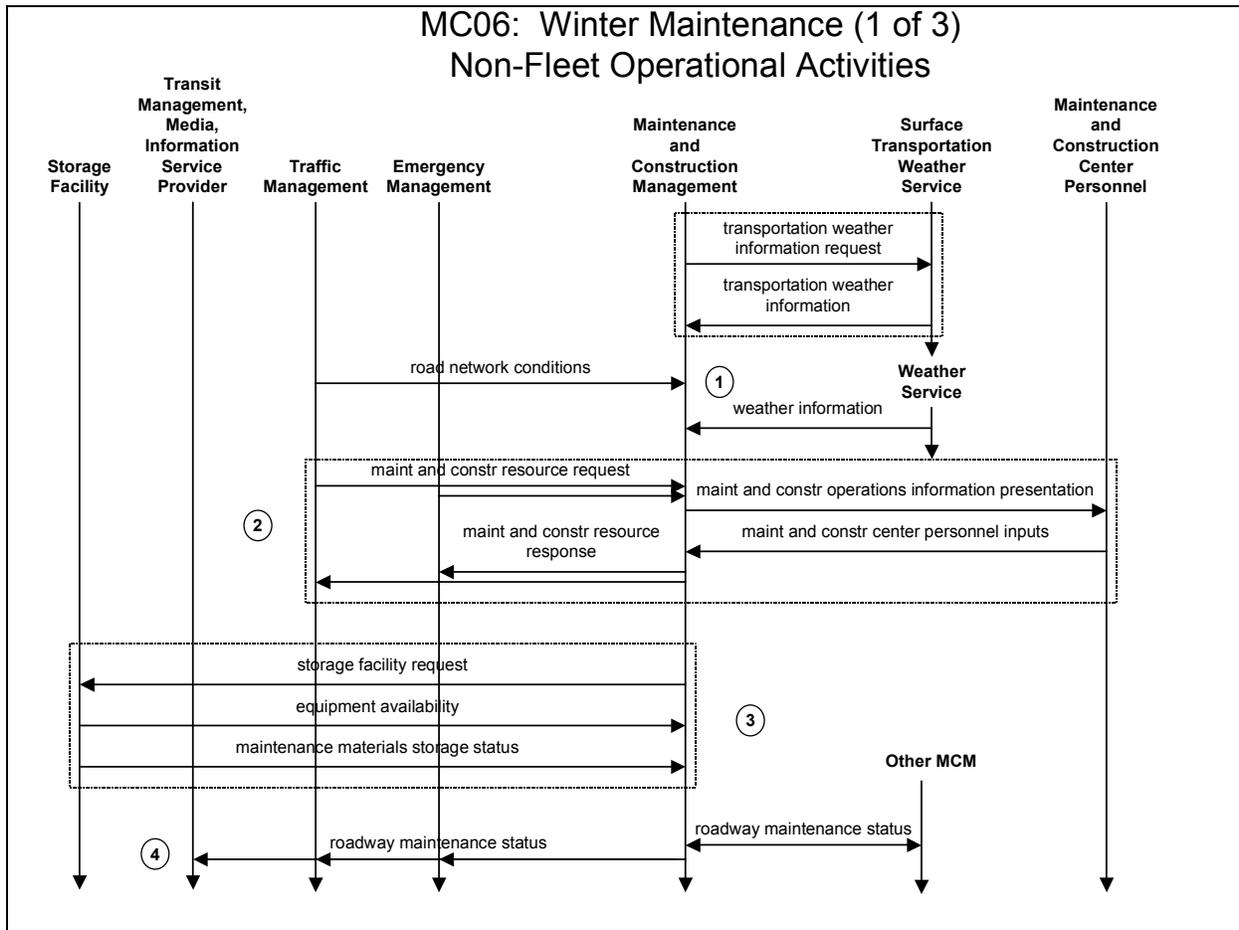


Figure 22. Winter Maintenance Transaction Set (1 of 3)

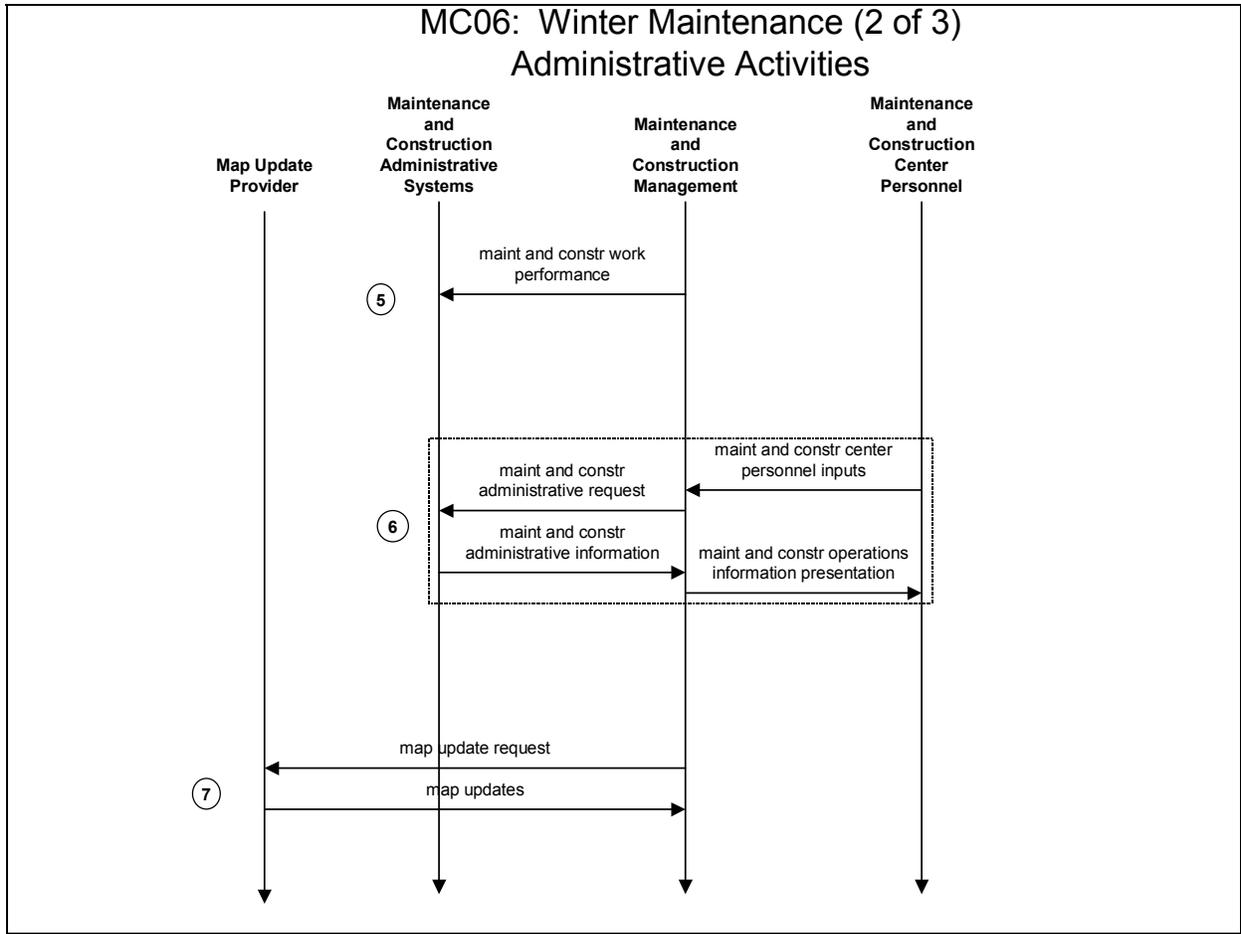


Figure 23. Winter Maintenance Transaction Set (2 of 3)

3. The MCMS can request information on equipment or materials (*storage facility request*) from the Storage Facility, which would respond regarding *equipment availability* or *maintenance materials storage status*. In this Winter Maintenance market package, the status of available roadway treatment materials such as sand or salt would be a key issue.
4. As part of its overall operational activities, the MCMS provides *roadway maintenance status* to the TMS, Information Service Provider, EM and Other MCM (maintenance organizations in other geographic areas). In addition, the MCMS receives *roadway maintenance status* from these other maintenance organizations.
5. The MCMS has several administrative functions that it supports. The MCMS can provide overall work performance information (*maint and const work performance*) to the Maintenance and Construction Administrative Systems to support contract administration.
6. In addition the MCMS makes requests (*maint and const administrative request*) for administrative information or services. An example of services requested might be the reordering of additional road treatment materials. The Maintenance and Construction Administrative Systems responds with the information or status requested (*maint and const administrative information*).
7. As part of winter maintenance operations, the MCMS will potentially use a map-based representation of the area where it is providing road treatment to track treatment application and snow plow progress. An interface to a Map Update Provider is available to keep this map-based representation of the transportation network current. The MCMS requests a map update (*map update request*) and the Map Update Provider electronically provides the update (*map updates*).
8. The Maintenance and Construction Vehicle Subsystem (MCVS) has several ITS systems (such as environmental sensors and dynamic message signs) that can be controlled and monitored either remotely from the MCMS (*maint and constr vehicle system control*) or directly from on board the MCVS. The same control flow from the MCMS can also control non-ITS systems on board the actual vehicle (e.g. materials spreader). For the non-ITS systems the control (*maint and const vehicle control*) is passed to the Basic Maintenance and Construction Vehicle (i.e. the part of the actual vehicle that is not considered an ITS element). One of the key items of information the Basic Maintenance and Construction Vehicle provides back to the MCVS (*maint and const material information*) is the remaining quantity and current application rate of materials on the vehicle. In addition the maintenance and construction vehicle can have a location capability (*vehicle location* sent from the Vehicle Subsystem (VS) to the MCVS) and advanced safety system features such as lane following (*safety system status* sent from the VS to the MCVS). The *roadway characteristics* flow represents the “inputs” to the sensors that perform the advanced safety functions. All of the status and information regarding ITS and non-ITS systems on the vehicle is provided to the Maintenance and Construction Field Personnel (*maint and const vehicle condition presentation*) and to the MCMS (*maint and const vehicle operational data*) where it eventually is presented to the Maintenance and Construction Center Personnel.
9. Coordination of an MCVS with another maintenance and construction vehicle (Other MCV) takes place to share operational status of the vehicles. For example, the Other MCV initiates an information exchange (*maint and const vehicle status coordination*). The information is passed to the Maintenance and Construction Field Personnel (*maint and const field personnel information presentation*). The field personnel can respond back to the Other MCV or append additional information to send to the MCMS (*maint and const field personnel inputs*). The vehicle’s operational status is sent to the MCMS (*maint and const vehicle operational data*). Information can also be passed from the MCVS back to the Other MCV (*maint and const vehicle status coordination*).
10. One of the key fleet activities of the MCMS is to dispatch the fleet vehicles. This *maint and const dispatch information*, which can include routing and winter-specific dispatch instructions, is sent to the MCVS, and presented to the Maintenance and Construction Field Personnel (*maint and const field personnel information presentation*). The field personnel can acknowledge the dispatch request and

provide inputs on their dispatch status as well as operator status, crew status, vehicle status, and equipment status (*maint and const field personnel inputs*). This information is forwarded to the MCMS (*maint and const dispatch status*).

3.10 Roadway Maintenance and Construction (MC07) Transactions

The Roadway Maintenance and Construction transactions are spread across 3 diagrams:

- Non-Fleet Operations Activities
- Administrative Activities
- Fleet Activities

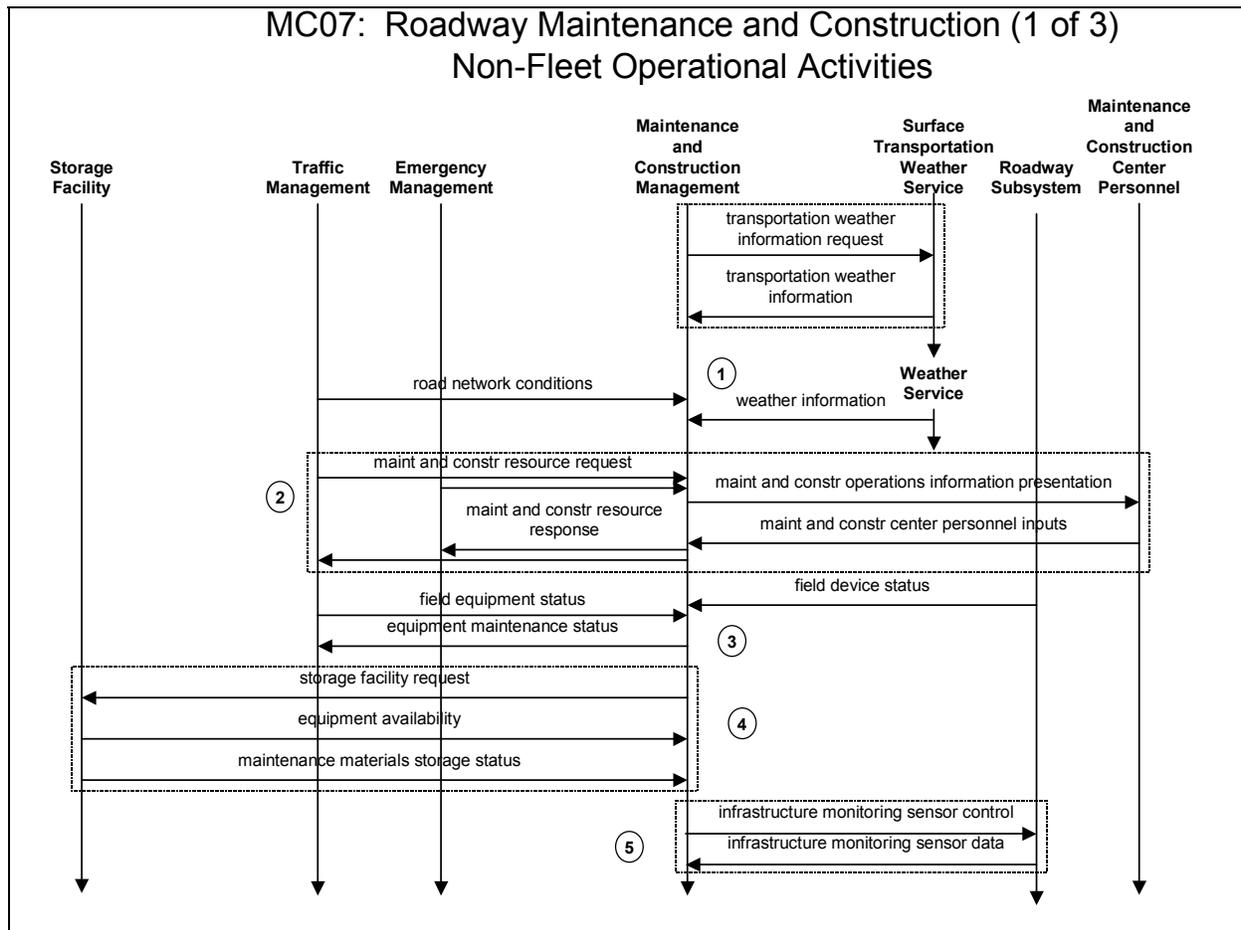


Figure 25. Roadway Maintenance and Construction Transaction Set (1 of 3)

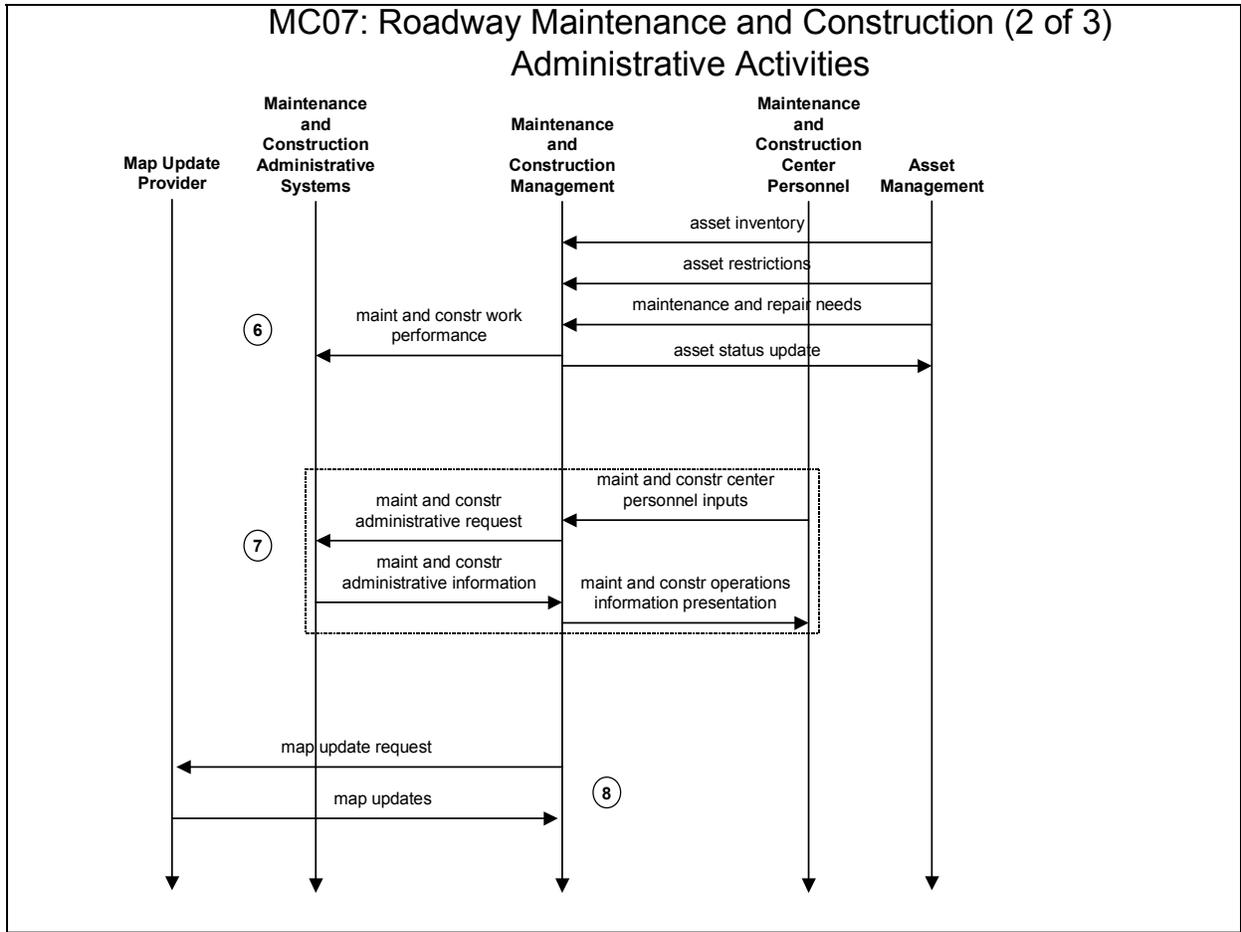


Figure 26. Roadway Maintenance and Construction Transaction Set (2 of 3)

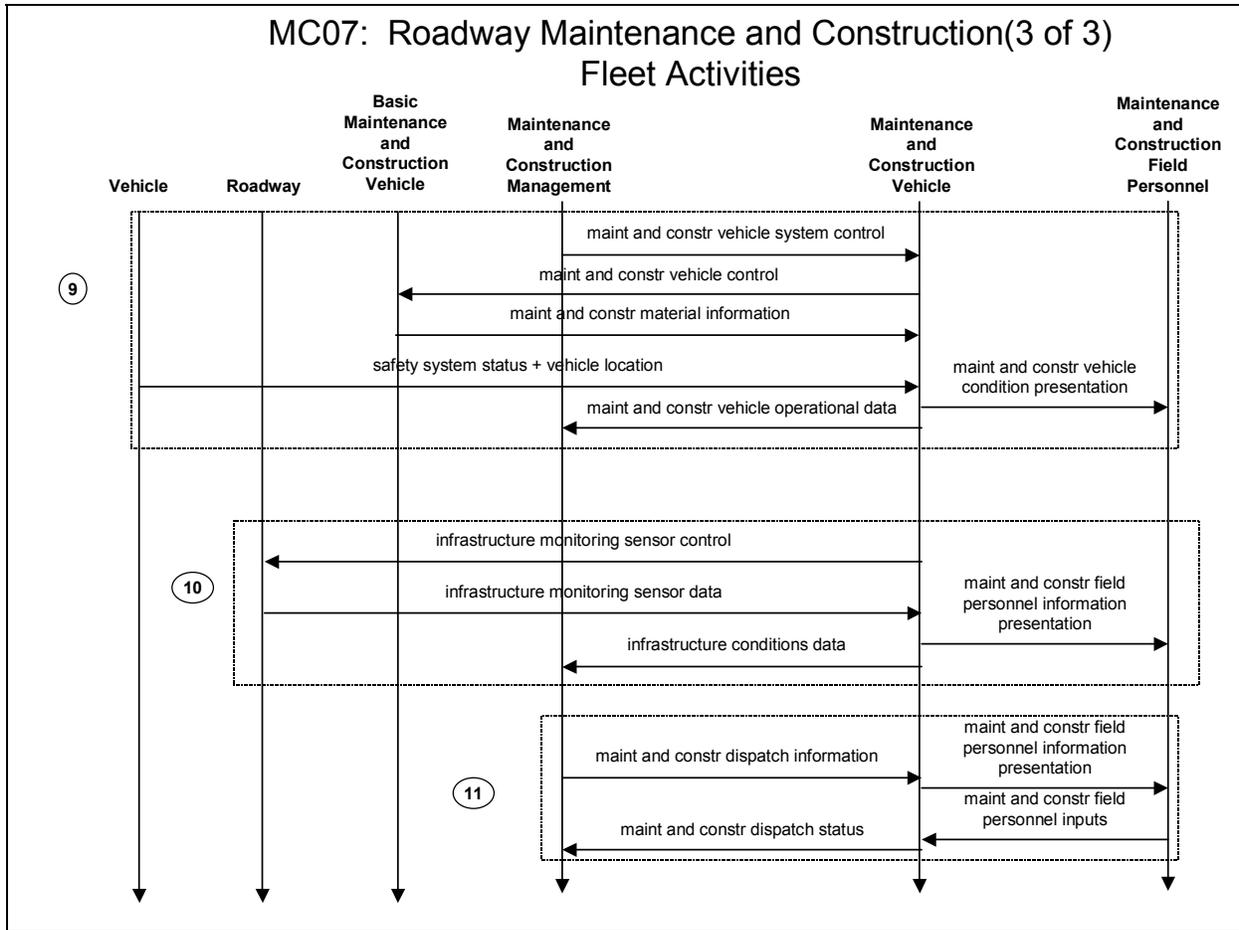


Figure 27. Roadway Maintenance and Construction Transaction Set (3 of 3)

This market package supports services for scheduled and unscheduled maintenance and construction on a roadway system or right-of-way. Maintenance services would include landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment on the roadway (e.g., signs, traffic controllers, traffic detectors, dynamic message signs, traffic signals, CCTV, etc.).

1. In order to support its operational activities, the Maintenance and Construction Management Subsystem (MCMS) inputs information regarding weather and the state of the road network. The information comes from the Surface Transportation Weather Service (via the request/ response pair of architecture flows *transportation weather information request/ transportation weather information*), from the Weather Service (*weather information*), and from the Traffic Management Subsystem (*road network conditions*, which can include traffic information and incident information as well as road weather conditions determined by the TMS).
2. One of the activities of the MCMS is to respond to resource requests from other center subsystems. The Emergency Management Subsystem (EM) or the TMS makes a request (*maint and const resource request*) for maintenance resources (possibly in support of incident management). This request is forwarded to the Maintenance and Construction Center Personnel (*maint and const operations information presentation*). The center personnel initiate a response to the request (*maint and const center personnel input*) and that response is returned to the originating center subsystem (*maint and const resource response*). The actions the Maintenance and Construction Center

Personnel take to respond to the request would most likely involve fleet activities that are covered below.

3. Another key activity of the MCMS is the maintenance of ITS and non-ITS field equipment. Fault indications from field devices are monitored directly by the MCMS (*field device status*) from the Roadway Subsystem, or the fault information could be sent from the TMS (*field equipment status*). Following the maintenance actions the *equipment maintenance status* is sent from the MCMS to the TMS.
4. The MCMS can request information on equipment or materials (*storage facility request*) from the Storage Facility, which responds regarding *equipment availability* or *maintenance materials storage status*. In this market package the status of available materials might include sand (for treatment of spills) or herbicide (for spraying of the vegetation along the roadside).
5. An additional maintenance activity that can be carried on by the MCMS is control (*infrastructure monitoring sensor control*) and monitoring (*infrastructure monitoring sensor data*) of roadway infrastructure sensors.
6. The administrative functions of the MCMS include exchanging information with the Asset Management entity and Maintenance and Construction Administrative Systems. Asset Management provides *asset inventory* information, which could include static information about the assets (e.g. location, installation information, and materials information) as well as information that has been collected about the assets (e.g. video logs and current maintenance status). Asset Management also sends *asset restrictions* to the MCMS, which could include height, width, or weight restrictions to various assets. Finally, Asset Management sends recommended strategies and schedules for maintenance of the transportation infrastructure (*maintenance and repair needs*). The MCMS provides back to Asset Management changes to the status of pavement, bridges, signs and other assets resulting from maintenance or construction activities or infrastructure monitoring (*asset status update*). This same flow can also contain results of infrastructure monitoring carried out by the maintenance organization. Another administrative function the MCMS supports is to provide overall work performance information (*maint and const work performance*) to the Maintenance and Construction Administrative Systems (MCAS) to support contract administration.
7. The MCMS makes requests (*maint and const administrative request*) for administrative information or services. An example of services requested might be the reordering of additional road treatment materials. The MCAS responds with the information or status requested (*maint and const administrative information*).
8. As part of its maintenance operations, the MCMS will potentially use a map-based representation of the area that it is maintaining. An interface to a Map Update Provider is available to keep this map-based representation of the transportation network current. The MCMS requests a map update (*map update request*), and the Map Update Provider electronically provides the update (*map updates*).
9. The Maintenance and Construction Vehicle Subsystem (MCVS) has several ITS systems (such as environmental sensors and dynamic message signs) that can be controlled and monitored either remotely from the MCMS (*maint and constr vehicle system control*) or directly from on board the MCVS. The same control flow from the MCMS can also control non-ITS systems on board the actual vehicle (e.g. materials spreader). For the non-ITS systems the control (*maint and const vehicle control*) is passed to the Basic Maintenance and Construction Vehicle (i.e. the part of the actual vehicle that is not considered an ITS element). One of the key items of information the Basic Maintenance and Construction Vehicle provides back to the MCVS (*maint and const material information*) is the remaining quantity and current application rate of materials on the vehicle. In addition the maintenance and construction vehicle can have a location capability (*vehicle location* sent from the Vehicle Subsystem (VS) to the MCVS) and advanced safety system features such as lane following (*safety system status* sent from the VS to the MCVS). All of the status and information regarding ITS and non-ITS systems on the vehicle is provided to the Maintenance and Construction Field Personnel (*maint and const vehicle condition presentation*) and to the MCMS

(maint and const vehicle operational data) where it is eventually presented to the Maintenance and Construction Center Personnel.

10. Another maintenance activity that can be carried on by the MCVS is control (*infrastructure monitoring sensor control*) and monitoring (*infrastructure monitoring sensor data*) of infrastructure sensors located at the Roadway Subsystem. The control flow is initiated by an action from the Maintenance and Construction Field Personnel, which is not explicitly shown in the figure. The infrastructure data is then presented to the Field Personnel (*maint and const field personnel information presentation*) and passed along to the MCMS (*infrastructure conditions data*). An alternative mode of operation for this function is for the infrastructure sensor to be on the MCVS, in which case these two architecture flows of the previous sentence would contain data collected directly on the MCVS.
11. One of the key fleet activities of the MCMS is to dispatch the fleet vehicles. This *maint and const dispatch information*, which can include routing, is sent to the MCVS, and presented to the Maintenance and Construction Field Personnel (*maint and const field personnel information presentation*). The field personnel can acknowledge the dispatch request and provide inputs on their dispatch status as well as operator status, crew status, vehicle status, and equipment status (*maint and const field personnel inputs*). This information is forwarded to the MCMS (*maint and const dispatch status*).

3.11 Work Zone Management (MC08) Transactions

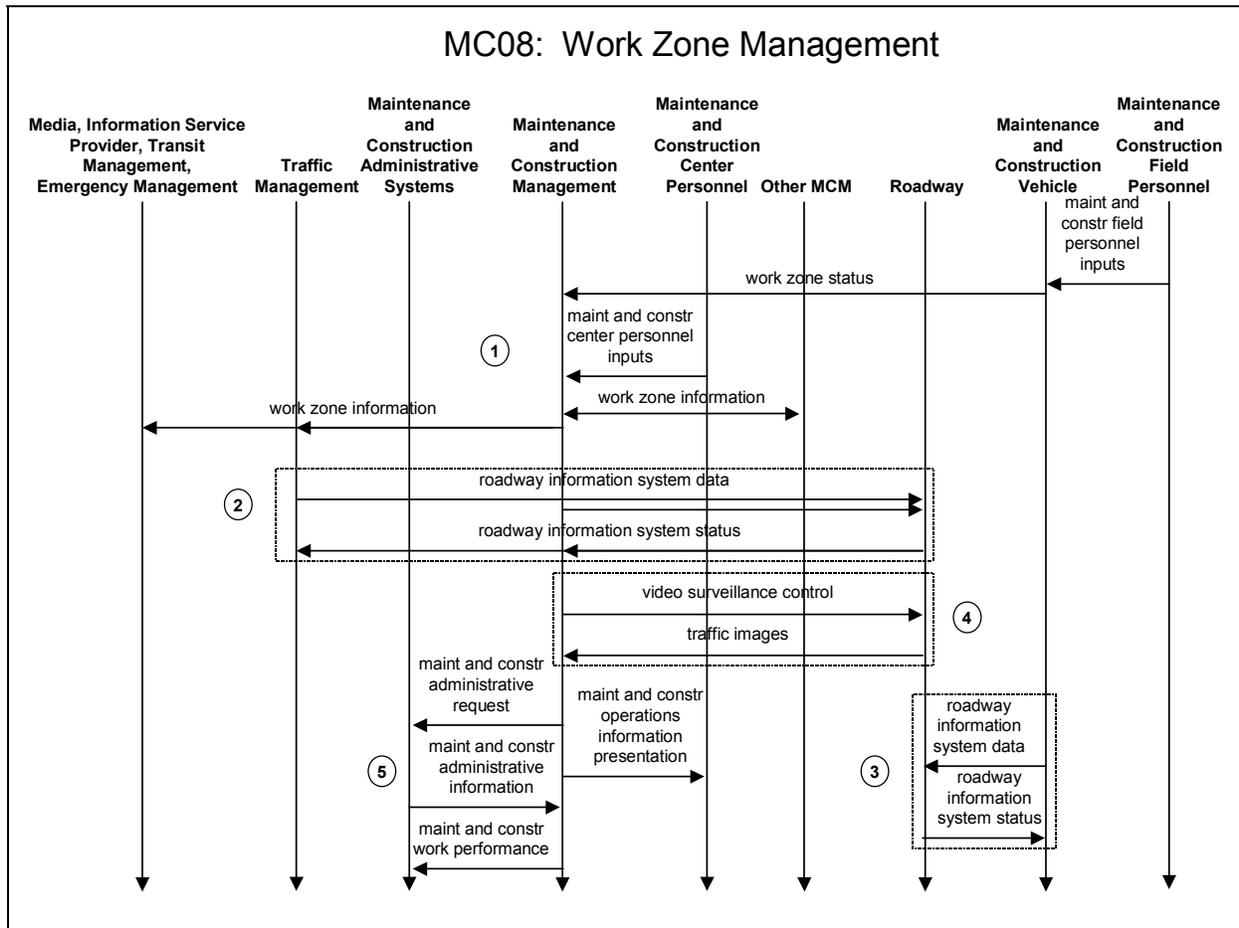


Figure 28. Work Zone Management Transaction Set

This market package directs activity in work zones, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., ISP, TMS, other maintenance and construction centers) for better coordination management. The market package also includes providing information to motorists regarding work zone delays.

1. Work zone status inputs start from the Maintenance and Construction Field Personnel, who enter the information into a system in the Maintenance and Construction Vehicle Subsystem, MCVS (*maint and const file personnel inputs*). Then *work zone status* is forwarded to the Maintenance and Construction Management Subsystem (MCMS). The Maintenance and Construction Center Personnel add their inputs to this information (*maint and const center personnel inputs*) and provide work zone information to the following centers and terminators:
 - Traffic Management
 - Transit Management
 - Emergency Management
 - Information Service Provider
 - Media
 - Other MCM (another maintenance or construction organization)

2. In addition to sending work zone information to other transportation centers, the MCMS or TMS provides information directly to Drivers affected by the work zone activity using *roadway information system data*, which controls output to dynamic message signs or Highway Advisory Radio. Additionally, the MCMS monitors the roadway information device to ensure its correct operation (*roadway information system status*).
3. The roadway information devices may also be controlled (*roadway system information data*) and monitored (*roadway system information status*) by the Field Personnel inside the MCVS.
4. The MCMS can also control surveillance devices (at the Roadway) within a work zone, specifically CCTVs (*video surveillance control*) which send *traffic images* back to the MCMS.
5. Based upon inputs from the field, the MCMS may place a request to the Maintenance and Construction Administrative Systems (*maint and const administrative request*) for 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. The Maintenance and Construction Administrative Systems responds with the information or status requested (*maint and const administrative information*). This information is presented to the Maintenance and Construction Center Personnel (*maint and const operations information presentation*). An additional administrative function the MCMS supports is to provide overall work performance information (*maint and const work performance*) to the Maintenance and Construction Administrative Systems (MCAS) for contract administration.

3.12 Work Zone Safety Monitoring (MC09) Transactions

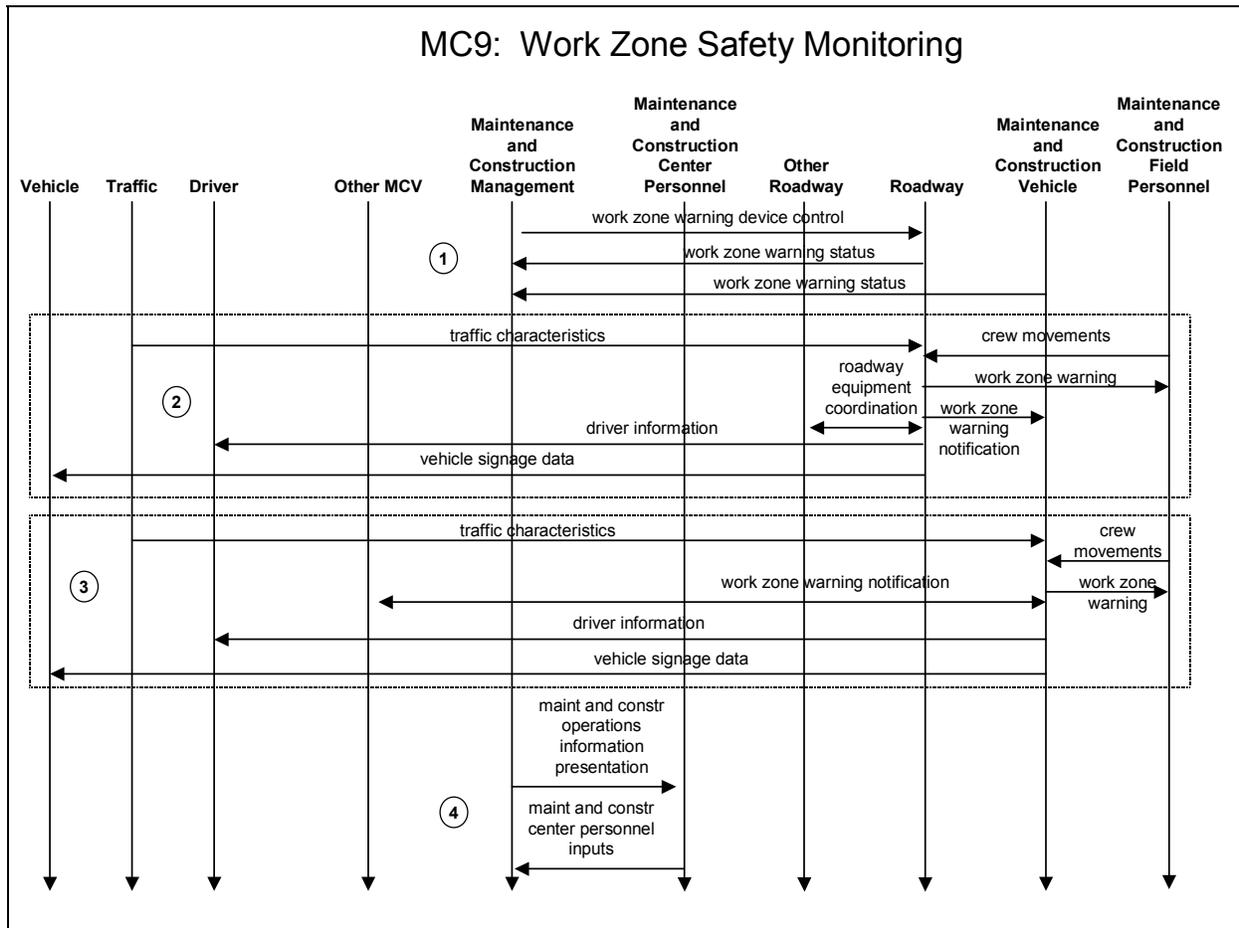


Figure 29. Work Zone Safety Monitoring Transaction Set

This market package detects vehicle intrusions in work zones and warns crew workers and drivers of imminent encroachment or other potential safety hazards. Crew movements are also monitored so that the crew can be warned of movement beyond the designated safe zone.

1. On an asynchronous basis, the Maintenance and Construction Management Subsystem (MCMS) controls work zone warning devices that are at the Roadway (*work zone warning device control*), and will monitor both these devices (*work zone warning status*) and similar warning devices that are placed on Maintenance and Construction Vehicle Subsystems (*work zone warning status*).
2. A work zone intrusion detection and alert device located at the Roadway might have the following operation. *Traffic characteristics* and *crew movements* of the Maintenance and Construction Field Personnel are monitored by the device. When an intrusion is detected, a general work zone warning is given to the Maintenance and Construction Vehicle Subsystem, MCVS (*work zone warning notification*) or to the Maintenance and Construction Field Personnel directly (*work zone warning*). An alternative mode of operation would be that warnings are provided based on knowledge of the crew's movements, rather than a general area warning. It is also possible that the intrusion detection device is separate from the alerting device, with data passing across the Roadway Subsystem to Other RS interface (*roadway equipment coordination*). Once an intrusion is detected an alert to the driver of the intruding vehicle is provided via a roadside information display (*driver information*) or via an in-vehicle signage display (*vehicle signage data*).

3. A work zone intrusion warning and alert device located on an MCVS would have a similar operation as that described above. *Traffic characteristics* and *crew movements* of the Maintenance and Construction Field Personnel are monitored by a the device. When an intrusion is detected, a general *work zone warning* is given to the Maintenance and Construction Field Personnel directly. An alternative mode of operation would be that warnings are provided based on knowledge of the crew's movements, rather than a general area warning. It is also possible that a *work zone warning notification* could be sent to another maintenance and construction vehicle (the Other MCV entity). Once an intrusion is detected an alert to the driver of the intruding vehicle could be provided via a roadside information display (*driver information*) or via an in-vehicle signage display (*vehicle signage data*).
4. To support the first two sequences described above, the Maintenance and Construction Center Personnel can provide the device control information (*maint and const center personnel inputs*) and can get an indication of work zone intrusions that have occurred and what alerts were provided (*maint and const operations information presentation*).

3.13 Maintenance and Construction Activity Coordination (MC10) Transactions

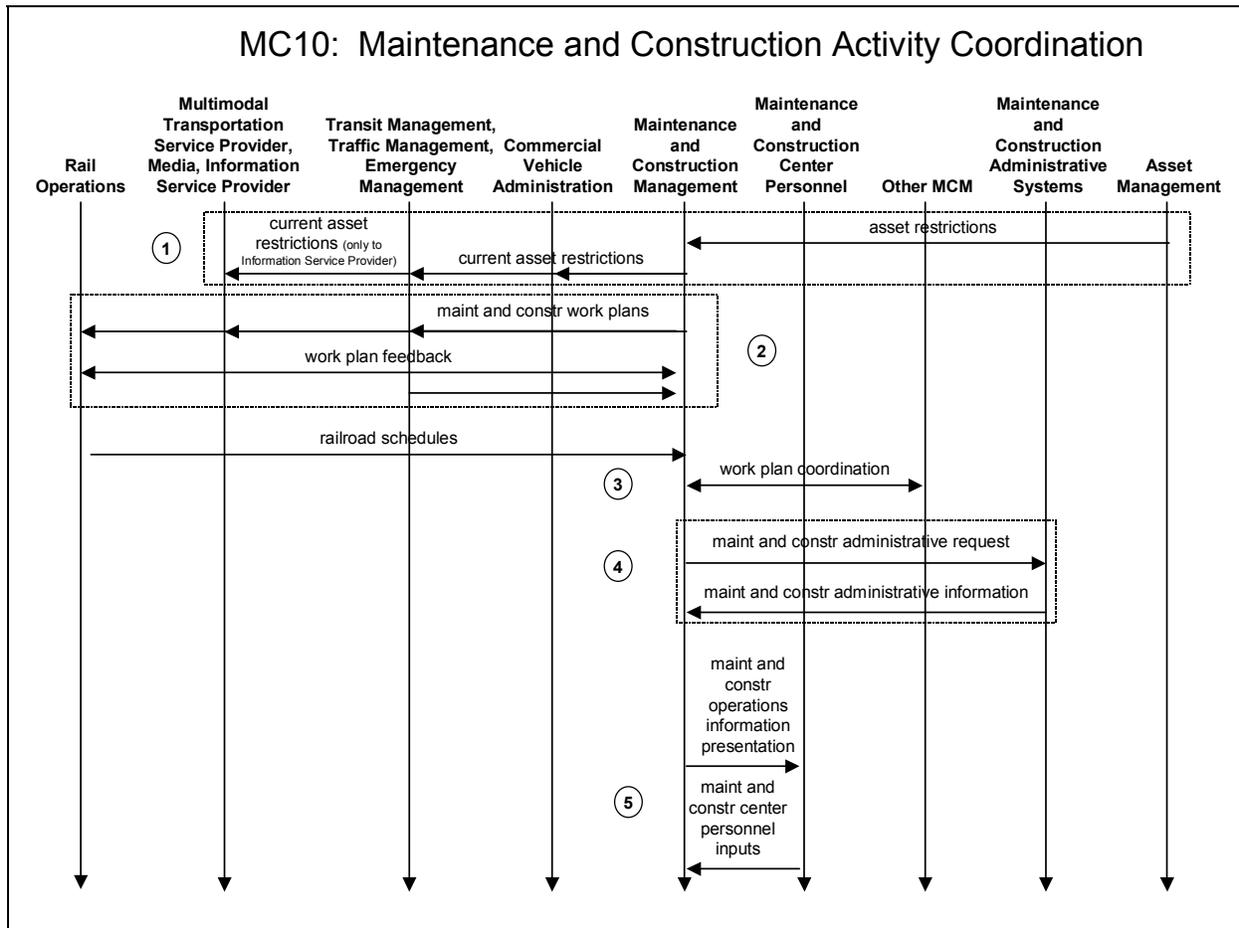


Figure 30. Maintenance and Construction Activity Coordination Transaction Set

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

1. Asset Management provides *asset restrictions* to the Maintenance and Construction Management Subsystem (MCMS). The restrictions may include standard height, width, and weight restrictions by facility as well as special restrictions such as spring weight restrictions and temporary bridge weight restrictions. These asset restrictions are provided to the following center subsystems:
 - Commercial Vehicle Administration
 - Emergency Management
 - Information Service Provider
 - Traffic Management
 - Transit Management

Some of the possible uses of this information by the receiving subsystems are: route selection and CVO clearances for to large or oversized vehicle limits.
2. One of the key functions of the MCMS is to plan maintenance and construction activity. These *maint and const work plans* are then disseminated to the following center subsystems and other key

terminators:

- Emergency Management
- Information Service Provider
- Media
- Multimodal Transportation Service Provider
- Rail Operations
- Traffic Management
- Transit Management

It is expected that the following entities will provide *work plan feedback* to the MCMS:

- Emergency Management
 - Rail Operations
 - Traffic Management
 - Transit Management
3. In addition to providing feedback on the MCMS work plans, Rail Operations provides its own railroad schedules to the MCMS to inform it of planned maintenance activities of the rail network that may impact the road maintenance activities. Also, an MCMS must coordinate its work plans with maintenance organizations in adjoining geographic areas (Other MCM). This coordination (*work plan coordination*) includes sharing work plans and providing feedback to work plans received.
 4. As a part of coordination activities, the MCMS makes requests of the Maintenance and Construction Administrative Systems (*maint and const administrative request*), which would respond with information such as 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 const administrative information*).
 5. To support the sequences described above, the Maintenance and Construction Center Personnel provides inputs on work plan scheduling and provides feedback to other schedules received (*maint and const center personnel inputs*). They can also receive the work plans of Rail Operations or other maintenance and construction management centers (Other MCM) and can receive the feedback on work plans they have disseminated to other entities (*maint and const operations information presentation*).

4 Communications Layer Requirements

This chapter describes relevant requirements regarding the Communications Layer for the portion of the ITS National Architecture covered by this package. In general the Communications Layer supports the four lower layers of the OSI model (transport, network, data link, and physical layer). A complete description of the Communications Layer is contained in the ITS National Architecture Communications Analysis Document.

4.1 Communications Services: Wireline and Wireless

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.

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 communication document for a complete description.)

An additional class of communications services is location services. These fall into 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.

The class of communications service for each Architecture Flow in this standards package is defined in a table in the following section.

4.2 Wireline Communication Elements (w)

The wireline links represent wide area network communications elements, which can take a number of forms. Typically, it will be a data network of some kind. Physically the network can be fiber, coaxial, twisted pair, or even microwave. It can be an ITS dedicated network, such as a communications system installed by a public agency to pass messages between a Traffic Management subsystem and associated Roadway subsystems distributed across a region. Alternatively it can be a privately deployed network

owned and operated by a communication service provider, where operators of ITS subsystems pay a service fee for connection to and use of the network or lease the lines. More than one network used for ITS may coexist in a region, and these networks will be connected (or internetworked) to support ITS message communication between subsystems that are attached to different networks.

It is expected that the current trend toward ubiquitous internetworking of public and private data networks, as currently embodied by the Internet will continue. This will enable inter-subsystem messaging across local, regional, and national distances. What the Internet is rapidly evolving to (as security and reliability issues of today's Internet are addressed) has been referred to as the "National Information Infrastructure" or "NII".

As commercial data networks are deployed, interconnected, and mature, and the cost of access and use of these private data networks drops, we expect more and more wireline networks for ITS to be supplied from Communication Service Providers (CSPs). The time when the transition from private data networks to commercial data networks becomes practical and economical will vary by region. We expect this transition to be analogous to the transition that was made early in this century from private phone networks to the Public Switched Telephone Network (PSTN). Our expectation is that in the 20-year time frame, most ITS communications will be provided by CSPs.

Table 1 shows the wireline architecture flows in this standards package.

Table 3. Wireline Data Flows (w) for Maintenance and Construction Management

Source	Destination	Architecture Flow	Communication Service
Asset Management	Maintenance and Construction Management	asset inventory	Messaging data
Asset Management	Maintenance and Construction Management	asset restrictions	Messaging data
Asset Management	Maintenance and Construction Management	maintenance and repair needs	Conversational data, Messaging data
Emergency Management	Maintenance and Construction Management	incident information	Conversational data, Messaging data
Emergency Management	Maintenance and Construction Management	incident response status	Conversational data, Messaging data
Emergency Management	Maintenance and Construction Management	maint and constr resource request	Conversational data, Messaging data
Emergency Management	Maintenance and Construction Management	road network probe information	Messaging data
Emergency Management	Maintenance and Construction Management	work plan feedback	Conversational data, Messaging data
Enforcement Agency	Roadway Subsystem	speed monitoring control	Conversational data, Messaging data
Equipment Repair Facility	Maintenance and Construction Management	maint and constr equipment repair status	Messaging data
Maintenance and Construction Administrative Systems	Maintenance and Construction Management	maint and constr administrative information	Conversational data, Messaging data
Maintenance and Construction Management	Asset Management	asset status update	Conversational data, Messaging data
Maintenance and Construction Management	Commercial Vehicle Administration	current asset restrictions	Messaging data
Maintenance and Construction Management	Emergency Management	current asset restrictions	Messaging data
Maintenance and Construction Management	Emergency Management	maint and constr work plans	Conversational data, Messaging data
Maintenance and Construction Management	Emergency Management	road weather information	Messaging data
Maintenance and Construction Management	Emergency Management	roadway maintenance status	Messaging data
Maintenance and Construction Management	Emergency Management	work zone information	Messaging data
Maintenance and Construction Management	Enforcement Agency	request for enforcement	Conversational data, Messaging data

Source	Destination	Architecture Flow	Communication Service
Maintenance and Construction Management	Equipment Repair Facility	maint and constr fleet information	Conversational data, Messaging data
Maintenance and Construction Management	Information Service Provider	current asset restrictions	Messaging data
Maintenance and Construction Management	Information Service Provider	maint and constr work plans	Conversational data, Messaging data
Maintenance and Construction Management	Information Service Provider	road weather information	Messaging data
Maintenance and Construction Management	Information Service Provider	roadway maintenance status	Messaging data
Maintenance and Construction Management	Information Service Provider	work zone information	Messaging data
Maintenance and Construction Management	Maintenance and Construction Administrative Systems	maint and constr administrative request	Conversational data, Messaging data
Maintenance and Construction Management	Maintenance and Construction Administrative Systems	maint and constr work performance	Conversational data, Messaging data
Maintenance and Construction Management	Media	maint and constr work plans	Conversational data, Messaging data
Maintenance and Construction Management	Media	road weather information	Messaging data
Maintenance and Construction Management	Media	roadway maintenance status	Messaging data
Maintenance and Construction Management	Media	work zone information	Messaging data
Maintenance and Construction Management	Multimodal Transportation Service Provider	maint and constr work plans	Conversational data, Messaging data
Maintenance and Construction Management	Other MCM	maint and constr resource coordination	Conversational data, Messaging data
Maintenance and Construction Management	Other MCM	road weather information	Messaging data
Maintenance and Construction Management	Other MCM	roadway maintenance status	Messaging data
Maintenance and Construction Management	Other MCM	work plan coordination	Conversational data, Messaging data
Maintenance and Construction Management	Other MCM	work zone information	Messaging data
Maintenance and Construction Management	Rail Operations	maint and constr work plans	Conversational data, Messaging data
Maintenance and Construction Management	Rail Operations	road weather information	Messaging data
Maintenance and Construction Management	Rail Operations	work plan feedback	Conversational data, Messaging data
Maintenance and Construction Management	Roadway Subsystem	infrastructure monitoring sensor control	Messaging data
Maintenance and Construction Management	Roadway Subsystem	roadway treatment system control	Conversational data, Messaging data
Maintenance and Construction Management	Roadway Subsystem	speed monitoring control	Conversational data, Messaging data
Maintenance and Construction Management	Roadway Subsystem	work zone warning device control	Conversational data, Messaging data
Maintenance and Construction Management	Storage Facility	storage facility request	Conversational data, Messaging data
Maintenance and Construction Management	Surface Transportation Weather Service	environmental conditions data	Messaging data
Maintenance and Construction Management	Surface Transportation Weather Service	road data	Messaging data
Maintenance and Construction Management	Surface Transportation Weather Service	road weather information	Messaging data
Maintenance and Construction Management	Surface Transportation Weather Service	transportation weather information request	Conversational data, Messaging data
Maintenance and Construction Management	Traffic Management	current asset restrictions	Messaging data
Maintenance and Construction Management	Traffic Management	equipment maintenance status	Messaging data
Maintenance and Construction Management	Traffic Management	incident information	Conversational data, Messaging data

Source	Destination	Architecture Flow	Communication Service
Maintenance and Construction Management	Traffic Management	maint and constr resource response	Conversational data, Messaging data
Maintenance and Construction Management	Traffic Management	maint and constr work plans	Conversational data, Messaging data
Maintenance and Construction Management	Traffic Management	road weather information	Messaging data
Maintenance and Construction Management	Traffic Management	roadway maintenance status	Messaging data
Maintenance and Construction Management	Traffic Management	work zone information	Messaging data
Maintenance and Construction Management	Transit Management	current asset restrictions	Messaging data
Maintenance and Construction Management	Transit Management	maint and constr work plans	Conversational data, Messaging data
Maintenance and Construction Management	Transit Management	road weather information	Messaging data
Maintenance and Construction Management	Transit Management	roadway maintenance status	Messaging data
Maintenance and Construction Management	Transit Management	work zone information	Messaging data
Maintenance and Construction Management	Weather Service	environmental conditions data	Messaging data
Maintenance and Construction Management	Weather Service	road weather information	Messaging data
Other MCM	Maintenance and Construction Management	maint and constr resource coordination	Conversational data, Messaging data
Other MCM	Maintenance and Construction Management	road weather information	Messaging data
Other MCM	Maintenance and Construction Management	roadway maintenance status	Messaging data
Other MCM	Maintenance and Construction Management	work plan coordination	Conversational data, Messaging data
Other MCM	Maintenance and Construction Management	work zone information	Messaging data
Rail Operations	Maintenance and Construction Management	railroad schedules	Conversational data, Messaging data
Rail Operations	Maintenance and Construction Management	work plan feedback	Conversational data, Messaging data
Roadway Subsystem	Enforcement Agency	speed monitoring information	Conversational data, Messaging data
Roadway Subsystem	Enforcement Agency	traffic violation notification	Messaging data
Roadway Subsystem	Maintenance and Construction Management	infrastructure monitoring sensor data	Messaging data
Roadway Subsystem	Maintenance and Construction Management	speed monitoring information	Conversational data, Messaging data
Roadway Subsystem	Maintenance and Construction Management	work zone warning status	Conversational data, Messaging data
Roadway Subsystem	Surface Transportation Weather Service	environmental conditions data	Messaging data
Roadway Subsystem	Traffic Management	speed monitoring information	Conversational data, Messaging data
Roadway Subsystem	Weather Service	environmental conditions data	Messaging data
Storage Facility	Maintenance and Construction Management	equipment availability	Conversational data, Messaging data
Storage Facility	Maintenance and Construction Management	maintenance materials storage status	Messaging data
Surface Transportation Weather Service	Maintenance and Construction Management	environmental conditions data	Messaging data
Surface Transportation Weather Service	Maintenance and Construction Management	transportation weather information	Messaging data, Broadcast data, Multicast
Surface Transportation Weather Service	Roadway Subsystem	environmental sensors control	Conversational data, Messaging data
Traffic Management	Maintenance and Construction Management	field equipment status	Conversational data, Messaging data
Traffic Management	Maintenance and Construction Management	incident information	Conversational data, Messaging data

Source	Destination	Architecture Flow	Communication Service
Traffic Management	Maintenance and Construction Management	maint and constr resource request	Conversational data, Messaging data
Traffic Management	Maintenance and Construction Management	work plan feedback	Conversational data, Messaging data
Traffic Management	Roadway Subsystem	speed monitoring control	Conversational data, Messaging data
Transit Management	Maintenance and Construction Management	work plan feedback	Conversational data, Messaging data
Weather Service	Maintenance and Construction Management	environmental conditions data	Messaging data
Weather Service	Maintenance and Construction Management	weather information	Messaging data, Broadcast data, Multicast
Weather Service	Roadway Subsystem	environmental sensors control	Conversational data, Messaging data

The primary requirements for the wireline communications layers include the utilization of open standards for the communications protocols. In the area of center to center communications there are several existing and developing communications standards to choose from. These include ATM, Frame Relay, MAN (IEEE 802.6), and FDDI. At the network layers, TCP/IP is a widespread standardized protocol. The key is that by using standard communication protocol suites the regional integration of the wireline data shown above will most readily be accomplished. For the links to the MCMS, the evolving ITS communications standard is the National Transportation Communications for ITS Protocol (NTCIP) family. This set of standards is being developed for the transmission of data and messages between ITS elements.

4.3 Wireless Communication Elements

Some of the interfaces for Maintenance and Construction Management require wireless communications. Wireless Communications are broken down into 3 categories:

- u1 – Wide Area Wireless
- u2 – Dedicated Short Range Communications (DSRC)
- u3 – Vehicle to Vehicle Communications

4.3.1 Wide Area Wireless (u1) Communications

Given the ITS goal of seamless nationwide wireless services, the following three requirements can be stated for any wide area wireless network:

1. The interfaces should use open standards. [This guarantees that ITS subsystem equipment from many competing manufacturers can be used to connect using the communications element. The cost of the data communication module (e.g., modem, transceiver) should be small relative to the ITS subsystem.]
2. The communication element should be internetworked with other communication elements. [The communication element provider must participate in the open internetworking standards that enable messaging between users of different communication element technologies.]
3. The communication element should be nearly ubiquitous to the nation or at least a region. [This enables users to “roam” over a substantial area of user interest and have seamless access to ITS services. The roaming capability should be supported by the communication service provider.]

Exceptions will be found for specific deployments where legacy communication systems need to be accommodated, or where some of the interoperability related benefits of ITS are not important (e.g. dedicated regional safety or transit services). It is expected in these cases that the capability to interface to open systems (through the wireline networks) to allow information exchange will still be possible.

The wide area wireless communication element can be dedicated to a specific user or agency (and publicly owned or privately owned), or it can be privately owned and operated by a communication service provider who sells access to this data network to many users or agencies for a fee.

A key feature of most wireless communication elements is that they are or can be internetworked to a wireline communication system of some sort. In this way, mobile units can exchange ITS messages with Center or Roadside subsystems. When implemented a 2-way ITS wireless communication network must have the necessary coverage for a particular user service application, and the wireless network must be internetworked to the wireline wide area communications network.

Wireless communication systems can be one-way (broadcast) or two-way.

The following architecture flows in this package require Wide Area Wireless Communications:

Table 4. Wide Area Wireless Communications Interfaces

Source	Destination	Architecture Flow	Communication Service
Maintenance and Construction Management	Maintenance and Construction Vehicle	environmental sensors control	Conversational data, Messaging data
Maintenance and Construction Management	Maintenance and Construction Vehicle	maint and constr dispatch information	Conversational data, Messaging data
Maintenance and Construction Management	Maintenance and Construction Vehicle	maint and constr vehicle system control	Conversational data, Messaging data
Maintenance and Construction Vehicle	Maintenance and Construction Management	environmental probe data	Messaging data
Maintenance and Construction Vehicle	Maintenance and Construction Management	infrastructure conditions data	Messaging data
Maintenance and Construction Vehicle	Maintenance and Construction Management	maint and constr dispatch status	Conversational data, Messaging data
Maintenance and Construction Vehicle	Maintenance and Construction Management	maint and constr vehicle conditions	Conversational data, Messaging data
Maintenance and Construction Vehicle	Maintenance and Construction Management	maint and constr vehicle location data	Conversational data, Messaging data
Maintenance and Construction Vehicle	Maintenance and Construction Management	maint and constr vehicle operational data	Conversational data, Messaging data
Maintenance and Construction Vehicle	Maintenance and Construction Management	work zone status	Conversational data, Messaging data
Maintenance and Construction Vehicle	Maintenance and Construction Management	work zone warning status	Conversational data, Messaging data
Transit Vehicle Subsystem	Transit Management	environmental probe data	Messaging data
Maintenance and Construction Vehicle	Equipment Repair Facility	maint and constr vehicle conditions	Conversational data, Messaging data

4.3.2 DSRC (u2) Communications

The u2, or DSRC, link is required to provide service between tetherless (or mobile) and close-proximity base stations, as occurs when a tetherless user communicates with a toll station for toll collection, a parking lot booth for fee collection, or the reception of information from roadside transmitters (roadside sign information). The primary use for this link is for rapid query-response interchanges and for local broadcast of information to nearby mobile users. The interchange must take place quickly as the vehicle will need the response for subsequent action. When used for two-way communications interference between users is reduced either by physical separation of users or by use of different frequencies within the same band. When the data flow is one directional, it is typically a broadcast function from the fixed

station to the mobile user. The u2 link provides wireless communication between the mobile user and the stationary user, or in the reverse direction.

The Communication Layers for Dedicated Short Range Communications are strong candidates for standardization in order to achieve national interoperability. The DSRC links described above have the following requirements:

- High reliability: $P(\text{bit error}) < 10^{-6}$ when vehicle is moving at speeds up to 200 km/h by a fixed roadside reader and with vehicle transponder separation of a minimum of 0.5 meters.
- High data rates [typically 300 – 600 Kbps].
- Two-way communication is a general requirement for DSRC, and the DSRC link should be able to support duplex communications. [Although there are some applications, e.g. in-vehicle signing, requiring only one-way communications].
- Utilize one frequency band for transmission and receipt of signals. (It is advantageous for national interoperability for all DSRC systems to be using the same basic frequency band; otherwise national interoperability can only be achieved by having readers which work at multiple frequency bands.) [Currently the band being utilized is 902-928 MHz. There is increasing interference from other non-ITS sources in this band, so a move to the 5.9 GHz band is underway. A band very near this has already been specified in Europe for DSRC applications].
- No network layer requirements- only physical layer and data link layers are required. [There are some implementations of DSRC which utilize a network layer to achieve separation between adjacent beacons. The roadside beacons will be part of a network, but the beacon to vehicle link typically will not be.]
- Utilize an open communications protocol. [At the Data link layer this could be a High Level Data Link Control (HDLC) or a non-proprietary Time Division Multiple Access (TDMA) protocol.]

The following architecture flows in this package require DSRC Communications:

Table 5. Dedicated Short Range Communications Interfaces

Source	Destination	Architecture Flow	Communication Service
Maintenance and Construction Vehicle	Equipment Repair Facility	maint and constr vehicle conditions	Conversational data, Messaging data
Maintenance and Construction Vehicle	Roadway Subsystem	environmental conditions data	Messaging data
Maintenance and Construction Vehicle	Roadway Subsystem	environmental sensors control	Conversational data, Messaging data
Maintenance and Construction Vehicle	Roadway Subsystem	infrastructure monitoring sensor control	Messaging data
Maintenance and Construction Vehicle	Roadway Subsystem	roadway information system data	Messaging data
Roadway Subsystem	Maintenance and Construction Vehicle	environmental conditions data	Messaging data
Roadway Subsystem	Maintenance and Construction Vehicle	infrastructure monitoring sensor data	Messaging data
Roadway Subsystem	Maintenance and Construction Vehicle	roadway information system status	Messaging data
Roadway Subsystem	Maintenance and Construction Vehicle	work zone warning notification	Conversational data, Messaging data
Vehicle	Roadway Subsystem	environmental probe data	Messaging data

4.3.3 Vehicle to Vehicle (u3) Communications

The National ITS Architecture defines another type of wireless communications to address the applications that will be located in one vehicle that need to communicate with applications in another moving vehicle. The specific technologies for this class of communications are yet to be determined; although 5.9 GHz band DSRC-type technologies are being considered.

The following architecture flows in this package require Vehicle to Vehicle Communications:

Table 6. Vehicle to Vehicle Communications Interfaces

Source	Destination	Architecture Flow	Communication Service
Maintenance and Construction Vehicle	Other MCV	maint and constr vehicle status coordination	Conversational data, Messaging data
Maintenance and Construction Vehicle	Other MCV	work zone warning notification	Conversational data, Messaging data
Maintenance and Construction Vehicle	Vehicle	vehicle signage data	Messaging data
Other MCV	Maintenance and Construction Vehicle	maint and constr vehicle status coordination	Conversational data, Messaging data
Other MCV	Maintenance and Construction Vehicle	work zone warning notification	Conversational data, Messaging data

5 Architecture Flow Commonality

There are many different interfaces in the architecture that carry the same information. These architecture flows are assigned identical, or very similar, names in the hope that they will be standardized in the same way.

There are two general categories:

- Architecture Flows on Like Communications Link Types
- Architecture Flows on Different Communications Link Types

In the former, the same information is sent between two systems across the same type of communications link. For example, weather information is disseminated from the Weather Service across a “Wireline” communications link to a variety of centers (TMS, TRMS, etc.). In the latter, environmental conditions data is sent across both “Wireline” and “DSRC” communications links. By understanding these relationships, it is hoped consensus will be reached by various standards development organization committees to consider standardization of these architecture flows in a similar fashion.

5.1 Architecture Flow Commonality on Like Communications Links Types

Identical data is shared between several subsystems (and terminators) across the same type of communications links in many places in the National ITS Architecture. For the interfaces described by this Standards Requirements Package, there are three general categories of interfaces that have examples of such shared data. They are: “Wireline” communications, including both Center-to-Field and Center-to-Center, and Wide-area-wireless communications.

5.1.1 Wireline: Center-to-Field

1. Roadway ⇔ MCMS, TMS, Weather Service, Surface Transportation Weather Service, Enforcement Agency

The table below shows identical architecture flows that appear on two or more Wireline Center-to-Field interfaces. The interfaces covered by these flows are between:

- Roadway Subsystem and the Traffic Management Subsystem (RS ⇔ TMS)
- Roadway Subsystem and Maintenance and Construction Management Subsystem (RS ⇔ MCMS)
- Roadway Subsystem and Weather Service (RS ⇔ X58)
- Roadway Subsystem and Surface Transportation Weather Service (RS ⇔ X77)
- Roadway Subsystem and Enforcement Agency (RS ⇔ X62)

When considering any of these flows for standardization, it is suggested that all the similar interfaces be covered by a single standards definition. This is particularly true for the information content that is standardized, but in most cases holds true for the communications protocols as well. For example, the same architecture flow “environmental conditions data” is sent from the Roadway Subsystem to the MCMS, TMS, Weather Service (X58), and Surface Transportation Weather Service (X77). Since this flow contains the same information, with possibly minor variations due to the recipient, it should carry the same definition when standardized.

The following table shows the set of architecture flows on center to field wireline interfaces that exist on the Maintenance and Construction Management Subsystem to Roadway Subsystem interface and on at least one other interface to the Roadway Subsystem. In addition to identifying the architecture flows and

interfaces, the table shows the standards requirements package where these flows are described in full detail. Note in this case that while many of the subject architecture flows are in this Standards Requirements Package (SRP) 14, other are described in SRPs 7 and 7A¹.

Table 7. Common Flows between RS and Centers

Architecture Flow	Source	Destination	7	7A	14
environmental conditions data	RS	MCMS		X	
	RS	TMS		X	
	RS	X58		X	X
	RS	X77		X	X
environmental sensors control	MCMS	RS		X	
	TMS	RS		X	
	X58	RS		X	X
	X77	RS		X	X
roadway information system data	MCMS	RS		X	
	TMS	RS	X		
roadway information system status	RS	MCMS		X	
	RS	TMS	X		
speed monitoring control	MCMS	RS		X	X
	TMS	RS		X	X
	X62	RS			X
speed monitoring information	RS	MCMS		X	X
	RS	TMS		X	X
	RS	X62			X
traffic images	RS	MCMS		X	
	RS	TMS	X		
video surveillance control	MCMS	RS		X	
	TMS	RS		X	

2. Roadway ⇔ MCMS (Only)

The table below shows flows that are only located on the interface between Roadway and Maintenance and Construction Management Subsystem (RS ⇔ MCMS).

Since they are very similar to the flows on the RS ⇔ TMS interface, they have also been mapped to both SRP 14 and SRP 7A (with the exception of two status flows that are mapped only to SRP 7A). This table was included to show the complete Center-to-Field interface between the MCMS and the Roadside field elements, in the anticipation that these flows will be standardized in the same way as Center-to-Field architecture flows already completed.

The table shows the flows included in this SRP (14), as well as flows from the other SRP (7A) that should be considered.

Table 8. RS-MCMS Flows Similar to RS-TMS Flows

Architecture Flow	Source	Destination	7	7A	14
field device status	RS	MCMS		X	
infrastructure monitoring sensor control	MCMS	RS		X	X

¹ Note: references in this section to Standards Requirements Packages (SRPs) with “A” designations are updates that are being made to the Hypertext version of the National ITS Architecture for Version 4.0, not revised documents. These hypertext updates will show a revised set of architecture flows that map to the set of interfaces covered by the SRP. For example SRP 7A above will show the revised set of flows from RS to TMS (and MCMS) that exist in Version 4.0. The only SRP documents being revised or created for Version 4.0 are SRP 4, 13, and 14.

Architecture Flow	Source	Destination	7	7A	14
infrastructure monitoring sensor data	RS	MCMS		X	X
roadway treatment system control	MCMS	RS		X	X
roadway treatment system status	RS	MCMS		X	
work zone warning device control	MCMS	RS		X	X
work zone warning status	RS	MCMS		X	X

5.1.2 Wireline: Center-to-Center

This section discusses architecture flows exist on more than one center to center interface. All of the following flows are sent between two center subsystems or between center subsystems and terminators (with a center class type).

1. Weather Service (X58) ⇔ Other Centers

The table below shows architecture flows that appear on interfaces between the Weather Service (X58) and other center type entities. The interfaces covered by these flows are between the Weather Service and:

- Traffic Management Subsystem (X58 ⇔ TMS)
- Maintenance and Construction Management Subsystem (X58 ⇔ MCMS)
- Archived Data Management Subsystem (X58 => ADMS)
- Emergency Management Subsystem (X58 => EM)
- Information Service Provider (X58 => ISP)
- Transit Management Subsystem (X58 => TRMS)

When considering any of these flows for standardization, it is suggested that all the similar interfaces be covered by a single standards definition. For example, the same architecture flow “environmental conditions data” is sent between the MCMS and the TMS to the Weather Service (X58). Since this flow contains the same information, with possibly minor variations due to the recipient, it should carry the same definition when standardized.

The following table shows the two architecture flows that are identical on multiple interfaces to the Weather Service. In addition to identifying the architecture flows and interfaces, the table shows the standards requirements package updates where references to these flows are made. Note that although “weather information” is described in many places, the detailed definition of this architecture flow (as described by the Logical Architecture data flows assigned to it) has been considerably expanded in Version 4.0 of the National ITS Architecture and that expanded definition is contained in this SRP (14).

Table 9. Common Weather Service Flows

Architecture flow	Source	Destination	6	6A	7A	9	10	11	13	14
environmental conditions data	MCMS	X58								X
	TMS	X58		X						
	X58	MCMS								X
	X58	TMS		X						
weather information	X58	ADMS							X	
	X58	EM				X				
	X58	ISP					X			
	X58	MCMS								X
	X58	TMS	X							
	X58	TRMS						X		

2. Surface Transportation Weather Service (X77) ⇔ Other Centers

The table below shows flows that are common on the interfaces between the Surface Transportation Weather Service (X77) and:

- Traffic Management Subsystem (X77 ⇔ TMS)
- Maintenance and Construction Management Subsystem (X77 ⇔ MCMS)
- Archived Data Management Subsystem (X77 ⇔ ADMS)
- Emergency Management Subsystem (X77 ⇔ EM)
- Information Service Provider (X77 ⇔ ISP)
- Transit Management Subsystem (X77 ⇔ TRMS)

When considering any of these flows for standardization, it is suggested that all the similar interfaces be covered by a single standards definition. For example, the same architecture flow “transportation weather information” is sent between the MCMS and the TMS to the Surface Transportation Weather Service (X77). Since this flow contains the same information, with possibly minor variations due to the recipient, it should carry the same definition when standardized.

The following table shows the three architecture flows that are identical on multiple interfaces to the Surface Transportation Weather Service. In addition to identifying the architecture flows and interfaces, the table shows the standards requirements package updates where references to these flows are made. Note that although the three architecture flows are described in many places, the detailed definition of these architecture flows (as described by the Logical Architecture data flows assigned to it) are all contained in this SRP (14).

Table 10. Common Surface Transportation Weather Service Flows

Architecture flow	Source	Destination	6A	7A	9A	10A	11A	13	14
environmental conditions data	MCMS	X77							X
	TMS	X77	X						
	X77	MCMS							X
	X77	TMS	X						
transportation weather information	X77	ADMS						X	
	X77	EM			X				
	X77	ISP				X			
	X77	MCMS							X
	X77	TMS	X						
transportation weather information request	X77	TRMS					X		
	EM	X77			X				
	ISP	X77				X			
	MCMS	X77							X
	TMS	X77	X						
	TRMS	X77					X		

3. MCMS ⇔ Other Centers

The table below shows flows that are common on the interfaces between the MCMS and these centers:

- Commercial Vehicle Administration (CVAS)
- Emergency Management (EM)
- Information Service Provider (ISP)
- Traffic Management (TMS)

- Transit Management (TRMS)
- Multimodal Transportation Service Provider (X02)
- Media (X27)
- Weather Service (X58)
- Enforcement Agency (X62)
- Rail Operations (X67)
- Surface Transportation Weather Service (X77)
- Other Maintenance and Construction Management (X78)

When considering any of these flows for standardization, it is suggested that all the similar interfaces be covered by a single standards definition. For example, the same architecture flow “current asset restrictions” is sent from the MCMS to the CVAS, EM, ISP, TMS, and TRMS. Since this flow contains the same information, with possibly minor variations due to the recipient, it should carry the same definition when standardized.

The following table shows the large number of architecture flows that exist on multiple MCMS interfaces and on additional center to center interfaces in the architecture. The table shows this SRP (14), as well as the other SRPs (6A, 7A, 9, 9A, 10A, 11A, 12) that should be considered. The definitions of all of the architecture flows in this table are contained in this SRP (14).

Table 11. Common Flows between MCMS and Other Centers

Architecture flow	Source	Destination	6A	7A	9	9A	10A	11A	12	14
current asset restrictions	MCMS	CVAS								X
	MCMS	EM								X
	MCMS	ISP								X
	MCMS	TMS								X
	MCMS	TRMS								X
maint and constr work plans	MCMS	EM								X
	MCMS	ISP								X
	MCMS	TMS								X
	MCMS	TRMS								X
	MCMS	X02								X
	MCMS	X27								X
	MCMS	X67								X
work plan feedback	EM	MCMS								X
	MCMS	X67								X
	TMS	MCMS								X
	TRMS	MCMS								X
	X67	MCMS								X
work plan coordination	MCMS	X78								x
road weather information	MCMS	EM								X
	MCMS	ISP								X
	MCMS	TMS								X
	MCMS	TRMS								X
	MCMS	X27								X
	MCMS	X58								X
	MCMS	X67								X
	MCMS	X77								X

Architecture flow	Source	Destination	6A	7A	9	9A	10A	11A	12	14
	MCMS	X78								X
	X78	MCMS								X
roadway maintenance status	MCMS	EM								X
	MCMS	ISP								X
	MCMS	TMS								X
	MCMS	TRMS								X
	MCMS	X27								X
	MCMS	X78								X
	X78	MCMS								X
work zone information	MCMS	EM								X
	MCMS	ISP								X
	MCMS	TMS								X
	MCMS	TRMS								X
	MCMS	X27								X
	MCMS	X78								X
	X78	MCMS								X
maint and constr resource request	EM	MCMS								X
	TMS	MCMS								X
maint and constr resource response	MCMS	EM				X				
	MCMS	TMS								X
incident information	EM	ISP			X					
	EM	MCMS								X
	EM	TMS			X					
	MCMS	EM				X				
	MCMS	TMS				X				X
	TMS	EM			X					
	TMS	MCMS				X				X
incident information for media	EM	X27			X					
incident response status	EM	MCMS								X
	EM	TMS			X					
railroad schedules	X67	MCMS								X
	X67	TMS							X	
request for enforcement	MCMS	X62								X
	TMS	X62	X							
road network probe information	EM	MCMS								X
	EM	TMS				X				
	ISP	MCMS					X			
	ISP	TMS	X							
	TRMS	MCMS						X		
	TRMS	TMS						X		
work zone warning notification	MCVS	X90								X
	RS	MCVS		X						X
	X90	MCVS								X

5.1.3 Wide-Area-Wireless

The table below shows a single flow that is common on the wide-area-wireless interfaces between the Maintenance and Construction Vehicle (MCVS) and:

- Maintenance and Construction Management Subsystem
- Equipment Repair Facility (X89)

When considering this flow for standardization, it is suggested that both interfaces be covered by a single standards definition. Both interfaces are defined in this SRP.

Table 12. Common MCVS Flows

Architecture flow	Source	Destination	14
maint and constr vehicle conditions	MCVS	MCMS	X
maint and constr vehicle conditions	MCVS	X89	X

5.2 Architecture Flow Commonality on Different Communications Links Types

Identical data is shared between several subsystems (and terminators) across the different types of communications links in many places in the National ITS Architecture. For example, the same type of information might be sent from a roadside element (environmental sensor station), for example, to a Traffic Management Subsystem (TMS) using a “Wireline” communications link as from that same roadside element to a Maintenance and Construction Vehicle collecting environmental data using a “DSRC” communications link. Both Wireline and DSRC communications link types are used to carry the same information. Following is area discussion tables of some of this architecture flow commonality related to the new Maintenance and Construction Management interfaces and a graphical representation of the first table.

These architecture flows represent the interfaces from the Maintenance and Construction Management (MCMS) Subsystem and the Maintenance and Construction Vehicle (MCVS) to:

- Emergency Management Subsystem
- Information Service Provider
- Traffic Management Subsystem
- Transit Management Subsystem
- Roadway Subsystem
- Weather Service (X58)
- Surface Transportation Weather Service (X77)
- Other MCV (X90)

The first case, “environmental conditions data”, shown in Table 13, represents a single set of information (data from environmental sensors) that is collected by multiple entities in the National ITS Architecture and transferred between multiple entities. This particularly complex set of interfaces is illustrated in Figure 31.

Table 13. Environmental Conditions Data, Various Interface Types

Architecture flow	Source	Destination	1A	6A	7A	14	Interface Type
environmental conditions data	MCMS	X58				X	Wireline: Center-to-Center
environmental conditions data	MCMS	X77				X	Wireline: Center-to-Center
environmental conditions data	MCVS	RS	X			X	DSRC
environmental conditions data	RS	MCMS			X		Wireline: Center-to-Field

Architecture flow	Source	Destination	1A	6A	7A	14	Interface Type
environmental conditions data	RS	MCVS			X	X	DSRC
environmental conditions data	RS	TMS			X		Wireline: Center-to-Field
environmental conditions data	RS	X58			X	X	Wireline: Center-to-Field
environmental conditions data	RS	X77			X	X	Wireline: Center-to-Field
environmental conditions data	TMS	X58		X			Wireline: Center-to-Center
environmental conditions data	TMS	X77		X			Wireline: Center-to-Center
environmental conditions data	X58	MCMS				X	Wireline: Center-to-Center
environmental conditions data	X58	TMS		X			Wireline: Center-to-Center
environmental conditions data	X77	MCMS				X	Wireline: Center-to-Center
environmental conditions data	X77	TMS		X			Wireline: Center-to-Center

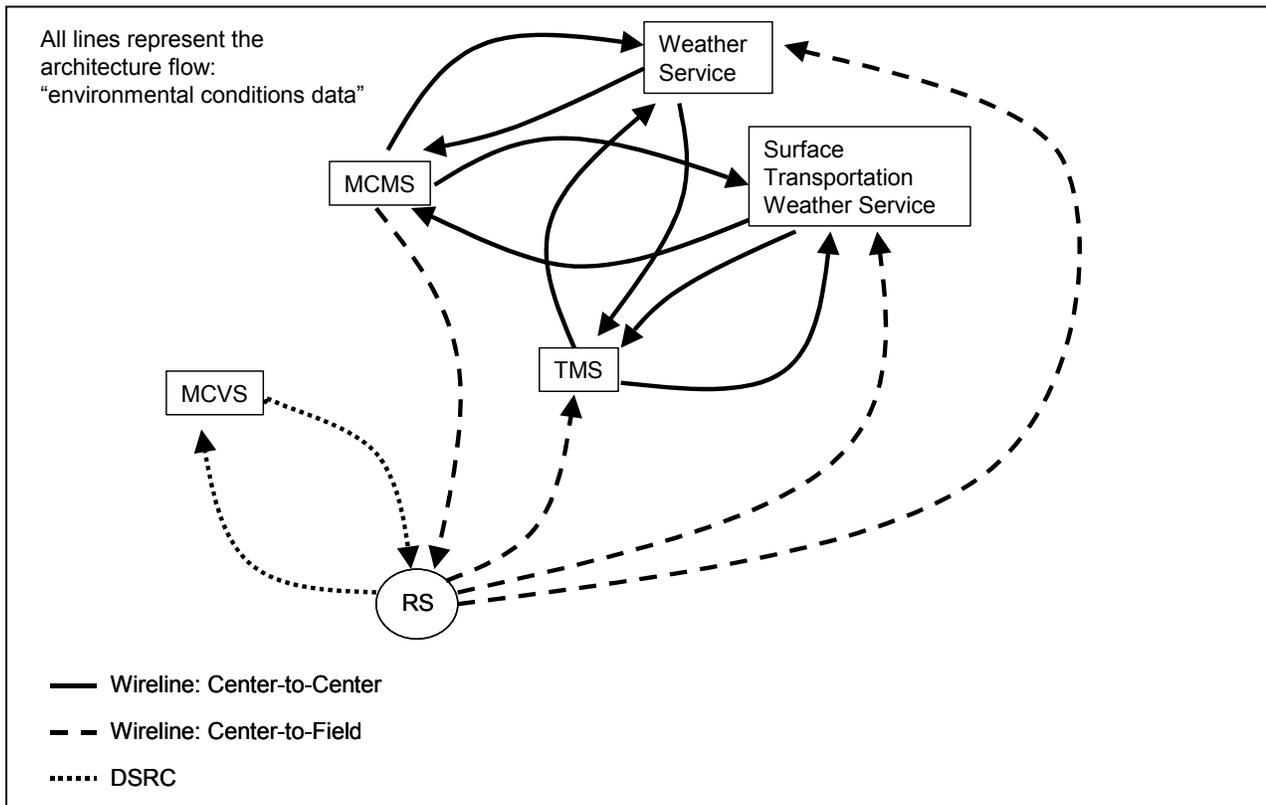


Figure 31. Architecture Flow Commonality

Similarly, the following architecture flows are common across different kinds of communications links and should be considered for common standardization:

Table 14. Common Architecture Flows with Different Interface Types

Architecture flow	Source	Destination	1	1A	3A	7	7A	14	Interface Type
environmental probe data	EVS	EM							Wide-Area Wireless
environmental probe data	MCVS	MCMS						X	Wide-Area Wireless
environmental probe data	RS	TMS					X		Wireline: Center-to-Field
environmental probe data	TRVS	TRMS						X	Wide-Area Wireless
environmental probe data	VS	ISP			X				Wide-Area Wireless

Architecture flow	Source	Destination	1	1A	3A	7	7A	14	Interface Type
environmental probe data	VS	RS		X				X	DSRC
environmental sensors control	MCMS	MCVS						X	Wide-Area Wireless
environmental sensors control	MCMS	RS					X		Wireline: Center-to-Field
environmental sensors control	MCVS	RS		X				X	DSRC
environmental sensors control	TMS	RS					X		Wireline: Center-to-Field
environmental sensors control	X58	RS					X	X	Wireline: Center-to-Field
environmental sensors control	X77	RS					X	X	Wireline: Center-to-Field
infrastructure monitoring sensor control	MCMS	RS					X	X	Wireline: Center-to-Field
infrastructure monitoring sensor control	MCVS	RS		X				X	DSRC
infrastructure monitoring sensor data	RS	MCMS					X	X	Wireline: Center-to-Field
infrastructure monitoring sensor data	RS	MCVS					X	X	DSRC
roadway information system data	MCMS	RS					X		Wireline: Center-to-Field
roadway information system data	MCVS	RS		X				X	DSRC
roadway information system data	TMS	RS				X			Wireline: Center-to-Field
roadway information system status	RS	MCMS					X		Wireline: Center-to-Field
roadway information system status	RS	MCVS					X	X	DSRC
roadway information system status	RS	TMS				X			Wireline: Center-to-Field
vehicle signing data	MCVS	VS		X				X	DSRC
vehicle signing data	RS	VS	X						DSRC
work zone warning notification	MCVS	X90						X	DSRC
work zone warning notification	RS	MCVS					X	X	DSRC
work zone warning notification	X90	MCVS						X	DSRC
work zone warning status	MCVS	MCMS						X	Wide-Area Wireless
work zone warning status	RS	MCMS					X	X	Wireline: Center-to-Field

6 Constraints

This chapter identifies constraints placed upon Physical Architecture flows, as described in Physical Architecture inter-subsystem message performance requirements below the application layer.

6.1. Assessment Categories

The following categories have been used in rating the constraints that exist on the physical architecture flows.

1. Performance

a. Emergency Priority (E)

Essentially "real-time" requirements. Emergency data that is time critical must be received by a certain absolute time, or it is useless. For these flows, the communication channel may require priority in emergencies. The data channels required must be operational even when there is an emergency that might place other loads on the interface. A private communication channel or frequency may be required to satisfy the requirement.

b. Reliability (R)

This category encompasses both the concepts of reliability and availability. Data must be delivered reliably. Loss cannot be tolerated. The communication link must also have high availability. 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 (e.g., for AHS applications), special attention will be paid to the transmitters, receivers, and potential interference for these connections.

c. Timing (T)

The timing constraints are critical. If communication does not occur within set limits system failures can occur. 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.

This timing constraint is related to (but not the same as) another attribute often discussed in specifying systems: latency. Latency is used to quantify end-to-end processing and transmission time (round trip delays). Data with a latency requirement must be handled within a certain time interval. This differs from "time criticality" in that it is a relative rather than absolute time requirement (i.e., latency: interface screen must update every 2 seconds; time criticality: route instructions must be received 30 seconds prior to first turning action). Because latency requirements are greatly affected by the implementation of the subsystem elements, it cannot be specified directly when discussing only the interface between two subsystems.

2. Data Sensitivity

a. Security (S)

Access to the data must be restricted. Data itself must be secure during transmission. This is typically used for financial information.

b. Privacy (P)

Anonymity of the data source or recipient must be protected. This is typically used for personal information.

6.2. Architecture Flow Constraints

The table below lists the architecture flows for the Maintenance and Construction Management Interfaces that have been assigned special constraints.

Table 15. Architecture Flow Constraints

Source	Destination	Architecture Flow	Interconnects	Communication Service	Special Constraints
Emergency Management	Maintenance and Construction Management	incident information	W (Wireline)	Conversational data, Messaging data	E
Emergency Management	Maintenance and Construction Management	incident response status	W (Wireline)	Conversational data, Messaging data	E
Maintenance and Construction Management	Enforcement Agency	request for enforcement	W (Wireline)	Conversational data, Messaging data	P
Maintenance and Construction Management	Traffic Management	incident information	W (Wireline)	Conversational data, Messaging data	E
Maintenance and Construction Vehicle	Vehicle	vehicle signage data	U3 (Vehicle-to-Vehicle)	Messaging data	T
Traffic Management	Maintenance and Construction Management	incident information	W (Wireline)	Conversational data, Messaging data	E
Vehicle	Roadway Subsystem	environmental probe data	U2 (Vehicle-to-Roadside)	Messaging data	T,P

7 Interface Decomposition

This section shows the interface decomposition for the interfaces covered in this package. The format shows the interface followed by the first physical architecture flow in the interface and its description. Each of the physical architecture flows is then decomposed into its constituent logical data flows, which in turn are decomposed hierarchically into more basic data flows. The data flows are numbered and indented to indicate which are top level flows (1) and which are constituent data flows (numbered 2 and lower). The definitions for all of the logical data flows are given in Section 8. That section contains the data dictionary entries, listed in alphabetical order, for all of the data flows contained in this package.

7.1 Wireline Interfaces

7.1.1 Center to Center

7.1.1.1 Asset Management → Maintenance and Construction Management

Physical Architecture Flow: asset inventory W

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 Flows:

(1) *fam_asset_inventory*

Physical Architecture Flow: asset restrictions W

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 Flows:

(1) *fam_asset_restrictions*

Physical Architecture Flow: maintenance and repair needs W

Recommended strategies and schedules for maintenance of the transportation infrastructure.

Logical Architecture Flows:

(1) *fam_asset_maint_and_repair_needs*

7.1.1.2 Emergency Management → Maintenance and Construction Management

Physical Architecture Flow: incident information W

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

Logical Architecture Flows:

- (1) *incident_info_from_emerg*
 - (2) *incident_duration*
 - (3) *duration*
 - (2) *incident_location*
 - (3) *location_identity*
 - (2) *incident_number*
 - (2) *incident_severity*

- (2) *incident_start_time*
- (3) *time*
- (2) *incident_traffic_impact*
- (2) *incident_type*

Physical Architecture Flow: incident response status

W

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

Logical Architecture Flows:

- (1) *incident_response_status_from_emerg*

Physical Architecture Flow: maint and constr resource request

W

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 Flows:

- (1) *m_and_c_resource_request_from_emerg*
- (1) *roadway_maint_action_req_from_emerg*

Physical Architecture Flow: road network probe information

W

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

Logical Architecture Flows:

- (1) *env_probe_info_from_emergency*
- (2) *env_probe_data*
- (2) *route_segment_identity*
- (3) *location_identity*
- (3) *route_segment_type*
- (3) *unit_number*
- (2) *route_segment_total_number*

Physical Architecture Flow: work plan feedback

W

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 Flows:

- (1) *m_and_c_plan_feedback_from_emerg*
- (2) *m_and_c_plan_feedback*

7.1.1.3 Equipment Repair Facility → Maintenance and Construction Management

Physical Architecture Flow: maint and constr equipment repair status

W

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 Flows:

- (1) *ferf_current_fleet_maintenance_status*
- (1) *ferf_equipment_repair_status*
- (1) *ferf_equipment_status_for_tracking*
- (1) *ferf_fleet_maintenance_record*

7.1.1.4 Maintenance and Construction Administrative Systems → Maintenance and Construction Management

Physical Architecture Flow: maint and constr administrative information W

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 Flows:

- (1) *fmcas_m_and_c_administrative_information*
- (1) *fmcas_m_and_c_personnel_information*
- (1) *fmcas_m_and_c_regulations*
- (1) *fmcas_resupply_response*

7.1.1.5 Maintenance and Construction Management → Asset Management

Physical Architecture Flow: asset status update W

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 Flows:

- (1) *tam_asset_status_update_for_asset_mgmt*
 - (2) *auto_treatment_system_status_for_archive*
 - (3) *auto_treatment_activation_data*
 - (3) *device_identity*
 - (3) *list_size*
 - (3) *station_id*
 - (2) *field_device_status_for_archive*
 - (3) *auto_treat equip_status_for_m_and_c*
 - (4) *device_identity*
 - (4) *list_size*
 - (4) *roadside_device_status*
 - (4) *station_id*
 - (3) *dms equip_status_for_m_and_c*
 - (4) *dms_advisory_text*
 - (5) *dms_auto_treat_info*
 - (5) *dms_highway_open_close*
 - (5) *dms_incident_warning*
 - (5) *dms_weather_warning*
 - (4) *dms_fault*
 - (5) *dms_identity*
 - (4) *indicator_identity*
 - (5) *indicator_type*
 - (5) *location_identity*
 - (5) *unit_number*
 - (4) *list_size*
 - (3) *env_sensor equip_status_for_m_and_c*
 - (4) *list_size*
 - (4) *sensor_identity*
 - (4) *sensor_status*
 - (5) *traffic_sensor_status*

- (4) *station_id*
- (3) *har_equip_status_for_m_and_c*
 - (4) *har_fault*
 - (5) *har_identity*
- (3) *hov_sensor_equip_status_for_m_and_c*
 - (4) *list_size*
 - (4) *sensor_identity*
 - (4) *sensor_status*
 - (5) *traffic_sensor_status*
 - (4) *station_id*
- (3) *indicator_equip_status_from_highways_for_m_and_c*
 - (4) *indicator_fault*
 - (4) *indicator_type*
 - (4) *list_size*
- (3) *indicator_equip_status_from_roads_for_m_and_c*
 - (4) *indicator_fault*
 - (4) *indicator_type*
 - (4) *list_size*
- (3) *infrastructure_sensor_equip_status_for_m_and_c*
 - (4) *infrastructure_sensor_status_for_m_and_c*
 - (5) *infrastructure_sensor_status_of_roadside_devices*
 - (4) *infrastructure_sensor_status_for_mcv*
 - (5) *infrastructure_sensor_status_of_roadside_devices*
- (3) *smart_probe_equip_status_for_m_and_c*
 - (4) *device_identity*
 - (4) *list_size*
 - (4) *roadside_device_status*
 - (4) *station_id*
- (3) *traffic_sensor_equip_status_for_m_and_c*
 - (4) *list_size*
 - (4) *sensor_identity*
 - (4) *sensor_status*
 - (5) *traffic_sensor_status*
 - (4) *station_id*
- (3) *vehicle_sign_equip_status_for_m_and_c*
 - (4) *device_identity*
 - (4) *list_size*
 - (4) *roadside_device_status*
 - (4) *station_id*
- (3) *video_device_equip_status_for_m_and_c*
 - (4) *device_identity*
 - (4) *list_size*
 - (4) *roadside_device_status*
 - (4) *station_id*
- (2) *infrastructure_data_for_archive*
 - (3) *infrastructure_sensor_data_for_m_and_c*
 - (4) *infrastructure_sensor_data_from_roadside_devices*
 - (5) *infrastructure_sensor_output*
 - (5) *list_size*
 - (5) *sensor_identity*
 - (5) *station_id*
 - (3) *mcv_infrastructure_sensor_data*
 - (4) *infrastructure_sensor_data_for_mcv*
 - (5) *infrastructure_sensor_data_from_roadside_devices*
 - (4) *infrastructure_sensor_data_from_onboard_devices*
 - (5) *infrastructure_sensor_output*
 - (5) *list_size*
 - (5) *sensor_identity*
 - (5) *vehicle_id_for_mcv*
- (3) *processed_infrastructure_sensor_data*

- (4) *infrastructure_sensor_data_for_m_and_c*
- (5) *infrastructure_sensor_data_from_roadside_devices*
- (4) *mcv_infrastructure_sensor_data*
- (5) *infrastructure_sensor_data_for_mcv*
- (5) *infrastructure_sensor_data_from_onboard_devices*
- (2) *m_and_c_activity_schedule_for_archive*
- (3) *m_and_c_activity_schedule*
- (4) *fleet_activity_schedule*
- (4) *m_and_c_work_plans*
- (4) *work_zone_activity_plan*
- (2) *m_and_c_activity_status_for_archive*
- (3) *m_and_c_activity_status*
- (4) *m_and_c_fleet_manager_status*
- (5) *m_and_c_fleet_status*
- (5) *m_and_c_view_of_road_network*
- (4) *m_and_c_work_performance*
- (4) *materials_availability_for_status*
- (5) *materials_status*
- (5) *storage_facility_id*
- (4) *work_zone_data_for_status*
- (5) *fomcm_work_zone_info*
- (5) *work_zone_device_status*
- (5) *work_zone_intrusion_warning_data*
- (5) *work_zone_resource_status*
- (5) *work_zone_status_from_mcv*
- (2) *m_and_c_maint_resource_needs_for_archive*
- (3) *m_and_c_resource_request_from_emerg*
- (3) *m_and_c_resource_request_from_traffic*
- (3) *resource_needs_from_scheduler*
- (4) *date*
- (4) *list_size*
- (4) *m_and_c_equipment_quantity*
- (4) *m_and_c_equipment_type*
- (4) *m_and_c_materials_quantity*
- (4) *m_and_c_materials_type*
- (4) *mcv_vehicle_type*
- (4) *time*
- (2) *m_and_c_roadway_maint_needs_for_archive*
- (3) *list_size*
- (3) *m_and_c_materials_quantity*
- (3) *m_and_c_materials_type*
- (3) *mcv_vehicle_type*
- (3) *need_date*
- (3) *need_time*
- (3) *roadway_maint_plan*
- (2) *m_and_c_winter_maint_needs_for_archive*
- (3) *list_size*
- (3) *m_and_c_materials_quantity*
- (3) *m_and_c_materials_type*
- (3) *mcv_vehicle_type*
- (3) *need_date*
- (3) *need_time*
- (3) *winter_treatment_plan*
- (2) *work_zone_data_for_archive*
- (3) *work_zone_data_for_status*
- (4) *fomcm_work_zone_info*
- (4) *work_zone_device_status*
- (5) *device_fault*
- (5) *device_identity*

- (5) *device_status*
- (5) *list_size*
- (4) *work_zone_intrusion_warning_data*
 - (5) *roadside_crew_warning_given*
 - (5) *work_zone_intrusion_alert*
 - (5) *work_zone_intrusion_detected*
 - (5) *work_zone_intrusion_video_image*
 - (5) *work_zone_intrusion_warning_notification*
- (4) *work_zone_resource_status*
 - (5) *work_zone_equipment_status*
 - (5) *work_zone_identifier*
 - (5) *work_zone_personnel_status*
 - (5) *work_zone_vehicle_status*
- (4) *work_zone_status_from_mcv*
- (1) *tam_infrastructure_data_for_analysis*
 - (2) *infrastructure_sensor_data_for_m_and_c*
 - (3) *infrastructure_sensor_data_from_roadside_devices*
 - (4) *infrastructure_sensor_output*
 - (4) *list_size*
 - (4) *sensor_identity*
 - (4) *station_id*
 - (2) *mcv_infrastructure_sensor_data*
 - (3) *infrastructure_sensor_data_for_mcv*
 - (4) *infrastructure_sensor_data_from_roadside_devices*
 - (5) *infrastructure_sensor_output*
 - (5) *list_size*
 - (5) *sensor_identity*
 - (5) *station_id*
 - (3) *infrastructure_sensor_data_from_onboard_devices*
 - (4) *infrastructure_sensor_output*
 - (4) *list_size*
 - (4) *sensor_identity*
 - (4) *vehicle_id_for_mcv*
 - (2) *processed_infrastructure_sensor_data*
 - (3) *infrastructure_sensor_data_for_m_and_c*
 - (4) *infrastructure_sensor_data_from_roadside_devices*
 - (5) *infrastructure_sensor_output*
 - (5) *list_size*
 - (5) *sensor_identity*
 - (5) *station_id*
 - (3) *mcv_infrastructure_sensor_data*
 - (4) *infrastructure_sensor_data_for_mcv*
 - (5) *infrastructure_sensor_data_from_roadside_devices*
 - (4) *infrastructure_sensor_data_from_onboard_devices*
 - (5) *infrastructure_sensor_output*
 - (5) *list_size*
 - (5) *sensor_identity*
 - (5) *vehicle_id_for_mcv*

7.1.1.6 Maintenance and Construction Management → Commercial Vehicle Administration

Physical Architecture Flow: current asset restrictions

W

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 Flows:

- (1) *asset_restrictions_for_com_veh*
- (2) *current_asset_restrictions*

7.1.1.7 Maintenance and Construction Management → Emergency Management**Physical Architecture Flow: current asset restrictions**

W

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 Flows:

- (1) *asset_restrictions_for_emerg*
- (2) *current_asset_restrictions*

Physical Architecture Flow: maint and constr work plans

W

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 Flows:

- (1) *m_and_c_work_plans_for_emerg*
- (2) *m_and_c_work_plans*

Physical Architecture Flow: road weather information

W

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

Logical Architecture Flows:

- (1) *road_weather_info_for_emergency*
 - (2) *road_conditions*
 - (3) *link_identity*
 - (4) *link_type*
 - (4) *location_identity*
 - (4) *unit_number*
 - (3) *list_size*
 - (3) *road_segment_conditions*
- (2) *road_weather_conditions*
 - (3) *link_identity*
 - (4) *link_type*
 - (4) *location_identity*
 - (4) *unit_number*
 - (3) *list_size*
 - (3) *road_segment_weather_conditions*

Physical Architecture Flow: roadway maintenance status

W

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

Logical Architecture Flows:

- (1) *roadway_maint_status_for_emerg*
- (2) *current_roadway_maintenance_status*

Physical Architecture Flow: work zone information

W

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 Flows:

- (1) *work_zone_info_for_emergency*
- (2) *work_zone_data_for_status*
- (3) *fomcm_work_zone_info*
- (3) *work_zone_device_status*
- (4) *device_fault*
- (4) *device_identity*
- (4) *device_status*
- (4) *list_size*
- (3) *work_zone_intrusion_warning_data*
- (4) *roadside_crew_warning_given*
- (4) *work_zone_intrusion_alert*
- (4) *work_zone_intrusion_detected*
- (5) *device_identity*
- (5) *intrusion_detection_device_output*
- (4) *work_zone_intrusion_video_image*
- (4) *work_zone_intrusion_warning_notification*
- (5) *work_zone_intrusion_alert_on_board*
- (5) *work_zone_warning_given_on_board*
- (3) *work_zone_resource_status*
- (4) *work_zone_equipment_status*
- (4) *work_zone_identifier*
- (4) *work_zone_personnel_status*
- (4) *work_zone_vehicle_status*
- (3) *work_zone_status_from_mcv*

7.1.1.8 Maintenance and Construction Management → Enforcement Agency

Physical Architecture Flow: request for enforcement W

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

Logical Architecture Flows:

- (1) *tea_enforcement_request_from_m_and_c*

7.1.1.9 Maintenance and Construction Management → Equipment Repair Facility

Physical Architecture Flow: maint and constr fleet information W

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 Flows:

- (1) *terf_fleet_maintenance_availability*
- (2) *fleet_maintenance_availability*
- (1) *terf_mdss_recommended_actions*
- (1) *terf_vehicle_utilization_information*
- (2) *vehicle_utilization_information*

7.1.1.10 Maintenance and Construction Management → Information Service Provider

Physical Architecture Flow: current asset restrictions W

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 Flows:

- (1) *asset_restrictions_for_info_provider*
- (2) *current_asset_restrictions*

Physical Architecture Flow: maint and constr work plans W

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 Flows:

- (1) *m_and_c_work_plans_for_info_provider*
- (2) *m_and_c_work_plans*

Physical Architecture Flow: road weather information W

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

Logical Architecture Flows:

- (1) *road_weather_info_for_isp*
 - (2) *road_conditions*
 - (3) *link_identity*
 - (4) *link_type*
 - (4) *location_identity*
 - (4) *unit_number*
 - (3) *list_size*
 - (3) *road_segment_conditions*
- (2) *road_weather_conditions*
 - (3) *link_identity*
 - (4) *link_type*
 - (4) *location_identity*
 - (4) *unit_number*
 - (3) *list_size*
 - (3) *road_segment_weather_conditions*

Physical Architecture Flow: roadway maintenance status W

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

Logical Architecture Flows:

- (1) *roadway_maint_status_for_info_provider*
- (2) *current_roadway_maintenance_status*

Physical Architecture Flow: work zone information W

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 Flows:

- (1) *work_zone_images_for_isp*
 - (2) *fomcm_work_zone_images*
 - (2) *work_zone_images*
- (1) *work_zone_info_for_isp*

- (2) *work_zone_data_for_status*
- (3) *fomcm_work_zone_info*
- (3) *work_zone_device_status*
 - (4) *device_fault*
 - (4) *device_identity*
 - (4) *device_status*
 - (4) *list_size*
- (3) *work_zone_intrusion_warning_data*
 - (4) *roadside_crew_warning_given*
 - (4) *work_zone_intrusion_alert*
 - (4) *work_zone_intrusion_detected*
 - (5) *device_identity*
 - (5) *intrusion_detection_device_output*
 - (4) *work_zone_intrusion_video_image*
 - (4) *work_zone_intrusion_warning_notification*
 - (5) *work_zone_intrusion_alert_on_board*
 - (5) *work_zone_warning_given_on_board*
- (3) *work_zone_resource_status*
 - (4) *work_zone_equipment_status*
 - (4) *work_zone_identifier*
 - (4) *work_zone_personnel_status*
 - (4) *work_zone_vehicle_status*
- (3) *work_zone_status_from_mcv*

7.1.1.11 Maintenance and Construction Management → Maintenance and Construction Administrative Systems

Physical Architecture Flow: maint and constr administrative request W

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 Flows:

- (1) *tmcas_m_and_c_administrative_request*
- (1) *tmcas_resupply_request*

Physical Architecture Flow: maint and constr work performance W

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

Logical Architecture Flows:

- (1) *tmcas_m_and_c_work_performance*
- (1) *tmcas_work_zone_info*
 - (2) *work_zone_data_for_status*
 - (3) *fomcm_work_zone_info*
 - (3) *work_zone_device_status*
 - (4) *device_fault*
 - (4) *device_identity*
 - (4) *device_status*
 - (4) *list_size*
 - (3) *work_zone_intrusion_warning_data*
 - (4) *roadside_crew_warning_given*
 - (4) *work_zone_intrusion_alert*
 - (4) *work_zone_intrusion_detected*
 - (5) *device_identity*
 - (5) *intrusion_detection_device_output*
 - (4) *work_zone_intrusion_video_image*
 - (4) *work_zone_intrusion_warning_notification*
 - (5) *work_zone_intrusion_alert_on_board*

- (5) *work_zone_warning_given_on_board*
- (3) *work_zone_resource_status*
- (4) *work_zone_equipment_status*
- (4) *work_zone_identifier*
- (4) *work_zone_personnel_status*
- (4) *work_zone_vehicle_status*
- (3) *work_zone_status_from_mcv*

7.1.1.12 Maintenance and Construction Management → Media

Physical Architecture Flow: maint and constr work plans W

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 Flows:

- (1) *tm_m_and_c_work_plans_for_media*
- (2) *m_and_c_work_plans*

Physical Architecture Flow: road weather information W

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

Logical Architecture Flows:

- (1) *tm_road_weather_info*
- (2) *road_conditions*
- (3) *link_identity*
- (4) *link_type*
- (4) *location_identity*
- (4) *unit_number*
- (3) *list_size*
- (3) *road_segment_conditions*
- (2) *road_weather_conditions*
- (3) *link_identity*
- (4) *link_type*
- (4) *location_identity*
- (4) *unit_number*
- (3) *list_size*
- (3) *road_segment_weather_conditions*

Physical Architecture Flow: roadway maintenance status W

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

Logical Architecture Flows:

- (1) *tm_roadway_maint_status_for_media*
- (2) *current_roadway_maintenance_status*

Physical Architecture Flow: work zone information W

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 Flows:

- (1) *tm_work_zone_images*
- (1) *tm_work_zone_info*

- (2) *work_zone_data_for_status*
- (3) *fomcm_work_zone_info*
- (3) *work_zone_device_status*
 - (4) *device_fault*
 - (4) *device_identity*
 - (4) *device_status*
 - (4) *list_size*
- (3) *work_zone_intrusion_warning_data*
 - (4) *roadside_crew_warning_given*
 - (4) *work_zone_intrusion_alert*
 - (4) *work_zone_intrusion_detected*
 - (5) *device_identity*
 - (5) *intrusion_detection_device_output*
 - (4) *work_zone_intrusion_video_image*
 - (4) *work_zone_intrusion_warning_notification*
 - (5) *work_zone_intrusion_alert_on_board*
 - (5) *work_zone_warning_given_on_board*
- (3) *work_zone_resource_status*
 - (4) *work_zone_equipment_status*
 - (4) *work_zone_identifier*
 - (4) *work_zone_personnel_status*
 - (4) *work_zone_vehicle_status*
- (3) *work_zone_status_from_mcv*

7.1.1.13 Maintenance and Construction Management → Multimodal Transportation Service Provider

Physical Architecture Flow: **maint and constr work plans** W

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 Flows:

- (1) *tmtsp_m_and_c_work_plans_for_mtsp*
- (2) *m_and_c_work_plans*

7.1.1.14 Maintenance and Construction Management → Other MCM

Physical Architecture Flow: **maint and constr resource coordination** W

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 Flows:

- (1) *tomcm_resource_coordination_data*

Physical Architecture Flow: **road weather information** W

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

Logical Architecture Flows:

- (1) *tomcm_env_sensor_data*
 - (2) *environment_sensor_attributes*
 - (3) *authorization_to_use*
 - (3) *collection_conditions*
 - (3) *collection_equipment*
 - (3) *data_aggregation*

- (3) *data_concept_identifier*
- (3) *data_reductions*
- (3) *data_revision*
- (3) *data_version*
- (3) *date_archived*
 - (4) *date*
 - (4) *time*
- (3) *date_created*
 - (4) *date*
 - (4) *time*
- (3) *date_published*
 - (4) *date*
 - (4) *time*
- (3) *equipment_status*
- (3) *error_handling*
- (3) *methods_applied*
- (3) *owner_entities*
- (3) *perishability_date*
 - (4) *date*
 - (4) *time*
- (3) *personal_identification_status*
- (3) *quality_control_attribute*
- (3) *record_size*
- (3) *security*
- (3) *standard_data_attribute*
- (3) *standard_message_attribute*
- (2) *environment_sensor_output*
- (2) *list_size*
- (2) *sensor_identity*
- (2) *station_id*
- (1) *tomcm_road_weather_info*
 - (2) *road_conditions*
 - (3) *link_identity*
 - (4) *link_type*
 - (4) *location_identity*
 - (4) *unit_number*
 - (3) *list_size*
 - (3) *road_segment_conditions*
 - (2) *road_weather_conditions*
 - (3) *link_identity*
 - (4) *link_type*
 - (4) *location_identity*
 - (4) *unit_number*
 - (3) *list_size*
 - (3) *road_segment_weather_conditions*

Physical Architecture Flow: roadway maintenance status

W

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

Logical Architecture Flows:

- (1) *tomcm_roadway_maint_status*
 - (2) *current_roadway_maintenance_status*

Physical Architecture Flow: work plan coordination

W

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 Flows:

- (1) *tomcm_m_and_c_plan_feedback*
- (1) *tomcm_m_and_c_work_plans*

Physical Architecture Flow: work zone information

W

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 Flows:

- (1) *tomcm_work_zone_images*
 - (2) *fomcm_work_zone_images*
 - (2) *work_zone_images*
 - (2) *work_zone_intrusion_video_image*
- (1) *tomcm_work_zone_info*
 - (2) *work_zone_data_for_status*
 - (3) *fomcm_work_zone_info*
 - (3) *work_zone_device_status*
 - (4) *device_fault*
 - (4) *device_identity*
 - (4) *device_status*
 - (4) *list_size*
 - (3) *work_zone_intrusion_warning_data*
 - (4) *roadside_crew_warning_given*
 - (4) *work_zone_intrusion_alert*
 - (4) *work_zone_intrusion_detected*
 - (5) *device_identity*
 - (5) *intrusion_detection_device_output*
 - (4) *work_zone_intrusion_video_image*
 - (4) *work_zone_intrusion_warning_notification*
 - (5) *work_zone_intrusion_alert_on_board*
 - (5) *work_zone_warning_given_on_board*
 - (3) *work_zone_resource_status*
 - (4) *work_zone_equipment_status*
 - (4) *work_zone_identifier*
 - (4) *work_zone_personnel_status*
 - (4) *work_zone_vehicle_status*
 - (3) *work_zone_status_from_mcv*

7.1.1.15 Maintenance and Construction Management → Rail Operations**Physical Architecture Flow: maint and constr work plans**

W

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 Flows:

- (1) *tro_m_and_c_work_plans_for_rail*

Physical Architecture Flow: road weather information

W

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

Logical Architecture Flows:

- (1) *tro_road_weather_info*
 - (2) *road_conditions*

- (3) *link_identity*
- (4) *link_type*
- (4) *location_identity*
- (4) *unit_number*
- (3) *list_size*
- (3) *road_segment_conditions*
- (2) *road_weather_conditions*
- (3) *link_identity*
- (4) *link_type*
- (4) *location_identity*
- (4) *unit_number*
- (3) *list_size*
- (3) *road_segment_weather_conditions*

Physical Architecture Flow: work plan feedback

W

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 Flows:

- (1) *tro_railroad_schedule_feedback*

7.1.1.16 Maintenance and Construction Management → Storage Facility

Physical Architecture Flow: storage facility request

W

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

Logical Architecture Flows:

- (1) *tsf_equipment_availability_request*

- (1) *tsf_materials_status_request*

7.1.1.17 Maintenance and Construction Management → Surface Transportation Weather Service

Physical Architecture Flow: environmental conditions data

W

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 Flows:

- (1) *tstws_env_sensor_data*
- (2) *environment_sensor_attributes*
- (3) *authorization_to_use*
- (3) *collection_conditions*
- (3) *collection_equipment*
- (3) *data_aggregation*
- (3) *data_concept_identifier*
- (3) *data_reductions*
- (3) *data_revision*
- (3) *data_version*
- (3) *date_archived*
- (4) *date*
- (4) *time*
- (3) *date_created*
- (4) *date*
- (4) *time*

- (3) *date_published*
- (4) *date*
- (4) *time*
- (3) *equipment_status*
- (3) *error_handling*
- (3) *methods_applied*
- (3) *owner_entities*
- (3) *perishability_date*
- (4) *date*
- (4) *time*
- (3) *personal_identification_status*
- (3) *quality_control_attribute*
- (3) *record_size*
- (3) *security*
- (3) *standard_data_attribute*
- (3) *standard_message_attribute*
- (2) *environment_sensor_output*
- (2) *list_size*
- (2) *sensor_identity*
- (2) *station_id*

Physical Architecture Flow: road data

W

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

Logical Architecture Flows:

- (1) *tstws_asset_treatment_info*

Physical Architecture Flow: road weather information

W

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

Logical Architecture Flows:

- (1) *tstws_env_info*
 - (2) *road_conditions*
 - (3) *link_identity*
 - (4) *link_type*
 - (4) *location_identity*
 - (4) *unit_number*
 - (3) *list_size*
 - (3) *road_segment_conditions*
- (2) *road_weather_conditions*
 - (3) *link_identity*
 - (4) *link_type*
 - (4) *location_identity*
 - (4) *unit_number*
 - (3) *list_size*
 - (3) *road_segment_weather_conditions*

Physical Architecture Flow: transportation weather information request

W

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 Flows:

- (1) *tstws_trans_weather_info_request*

7.1.1.18 Maintenance and Construction Management → Traffic Management

Physical Architecture Flow: current asset restrictions W

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 Flows:

- (1) *asset_restrictions_for_traffic*
- (2) *current_asset_restrictions*

Physical Architecture Flow: equipment maintenance status W

Current status of field equipment maintenance actions.

Logical Architecture Flows:

- (1) *field equip maint status*
 - (2) *device_identity*
 - (2) *list_size*
 - (2) *roadside_device_status*
 - (2) *station_id*

Physical Architecture Flow: incident information W

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

Logical Architecture Flows:

- (1) *incident_info_for_traffic*
 - (2) *incident_duration*
 - (3) *duration*
 - (2) *incident_location*
 - (3) *location_identity*
 - (2) *incident_number*
 - (2) *incident_severity*
 - (2) *incident_start_time*
 - (3) *time*
 - (2) *incident_traffic_impact*
 - (2) *incident_type*

Physical Architecture Flow: maint and constr resource response W

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

Logical Architecture Flows:

- (1) *m_and_c_resource_response_to_traffic*

Physical Architecture Flow: maint and constr work plans W

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 Flows:

- (1) *m_and_c_work_plans_for_traffic*
 - (2) *m_and_c_work_plans*

Physical Architecture Flow: road weather information W

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

Logical Architecture Flows:

- (1) *road_weather_info_for_traffic*
 - (2) *road_conditions*
 - (3) *link_identity*
 - (4) *link_type*
 - (4) *location_identity*
 - (4) *unit_number*
 - (3) *list_size*
 - (3) *road_segment_conditions*
- (2) *road_weather_conditions*
 - (3) *link_identity*
 - (4) *link_type*
 - (4) *location_identity*
 - (4) *unit_number*
 - (3) *list_size*
 - (3) *road_segment_weather_conditions*

Physical Architecture Flow: roadway maintenance status

W

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

Logical Architecture Flows:

- (1) *roadway_maint_status_for_traffic*
 - (2) *current_roadway_maintenance_status*

Physical Architecture Flow: work zone information

W

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 Flows:

- (1) *work_zone_images_for_traffic*
 - (2) *fomcm_work_zone_images*
 - (2) *work_zone_images*
- (1) *work_zone_info_for_traffic*
 - (2) *work_zone_data_for_status*
 - (3) *fomcm_work_zone_info*
 - (3) *work_zone_device_status*
 - (4) *device_fault*
 - (4) *device_identity*
 - (4) *device_status*
 - (4) *list_size*
 - (3) *work_zone_intrusion_warning_data*
 - (4) *roadside_crew_warning_given*
 - (4) *work_zone_intrusion_alert*
 - (4) *work_zone_intrusion_detected*
 - (5) *device_identity*
 - (5) *intrusion_detection_device_output*
 - (4) *work_zone_intrusion_video_image*
 - (4) *work_zone_intrusion_warning_notification*
 - (5) *work_zone_intrusion_alert_on_board*
 - (5) *work_zone_warning_given_on_board*
 - (3) *work_zone_resource_status*
 - (4) *work_zone_equipment_status*
 - (4) *work_zone_identifier*
 - (4) *work_zone_personnel_status*
 - (4) *work_zone_vehicle_status*

- (3) *work_zone_status_from_mcv*

7.1.1.19 Maintenance and Construction Management → Transit Management

Physical Architecture Flow: current asset restrictions W

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 Flows:

- (1) *asset_restrictions_for_transit*
- (2) *current_asset_restrictions*

Physical Architecture Flow: maint and constr work plans W

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 Flows:

- (1) *m_and_c_work_plans_for_transit*
- (2) *m_and_c_work_plans*

Physical Architecture Flow: road weather information W

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

Logical Architecture Flows:

- (1) *road_weather_info_for_transit*
 - (2) *road_conditions*
 - (3) *link_identity*
 - (4) *link_type*
 - (4) *location_identity*
 - (4) *unit_number*
 - (3) *list_size*
 - (3) *road_segment_conditions*
- (2) *road_weather_conditions*
 - (3) *link_identity*
 - (4) *link_type*
 - (4) *location_identity*
 - (4) *unit_number*
 - (3) *list_size*
 - (3) *road_segment_weather_conditions*

Physical Architecture Flow: roadway maintenance status W

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

Logical Architecture Flows:

- (1) *roadway_maint_status_for_transit*
- (2) *current_roadway_maintenance_status*

Physical Architecture Flow: work zone information W

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 Flows:

- (1) *work_zone_info_for_transit*
 - (2) *work_zone_data_for_status*
 - (3) *fomcm_work_zone_info*
 - (3) *work_zone_device_status*
 - (4) *device_fault*
 - (4) *device_identity*
 - (4) *device_status*
 - (4) *list_size*
 - (3) *work_zone_intrusion_warning_data*
 - (4) *roadside_crew_warning_given*
 - (4) *work_zone_intrusion_alert*
 - (4) *work_zone_intrusion_detected*
 - (5) *device_identity*
 - (5) *intrusion_detection_device_output*
 - (4) *work_zone_intrusion_video_image*
 - (4) *work_zone_intrusion_warning_notification*
 - (5) *work_zone_intrusion_alert_on_board*
 - (5) *work_zone_warning_given_on_board*
 - (3) *work_zone_resource_status*
 - (4) *work_zone_equipment_status*
 - (4) *work_zone_identifier*
 - (4) *work_zone_personnel_status*
 - (4) *work_zone_vehicle_status*
 - (3) *work_zone_status_from_mcv*

7.1.1.20 Maintenance and Construction Management → Weather Service

Physical Architecture Flow: environmental conditions data W

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 Flows:

- (1) *tws_env_sensor_data*
 - (2) *environment_sensor_attributes*
 - (3) *authorization_to_use*
 - (3) *collection_conditions*
 - (3) *collection_equipment*
 - (3) *data_aggregation*
 - (3) *data_concept_identifier*
 - (3) *data_reductions*
 - (3) *data_revision*
 - (3) *data_version*
 - (3) *date_archived*
 - (4) *date*
 - (4) *time*
 - (3) *date_created*
 - (4) *date*
 - (4) *time*
 - (3) *date_published*
 - (4) *date*
 - (4) *time*
 - (3) *equipment_status*
 - (3) *error_handling*
 - (3) *methods_applied*

- (3) *owner_entities*
- (3) *perishability_date*
 - (4) *date*
 - (4) *time*
- (3) *personal_identification_status*
- (3) *quality_control_attribute*
- (3) *record_size*
- (3) *security*
- (3) *standard_data_attribute*
- (3) *standard_message_attribute*
- (2) *environment_sensor_output*
- (2) *list_size*
- (2) *sensor_identity*
- (2) *station_id*

Physical Architecture Flow: road weather information

W

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

Logical Architecture Flows:

- (1) *tws_env_info*
 - (2) *road_conditions*
 - (3) *link_identity*
 - (4) *link_type*
 - (4) *location_identity*
 - (4) *unit_number*
 - (3) *list_size*
 - (3) *road_segment_conditions*
- (2) *road_weather_conditions*
 - (3) *link_identity*
 - (4) *link_type*
 - (4) *location_identity*
 - (4) *unit_number*
 - (3) *list_size*
 - (3) *road_segment_weather_conditions*

7.1.1.21 Other MCM → Maintenance and Construction Management

Physical Architecture Flow: maint and constr resource coordination

W

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 Flows:

- (1) *fomcm_resource_coordination_data*

Physical Architecture Flow: road weather information

W

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

Logical Architecture Flows:

- (1) *fomcm_env_sensor_data*
 - (2) *environment_sensor_attributes*
 - (3) *authorization_to_use*
 - (3) *collection_conditions*
 - (3) *collection_equipment*

- (3) *data_aggregation*
- (3) *data_concept_identifier*
- (3) *data_reductions*
- (3) *data_revision*
- (3) *data_version*
- (3) *date_archived*
 - (4) *date*
 - (4) *time*
- (3) *date_created*
 - (4) *date*
 - (4) *time*
- (3) *date_published*
 - (4) *date*
 - (4) *time*
- (3) *equipment_status*
- (3) *error_handling*
- (3) *methods_applied*
- (3) *owner_entities*
- (3) *perishability_date*
 - (4) *date*
 - (4) *time*
- (3) *personal_identification_status*
- (3) *quality_control_attribute*
- (3) *record_size*
- (3) *security*
- (3) *standard_data_attribute*
- (3) *standard_message_attribute*
- (2) *environment_sensor_output*
- (2) *list_size*
- (2) *sensor_identity*
- (2) *station_id*
- (1) *fomcm_road_weather_info*
 - (2) *road_conditions*
 - (3) *link_identity*
 - (4) *link_type*
 - (4) *location_identity*
 - (4) *unit_number*
 - (3) *list_size*
 - (3) *road_segment_conditions*
 - (2) *road_weather_conditions*
 - (3) *link_identity*
 - (4) *link_type*
 - (4) *location_identity*
 - (4) *unit_number*
 - (3) *list_size*
 - (3) *road_segment_weather_conditions*

Physical Architecture Flow: roadway maintenance status

W

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

Logical Architecture Flows:

- (1) *fomcm_roadway_maint_status*
 - (2) *current_roadway_maintenance_status*

Physical Architecture Flow: work plan coordination

W

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 Flows:

- (1) *fomcm_m_and_c_plan_feedback*
- (1) *fomcm_m_and_c_work_plans*
 - (2) *m_and_c_work_plans*

Physical Architecture Flow: work zone information

W

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 Flows:

- (1) *fomcm_work_zone_images*
- (1) *fomcm_work_zone_info*

7.1.1.22 Rail Operations → Maintenance and Construction Management

Physical Architecture Flow: railroad schedules

W

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

Logical Architecture Flows:

- (1) *fro_railroad_schedules*

Physical Architecture Flow: work plan feedback

W

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 Flows:

- (1) *fro_m_and_c_plan_feedback_from_rail*

7.1.1.23 Storage Facility → Maintenance and Construction Management

Physical Architecture Flow: equipment availability

W

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 Flows:

- (1) *fsf_equipment_availability*
- (1) *fsf_equipment_availability_for_fleet_manager*
- (1) *fsf_equipment_status_for_tracking*

Physical Architecture Flow: maintenance materials storage status

W

The amount and availability of maintenance materials in storage facilities.

Logical Architecture Flows:

- (1) *fsf_materials_status*

7.1.1.24 Surface Transportation Weather Service → Maintenance and Construction Management

Physical Architecture Flow: environmental conditions data

W

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 Flows:

- (1) *fstws_env_sensor_data*
 - (2) *environment_sensor_attributes*
 - (3) *authorization_to_use*
 - (3) *collection_conditions*
 - (3) *collection_equipment*
 - (3) *data_aggregation*
 - (3) *data_concept_identifier*
 - (3) *data_reductions*
 - (3) *data_revision*
 - (3) *data_version*
 - (3) *date_archived*
 - (4) *date*
 - (4) *time*
 - (3) *date_created*
 - (4) *date*
 - (4) *time*
 - (3) *date_published*
 - (4) *date*
 - (4) *time*
 - (3) *equipment_status*
 - (3) *error_handling*
 - (3) *methods_applied*
 - (3) *owner_entities*
 - (3) *perishability_date*
 - (4) *date*
 - (4) *time*
 - (3) *personal_identification_status*
 - (3) *quality_control_attribute*
 - (3) *record_size*
 - (3) *security*
 - (3) *standard_data_attribute*
 - (3) *standard_message_attribute*
 - (2) *environment_sensor_output*
 - (2) *list_size*
 - (2) *sensor_identity*
 - (2) *station_id*
- (1) *fstws_surface_trans_weather_observations*
 - (2) *surface_trans_weather_observations*
 - (2) *weather_observation_attributes*

Physical Architecture Flow: transportation weather information

W

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 Flows:

- (1) *fstws_surface_trans_weather_forecasts*

- (2) *climatic_scale_surface_trans_weather_forecasts*
- (2) *meso_scale_surface_trans_weather_forecasts*
 - (3) *surface_trans_weather_advisories*
 - (3) *surface_trans_weather_forecast_details*
- (2) *micro_scale_surface_trans_weather_forecasts*
 - (3) *surface_trans_weather_forecast_details*
- (2) *miso_scale_surface_trans_weather_forecasts*
 - (3) *surface_trans_weather_advisories*
 - (3) *surface_trans_weather_forecast_details*
- (2) *surface_trans_weather_scale_forecast_data_attributes*
- (2) *synoptic_scale_surface_trans_weather_forecasts*
 - (3) *surface_trans_weather_forecast_details*

7.1.1.25 Traffic Management → Maintenance and Construction Management

Physical Architecture Flow: field equipment status

W

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

Logical Architecture Flows:

- (1) *field_equipment_status_from_traffic*
 - (2) *device_identity*
 - (2) *list_size*
 - (2) *roadside_device_status*
 - (2) *station_id*

Physical Architecture Flow: incident information

W

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

Logical Architecture Flows:

- (1) *incident_info_from_traffic*
 - (2) *incident_duration*
 - (3) *duration*
 - (2) *incident_location*
 - (3) *location_identity*
 - (2) *incident_severity*
 - (2) *incident_start_time*
 - (3) *time*
 - (2) *incident_traffic_impact*
 - (2) *incident_type*

Physical Architecture Flow: maint and constr resource request

W

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 Flows:

- (1) *m_and_c_resource_request_from_traffic*
- (1) *roadway_maint_action_req_from_traffic*
- (1) *winter_maint_action_req_from_traffic*

Physical Architecture Flow: work plan feedback

W

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 Flows:

- (1) *m_and_c_plan_feedback_from_traffic*
- (2) *m_and_c_plan_feedback*

7.1.1.26 Transit Management → Maintenance and Construction Management

Physical Architecture Flow: work plan feedback

W

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 Flows:

- (1) *m_and_c_plan_feedback_from_transit*
- (2) *m_and_c_plan_feedback*

7.1.1.27 Weather Service → Maintenance and Construction Management

Physical Architecture Flow: environmental conditions data

W

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 Flows:

- (1) *fws_env_sensor_data*
- (2) *environment_sensor_attributes*
 - (3) *authorization_to_use*
 - (3) *collection_conditions*
 - (3) *collection_equipment*
 - (3) *data_aggregation*
 - (3) *data_concept_identifier*
 - (3) *data_reductions*
 - (3) *data_revision*
 - (3) *data_version*
 - (3) *date_archived*
 - (4) *date*
 - (4) *time*
 - (3) *date_created*
 - (4) *date*
 - (4) *time*
 - (3) *date_published*
 - (4) *date*
 - (4) *time*
 - (3) *equipment_status*
 - (3) *error_handling*
 - (3) *methods_applied*
 - (3) *owner_entities*
 - (3) *perishability_date*
 - (4) *date*
 - (4) *time*
 - (3) *personal_identification_status*
 - (3) *quality_control_attribute*
 - (3) *record_size*
 - (3) *security*
 - (3) *standard_data_attribute*
 - (3) *standard_message_attribute*
- (2) *environment_sensor_output*
- (2) *list_size*
- (2) *sensor_identity*

- (2) *station_id*

Physical Architecture Flow: weather information

W

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

Logical Architecture Flows:

- (1) *fws_current_weather_observations*
 - (2) *current_weather_observations*
 - (2) *weather_observation_attributes*
- (1) *fws_weather_forecasts*
 - (2) *climatic_scale_weather_forecasts*
 - (2) *meso_scale_weather_forecasts*
 - (3) *weather_advisories*
 - (3) *weather_forecast_details*
 - (3) *weather_warnings*
 - (3) *weather_watches*
 - (2) *miso_scale_weather_forecasts*
 - (3) *weather_advisories*
 - (3) *weather_forecast_details*
 - (3) *weather_warnings*
 - (2) *synoptic_scale_weather_forecasts*
 - (3) *weather_forecast_details*
 - (3) *weather_watches*
 - (2) *weather_scale_forecast_data_attributes*

7.1.2 Center to Field

7.1.2.1 Enforcement Agency → Roadway Subsystem

Physical Architecture Flow: speed monitoring control

W

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

Logical Architecture Flows:

- (1) *fea_enforcement_parameters*
- (1) *fea_speed_sensor_control*
 - (2) *list_size*
 - (2) *sensor_identity*
 - (2) *speed_sensor_control*

7.1.2.2 Maintenance and Construction Management → Roadway Subsystem

Physical Architecture Flow: infrastructure monitoring sensor control

W

Data used to configure and control infrastructure monitoring sensors.

Logical Architecture Flows:

- (1) *infrastructure_sensor_control_from_m_and_c*
 - (2) *infrastructure_sensor_control_of_roadside_devices*

Physical Architecture Flow: roadway treatment system control

W

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

Logical Architecture Flows:

- (1) *roadway_treatment_system_control*
- (2) *auto_treatment_device_control*
- (2) *env_sensor_control_by_roadway_treatment_device*

Physical Architecture Flow: speed monitoring control

W

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

Logical Architecture Flows:

- (1) *speed_sensor_control_from_m_and_c*
- (2) *list_size*
- (2) *sensor_identity*
- (2) *speed_sensor_control*

Physical Architecture Flow: work zone warning device control

W

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

Logical Architecture Flows:

- (1) *intrusion_alert_device_control*
- (1) *intrusion_detection_device_control*

7.1.2.3 Roadway Subsystem → Enforcement Agency

Physical Architecture Flow: speed monitoring information

W

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

Logical Architecture Flows:

- (1) *tea_speed_sensor_status*
- (2) *list_size*
- (2) *sensor_device_status*
- (2) *sensor_identity*

Physical Architecture Flow: traffic violation notification

W

Notification to enforcement agency of a detected traffic violation including speed violations, HOV passenger occupancy violations, and vehicle emissions violations.

Logical Architecture Flows:

- (1) *tea_speed_violation_notification*

7.1.2.4 Roadway Subsystem → Maintenance and Construction Management

Physical Architecture Flow: infrastructure monitoring sensor data

W

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

Logical Architecture Flows:

- (1) *infrastructure_sensor_data_for_m_and_c*
- (2) *infrastructure_sensor_data_from_roadside_devices*
- (3) *infrastructure_sensor_output*
- (3) *list_size*
- (3) *sensor_identity*
- (3) *station_id*

- (1) *infrastructure_sensor_status_for_m_and_c*
 - (2) *infrastructure_sensor_status_of_roadside_devices*
 - (3) *list_size*
 - (3) *sensor_identity*
 - (3) *sensor_status*
 - (4) *traffic_sensor_status*
 - (3) *station_id*

Physical Architecture Flow: speed monitoring information

W

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

Logical Architecture Flows:

- (1) *speed_data_for_m_and_c_speed_monitoring*
 - (2) *list_size*
 - (2) *sensor_identity*
 - (2) *station_id*
 - (2) *traffic_sensor_output*
- (1) *speed_sensor_log_for_m_and_c*
 - (2) *list_size*
 - (2) *processed_speed_sensor_data*
 - (2) *sensor_identity*
 - (2) *speed_sensor_data*
- (1) *speed_sensor_status_for_m_and_c*
 - (2) *list_size*
 - (2) *sensor_device_status*
 - (2) *sensor_identity*
- (1) *speed_violation_notification_for_m_and_c*
 - (2) *individual_vehicle_speed*
 - (3) *list_size*
 - (3) *sensor_identity*
 - (3) *speed_sensor_data*
 - (3) *timestamp*
 - (4) *date*
 - (4) *time*

Physical Architecture Flow: work zone warning status

W

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 Flows:

- (1) *intrusion_alert_device_status*
 - (2) *device_fault*
 - (2) *device_identity*
 - (2) *device_status*
 - (2) *list_size*
- (1) *intrusion_detection_device_status*
 - (2) *device_fault*
 - (2) *device_identity*
 - (2) *device_status*
 - (2) *list_size*
- (1) *roadside_crew_warning_given*
- (1) *work_zone_intrusion_alert*
- (1) *work_zone_intrusion_detected*
 - (2) *device_identity*
 - (2) *intrusion_detection_device_output*
- (1) *work_zone_intrusion_video_image*

7.1.2.5 Roadway Subsystem → Surface Transportation Weather Service

Physical Architecture Flow: environmental conditions data

W

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 Flows:

- (1) *tstws_roadway_env_sensor_data*
 - (2) *environment_sensor_attributes*
 - (3) *authorization_to_use*
 - (3) *collection_conditions*
 - (3) *collection_equipment*
 - (3) *data_aggregation*
 - (3) *data_concept_identifier*
 - (3) *data_reductions*
 - (3) *data_revision*
 - (3) *data_version*
 - (3) *date_archived*
 - (4) *date*
 - (4) *time*
 - (3) *date_created*
 - (4) *date*
 - (4) *time*
 - (3) *date_published*
 - (4) *date*
 - (4) *time*
 - (3) *equipment_status*
 - (3) *error_handling*
 - (3) *methods_applied*
 - (3) *owner_entities*
 - (3) *perishability_date*
 - (4) *date*
 - (4) *time*
 - (3) *personal_identification_status*
 - (3) *quality_control_attribute*
 - (3) *record_size*
 - (3) *security*
 - (3) *standard_data_attribute*
 - (3) *standard_message_attribute*
 - (2) *environment_sensor_output*
 - (2) *list_size*
 - (2) *sensor_identity*
 - (2) *station_id*
- (1) *tstws_roadway_env_sensor_status*
 - (2) *list_size*
 - (2) *sensor_device_status*
 - (2) *sensor_identity*
 - (2) *station_id*

7.1.2.6 Roadway Subsystem → Traffic Management

Physical Architecture Flow: speed monitoring information

W

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

Logical Architecture Flows:

- (1) *speed_data_for_traffic_speed_monitoring*
 - (2) *list_size*
 - (2) *sensor_identity*
 - (2) *station_id*
 - (2) *traffic_sensor_output*
- (1) *speed_sensor_log_for_traffic*
 - (2) *list_size*
 - (2) *processed_speed_sensor_data*
 - (2) *sensor_identity*
 - (2) *speed_sensor_data*
- (1) *speed_sensor_status_for_traffic*
 - (2) *list_size*
 - (2) *sensor_device_status*
 - (2) *sensor_identity*
- (1) *speed_violation_notification_for_traffic*
 - (2) *individual_vehicle_speed*
 - (3) *list_size*
 - (3) *sensor_identity*
 - (3) *speed_sensor_data*
 - (3) *timestamp*
 - (4) *date*
 - (4) *time*

7.1.2.7 Roadway Subsystem → Weather Service

Physical Architecture Flow: environmental conditions data

W

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 Flows:

- (1) *tws_roadway_env_sensor_data*
 - (2) *environment_sensor_attributes*
 - (3) *authorization_to_use*
 - (3) *collection_conditions*
 - (3) *collection_equipment*
 - (3) *data_aggregation*
 - (3) *data_concept_identifier*
 - (3) *data_reductions*
 - (3) *data_revision*
 - (3) *data_version*
 - (3) *date_archived*
 - (4) *date*
 - (4) *time*
 - (3) *date_created*
 - (4) *date*
 - (4) *time*
 - (3) *date_published*
 - (4) *date*
 - (4) *time*
 - (3) *equipment_status*
 - (3) *error_handling*
 - (3) *methods_applied*
 - (3) *owner_entities*
 - (3) *perishability_date*
 - (4) *date*

- (4) *time*
- (3) *personal_identification_status*
- (3) *quality_control_attribute*
- (3) *record_size*
- (3) *security*
- (3) *standard_data_attribute*
- (3) *standard_message_attribute*
- (2) *environment_sensor_output*
- (2) *list_size*
- (2) *sensor_identity*
- (2) *station_id*
- (1) *tws_roadway_env_sensor_status*
 - (2) *list_size*
 - (2) *sensor_device_status*
 - (2) *sensor_identity*
 - (2) *station_id*

7.1.2.8 Surface Transportation Weather Service → Roadway Subsystem

Physical Architecture Flow: environmental sensors control

W

Data used to configure and control environmental sensors.

Logical Architecture Flows:

- (1) *fstws_roadway_env_sensor_control*
 - (2) *environmental_sensor_control*
 - (2) *list_size*
 - (2) *sensor_identity*
 - (2) *station_id*

7.1.2.9 Traffic Management → Roadway Subsystem

Physical Architecture Flow: speed monitoring control

W

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

Logical Architecture Flows:

- (1) *speed_sensor_control_from_traffic*
 - (2) *list_size*
 - (2) *sensor_identity*
 - (2) *speed_sensor_control*

7.1.2.10 Weather Service → Roadway Subsystem

Physical Architecture Flow: environmental sensors control

W

Data used to configure and control environmental sensors.

Logical Architecture Flows:

- (1) *fws_roadway_env_sensor_control*
 - (2) *environmental_sensor_control*
 - (2) *list_size*
 - (2) *sensor_identity*
 - (2) *station_id*

7.2 Wide Area Wireless Interfaces

7.2.1 Maintenance and Construction Management → Maintenance and Construction Vehicle

Physical Architecture Flow: environmental sensors control UIt
Data used to configure and control environmental sensors.

Logical Architecture Flows:

- (1) *environmental_sensor_control_for_mcv*

Physical Architecture Flow: maint and constr dispatch information UIt

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 Flows:

- (1) *dispatch_orders_to_mcv*
 - (2) *date*
 - (2) *m_and_c_center_identity*
 - (2) *mcv_dispatch_instructions*
 - (2) *time*
 - (2) *vehicle_id_for_mcv*
- (1) *mdss_recommended_actions_for_operator*
- (1) *road_network_info_to_mcv*
 - (2) *m_and_c_view_of_road_network*
 - (3) *current_data*
 - (4) *current_other_routes_use*
 - (5) *route_segment_guided_travelers*
 - (5) *route_segment_identity*
 - (5) *route_segment_journey_time*
 - (5) *route_segment_total_number*
 - (4) *parking_lot_storage_data*
 - (5) *list_size*
 - (5) *parking_lot_current_occupancy*
 - (5) *parking_lot_identity*
 - (5) *parking_lot_state*
 - (4) *processed_data*
 - (5) *hri_state_data*
 - (5) *link_state_data*
 - (5) *o_d_matrix*
 - (5) *parking_lot_input_data*
 - (5) *private_vehicle_occupants*
 - (5) *ramp_data*
 - (5) *roadway_environment_conditions*
 - (5) *roadway_traffic_conditions*
 - (5) *strategy_data*
 - (4) *sensor_output_data*
 - (5) *environment_sensor_data*
 - (5) *hri_sensor_data*
 - (5) *pedestrian_sensor_data*
 - (5) *traffic_sensor_data*
 - (5) *traffic_video_image*
 - (4) *stored_incident_data*

- (5) *current_incident_data*
- (5) *planned_event_data*
- (4) *traffic_flow_state*
- (5) *current_road_network_use*
- (5) *current_roadway_network_data*
- (5) *hov_lane_data*
- (5) *link_data_from_avl*
- (5) *link_data_from_tags*
- (5) *ramp_signal_state*
- (4) *traffic_management_storage_data*
- (5) *indicator_control_storage_data*
- (5) *indicator_input_storage_data*
- (5) *selected_strategy*
- (4) *traffic_video_image_data*
- (5) *list_size*
- (5) *traffic_video_camera_number*
- (5) *traffic_video_image*
- (4) *vehicle_smart_probe_stored_data*
- (5) *list_size*
- (5) *vehicle_smart_probe_data_for_storage*
- (4) *wide_area_pollution_data*
- (5) *list_size*
- (5) *pollution_state_area_collection*
- (5) *pollution_state_roadside_collection*
- (3) *env_info_for_road_network*
- (4) *road_conditions*
- (5) *link_identity*
- (5) *list_size*
- (5) *road_segment_conditions*
- (4) *road_weather_conditions*
- (5) *link_identity*
- (5) *list_size*
- (5) *road_segment_weather_conditions*
- (3) *incident_duration*
- (4) *duration*
- (3) *incident_location*
- (4) *location_identity*
- (3) *incident_number*
- (3) *incident_response_status_from_emerg*
- (3) *incident_severity*
- (3) *incident_start_time*
- (4) *time*
- (3) *incident_traffic_impact*
- (3) *incident_type*
- (3) *link_state_data*
- (4) *link_list*
- (5) *link_identity*
- (5) *list_size*
- (4) *list_size*
- (4) *vehicle_count*
- (4) *vehicle_headway*
- (4) *vehicle_occupancy*
- (4) *vehicle_queue_length*
- (4) *vehicle_speed*
- (3) *predicted_road_network_data*
- (4) *link_delay*
- (4) *link_journey_time*
- (4) *link_list_for_roads*
- (5) *link_identity*

- (5) *list_size*
- (4) *link_occupancy*
- (4) *link_speed*
- (3) *roadway_environment_conditions*
- (4) *link_environment_conditions*
- (4) *link_list*
- (5) *link_identity*
- (5) *list_size*
- (1) *status_of_other_work_zones*
- (1) *suggested_route_to_mcv*
 - (2) *route_identity*
 - (2) *route_segment_description*
 - (2) *route_segment_end_point*
 - (3) *location_identity*
 - (2) *route_segment_estimated_travel_time*
 - (2) *route_segment_report_position_points*
 - (3) *list_size*
 - (3) *route_segment_way_point*
 - (4) *location_identity*
 - (2) *route_segment_start_point*
 - (3) *location_identity*
 - (2) *vehicle_id_for_mcv*
- (1) *winter_dispatch_orders_to_mcv*
 - (2) *date*
 - (2) *m_and_c_center_identity*
 - (2) *mcv_winter_dispatch_instructions*
 - (2) *time*
 - (2) *vehicle_id_for_mcv*

Physical Architecture Flow: maint and constr vehicle system control

U1t

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 Flows:

- (1) *center_control_of_on_board_work_zone_devices*
- (1) *mcv_infrastructure_sensor_control*
 - (2) *infrastructure_sensor_control_from_mcv*
 - (3) *infrastructure_sensor_control_of_roadside_devices*
 - (2) *infrastructure_sensor_control_of_onboard_devices*
- (1) *mcv_vehicle_systems_control_by_fleet_manager*

7.2.2 Maintenance and Construction Vehicle → Equipment Repair Facility

Physical Architecture Flow: maint and constr vehicle conditions

U1t, U2

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 Flows:

- (1) *terf_basic_mcv_measures_for equip_repair*
 - (2) *vehicle_id_for_mcv*
 - (2) *vehicle_system_status*

7.2.3 Maintenance and Construction Vehicle → Maintenance and Construction Management

Physical Architecture Flow: environmental probe data

U1t

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 Flows:

- (1) *environmental_sensor_data_from_mcv*
- (2) *environmental_sensor_data_from_mcv_sensors*
- (3) *environment_sensor_attributes*
 - (4) *authorization_to_use*
 - (4) *collection_conditions*
 - (4) *collection_equipment*
 - (4) *data_aggregation*
 - (4) *data_concept_identifier*
 - (4) *data_reductions*
 - (4) *data_revision*
 - (4) *data_version*
 - (4) *date_archived*
 - (5) *date*
 - (5) *time*
 - (4) *date_created*
 - (5) *date*
 - (5) *time*
 - (4) *date_published*
 - (5) *date*
 - (5) *time*
 - (4) *equipment_status*
 - (4) *error_handling*
 - (4) *methods_applied*
 - (4) *owner_entities*
 - (4) *perishability_date*
 - (5) *date*
 - (5) *time*
 - (4) *personal_identification_status*
 - (4) *quality_control_attribute*
 - (4) *record_size*
 - (4) *security*
 - (4) *standard_data_attribute*
 - (4) *standard_message_attribute*
- (3) *environment_sensor_output*
- (3) *sensor_identity*
- (3) *station_id*
- (2) *environmental_sensor_data_from_roadway*
- (3) *environment_sensor_attributes*
 - (4) *authorization_to_use*
 - (4) *collection_conditions*
 - (4) *collection_equipment*
 - (4) *data_aggregation*
 - (4) *data_concept_identifier*
 - (4) *data_reductions*
 - (4) *data_revision*
 - (4) *data_version*
 - (4) *date_archived*
 - (5) *date*

- (5) *time*
- (4) *date_created*
- (5) *date*
- (5) *time*
- (4) *date_published*
- (5) *date*
- (5) *time*
- (4) *equipment_status*
- (4) *error_handling*
- (4) *methods_applied*
- (4) *owner_entities*
- (4) *perishability_date*
- (5) *date*
- (5) *time*
- (4) *personal_identification_status*
- (4) *quality_control_attribute*
- (4) *record_size*
- (4) *security*
- (4) *standard_data_attribute*
- (4) *standard_message_attribute*
- (3) *environment_sensor_output*
- (3) *sensor_identity*
- (3) *station_id*
- (1) *environmental_sensor_fault_data_from_mcv*
 - (2) *environmental_sensor_fault_data_from_mcv_sensors*
 - (3) *sensor_fault_data*
 - (3) *sensor_identity*
 - (3) *station_id*
- (2) *environmental_sensor_fault_data_from_roadway*
 - (3) *sensor_fault_data*
 - (3) *sensor_identity*
 - (3) *station_id*
- (1) *environmental_sensor_status_from_mcv*
 - (2) *environmental_sensor_status_from_mcv_sensors*
 - (3) *sensor_identity*
 - (3) *sensor_status*
 - (4) *traffic_sensor_status*
 - (3) *station_id*
- (2) *environmental_sensor_status_from_roadway*
 - (3) *sensor_identity*
 - (3) *sensor_status*
 - (4) *traffic_sensor_status*
 - (3) *station_id*

Physical Architecture Flow: infrastructure conditions data

U1t

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 Flows:

- (1) *mcv_infrastructure_sensor_data*
 - (2) *infrastructure_sensor_data_for_mcv*
 - (3) *infrastructure_sensor_data_from_roadside_devices*
 - (4) *infrastructure_sensor_output*
 - (4) *list_size*
 - (4) *sensor_identity*
 - (4) *station_id*
- (2) *infrastructure_sensor_data_from_onboard_devices*
 - (3) *infrastructure_sensor_output*

- (3) *list_size*
- (3) *sensor_identity*
- (3) *vehicle_id_for_mcv*
- (1) *mcv_infrastructure_sensor_status*
 - (2) *infrastructure_sensor_status_for_mcv*
 - (3) *infrastructure_sensor_status_of_roadside_devices*
 - (4) *list_size*
 - (4) *sensor_identity*
 - (4) *sensor_status*
 - (5) *traffic_sensor_status*
 - (4) *station_id*
 - (2) *infrastructure_sensor_status_of_onboard_devices*
 - (3) *list_size*
 - (3) *sensor_identity*
 - (3) *sensor_status*
 - (4) *traffic_sensor_status*
 - (3) *vehicle_id_for_mcv*

Physical Architecture Flow: maint and constr dispatch status

U1t

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

Logical Architecture Flows:

- (1) *dispatch_response_from_mcv*
- (1) *field equip status from_mcv_operator*
 - (2) *device_identity*
 - (2) *list_size*
 - (2) *roadside_device_status*
 - (2) *station_id*
- (1) *m_and_c_status_from_mcv_operator*
 - (2) *date*
 - (2) *mcv_crew_status*
 - (2) *mcv_operator_status*
 - (2) *mcv_status_from_operator*
 - (2) *mcv_work_activity_status*
 - (2) *time*
 - (2) *vehicle_id_for_mcv*

Physical Architecture Flow: maint and constr vehicle conditions

U1t

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 Flows:

- (1) *basic_mcv_measures_for_maint_sched*
 - (2) *vehicle_id_for_mcv*
 - (2) *vehicle_system_status*
- (1) *safety_data_for_fleet_mgmt*
 - (2) *date*
 - (2) *safety_data_for_mcv*
 - (3) *driver_safety_status*
 - (3) *vehicle_attitude_data*
 - (3) *vehicle_motion_data*
 - (3) *vehicle_proximity_data*
 - (3) *vehicle_safety_status*
 - (2) *time*

- (2) *vehicle_id_for_mcv*

Physical Architecture Flow: maint and constr vehicle location data

U1t

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

Logical Architecture Flows:

- (1) *vehicle_location_for_mcv_tracking*
 - (2) *date*
 - (2) *time*
 - (2) *vehicle_id_for_mcv*
 - (2) *vehicle_location_for_mcv*
 - (3) *location_identity*

Physical Architecture Flow: maint and constr vehicle operational data

U1t

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 Flows:

- (1) *mcv_materials_status*
 - (2) *materials_status*
 - (3) *date*
 - (3) *list_size*
 - (3) *m_and_c_materials_quantity*
 - (3) *m_and_c_materials_type*
 - (3) *m_and_c_materials_usage_rate*
 - (3) *time*
- (2) *vehicle_id_for_mcv*
- (1) *mcv_operational_data*
 - (2) *mcv_equipment_configuration*
 - (2) *mcv_vehicle_type*
 - (2) *operational_data_for_mcv*
 - (2) *vehicle_id_for_mcv*
- (1) *on_board_work_zone_device_status*
 - (2) *device_fault*
 - (2) *device_identity*
 - (2) *device_status*
 - (2) *list_size*

Physical Architecture Flow: work zone status

U1t

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 Flows:

- (1) *work_zone_status_from_mcv*

Physical Architecture Flow: work zone warning status

U1t

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 Flows:

- (1) *work_zone_intrusion_warning_notification*
- (2) *work_zone_intrusion_alert_on_board*
- (2) *work_zone_warning_given_on_board*

7.2.4 Transit Vehicle Subsystem → Transit Management

Physical Architecture Flow: environmental probe data

U1t

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 Flows:

- (1) *env_probe_data_from_transit_vehicle*
 - (2) *environment_sensor_attributes*
 - (3) *authorization_to_use*
 - (3) *collection_conditions*
 - (3) *collection_equipment*
 - (3) *data_aggregation*
 - (3) *data_concept_identifier*
 - (3) *data_reductions*
 - (3) *data_revision*
 - (3) *data_version*
 - (3) *date_archived*
 - (4) *date*
 - (4) *time*
 - (3) *date_created*
 - (4) *date*
 - (4) *time*
 - (3) *date_published*
 - (4) *date*
 - (4) *time*
 - (3) *equipment_status*
 - (3) *error_handling*
 - (3) *methods_applied*
 - (3) *owner_entities*
 - (3) *perishability_date*
 - (4) *date*
 - (4) *time*
 - (3) *personal_identification_status*
 - (3) *quality_control_attribute*
 - (3) *record_size*
 - (3) *security*
 - (3) *standard_data_attribute*
 - (3) *standard_message_attribute*
 - (2) *environment_sensor_output*
 - (2) *sensor_identity*
 - (2) *transit_vehicle_identity*

7.3 Dedicated Short Range Communications Interfaces

7.3.1 Maintenance and Construction Vehicle → Equipment Repair Facility

Physical Architecture Flow: **maint and constr vehicle conditions** U1t, U2

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 Flows:

- (1) *terf_basic_mcv_measures_for equip_repair*
- (2) *vehicle_id_for_mcv*
- (2) *vehicle_system_status*

7.3.2 Maintenance and Construction Vehicle → Roadway Subsystem

Physical Architecture Flow: **environmental conditions data** U2

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 Flows:

- (1) *environmental_sensor_data_for_roadway*
- (2) *environment_sensor_attributes*
- (3) *authorization_to_use*
- (3) *collection_conditions*
- (3) *collection_equipment*
- (3) *data_aggregation*
- (3) *data_concept_identifier*
- (3) *data_reductions*
- (3) *data_revision*
- (3) *data_version*
- (3) *date_archived*
- (4) *date*
- (4) *time*
- (3) *date_created*
- (4) *date*
- (4) *time*
- (3) *date_published*
- (4) *date*
- (4) *time*
- (3) *equipment_status*
- (3) *error_handling*
- (3) *methods_applied*
- (3) *owner_entities*
- (3) *perishability_date*
- (4) *date*
- (4) *time*
- (3) *personal_identification_status*
- (3) *quality_control_attribute*
- (3) *record_size*
- (3) *security*
- (3) *standard_data_attribute*
- (3) *standard_message_attribute*

- (2) *environment_sensor_output*
- (2) *sensor_identity*
- (2) *station_id*

Physical Architecture Flow: environmental sensors control U2
 Data used to configure and control environmental sensors.

Logical Architecture Flows:

- (1) *environmental_sensor_control_for_roadway*
- (2) *environmental_sensor_control*
- (2) *sensor_identity*
- (2) *station_id*

Physical Architecture Flow: infrastructure monitoring sensor control U2
 Data used to configure and control infrastructure monitoring sensors.

Logical Architecture Flows:

- (1) *infrastructure_sensor_control_from_mcv*
- (2) *infrastructure_sensor_control_of_roadside_devices*

Physical Architecture Flow: roadway information system data U2
 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 Flows:

- (1) *dms_data_from_mcv*
 - (2) *dms_advisory_text*
 - (3) *dms_auto_treat_info*
 - (3) *dms_highway_open_close*
 - (3) *dms_incident_warning*
 - (3) *dms_weather_warning*
- (2) *indicator_identity*
 - (3) *indicator_type*
 - (3) *location_identity*
 - (3) *unit_number*
- (2) *lane_dms_controls*
- (2) *list_size*

7.3.3 Roadway Subsystem → Maintenance and Construction Vehicle

Physical Architecture Flow: environmental conditions data U2
 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 Flows:

- (1) *environmental_sensor_data_from_roadway*
- (2) *environment_sensor_attributes*
 - (3) *authorization_to_use*
 - (3) *collection_conditions*
 - (3) *collection_equipment*
 - (3) *data_aggregation*

- (3) *data_concept_identifier*
- (3) *data_reductions*
- (3) *data_revision*
- (3) *data_version*
- (3) *date_archived*
 - (4) *date*
 - (4) *time*
- (3) *date_created*
 - (4) *date*
 - (4) *time*
- (3) *date_published*
 - (4) *date*
 - (4) *time*
- (3) *equipment_status*
- (3) *error_handling*
- (3) *methods_applied*
- (3) *owner_entities*
- (3) *perishability_date*
 - (4) *date*
 - (4) *time*
- (3) *personal_identification_status*
- (3) *quality_control_attribute*
- (3) *record_size*
- (3) *security*
- (3) *standard_data_attribute*
- (3) *standard_message_attribute*
- (2) *environment_sensor_output*
- (2) *sensor_identity*
- (2) *station_id*
- (1) *environmental_sensor_fault_data_from_roadway*
 - (2) *sensor_fault_data*
 - (2) *sensor_identity*
 - (2) *station_id*
- (1) *environmental_sensor_status_from_roadway*
 - (2) *sensor_identity*
 - (2) *sensor_status*
 - (3) *traffic_sensor_status*
 - (2) *station_id*

Physical Architecture Flow: infrastructure monitoring sensor data

U2

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

Logical Architecture Flows:

- (1) *infrastructure_sensor_data_for_mcv*
 - (2) *infrastructure_sensor_data_from_roadside_devices*
 - (3) *infrastructure_sensor_output*
 - (3) *list_size*
 - (3) *sensor_identity*
 - (3) *station_id*
- (1) *infrastructure_sensor_status_for_mcv*
 - (2) *infrastructure_sensor_status_of_roadside_devices*
 - (3) *list_size*
 - (3) *sensor_identity*
 - (3) *sensor_status*
 - (4) *traffic_sensor_status*
 - (3) *station_id*

Physical Architecture Flow: roadway information system status

U2

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 Flows:

- (1) *dms_status_for_mcv*
 - (2) *dms_fault*
 - (3) *dms_identity*
- (2) *indicator_identity*
 - (3) *indicator_type*
 - (3) *location_identity*
 - (3) *unit_number*

Physical Architecture Flow: work zone warning notification

U2

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 Flows:

- (1) *work_zone_intrusion_detection_for_on_board*
 - (2) *device_identity*
 - (2) *intrusion_detection_device_output*

7.3.4 Vehicle → Roadway Subsystem

Physical Architecture Flow: environmental probe data

U2

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 Flows:

- (1) *vehicle_smart_probe_data*
- (1) *vehicle_status_details_for_emissions*
 - (2) *vehicle_status_details*
 - (3) *vehicle_security_status*
 - (3) *vehicle_system_status*

7.4 Vehicle to Vehicle Interfaces

7.4.1 Maintenance and Construction Vehicle → Other MCV

Physical Architecture Flow: maint and constr vehicle status coordination

U3

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

Logical Architecture Flows:

- (1) *tomcv_env_conditions*
 - (2) *environment_sensor_output*
 - (2) *sensor_identity*
- (1) *tomcv_vehicle_operational_data*
 - (2) *operational_data_for_mcv*
 - (2) *vehicle_id_for_mcv*

Physical Architecture Flow: work zone warning notification

U3

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 Flows:

- (1) *tomcv_crew_movements*
- (1) *tomcv_work_zone_intrusion_alert_on_board*
- (1) *tomcv_work_zone_intrusion_detection_on_board*
- (1) *tomcv_work_zone_intrusion_warning_to_crew*

7.4.2 Maintenance and Construction Vehicle → Vehicle

Physical Architecture Flow: vehicle signage data

U3

In-vehicle signage data generated by the roadway infrastructure indicating either road conditions, street names, or special information.

Logical Architecture Flows:

- (1) *work_zone_intrusion_alert_on_board_for_in_vehicle_signing*

7.4.3 Other MCV → Maintenance and Construction Vehicle

Physical Architecture Flow: maint and constr vehicle status coordination

U3

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

Logical Architecture Flows:

- (1) *fomcv_env_conditions*
 - (2) *environment_sensor_output*
 - (2) *sensor_identity*
- (1) *fomcv_vehicle_operational_data*
 - (2) *operational_data_for_mcv*
 - (2) *vehicle_id_for_mcv*

Physical Architecture Flow: work zone warning notification

U3

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 Flows:

- (1) *fomcv_crew_movements*
- (1) *fomcv_work_zone_intrusion_alert_on_board*
- (1) *fomcv_work_zone_intrusion_detection_on_board*
- (1) *fomcv_work_zone_intrusion_warning_to_crew*

8 Data Dictionary Elements

This section contains the logical data dictionary element (DDE) definitions for all the logical data dictionary elements listed in this standards requirements package.

The DDE's are given in alphabetical order.

area_air_quality_index

This data flow contains a code for the area wide air quality level.

asset_restrictions_for_com_veh

This data flow is sent from the Manage Maintenance and Construction function to the Manage Commercial Vehicles function and contains information regarding restrictions on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This could include height, width, weight, and special restrictions for bridges; both permanent restrictions, and temporary restrictions due to current maintenance and construction activities are included.

asset_restrictions_for_emerg

This data flow is sent from the Manage Maintenance and Construction function to the Manage Emergency Services function and contains information regarding restrictions on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This could include height, width, weight, and special restrictions for bridges; both permanent restrictions, and temporary restrictions due to current maintenance and construction activities are included. This information can be used to anticipate incidents or routing emergency vehicles.

asset_restrictions_for_info_provider

This data flow is sent from the Manage Maintenance and Construction function to the Manage Traffic function and contains information regarding restrictions on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This could include height, width, weight, and special restrictions for bridges; both permanent restrictions, and temporary restrictions due to current maintenance and construction activities are included. This information can be passed on to travelers or used in creating routes.

asset_restrictions_for_traffic

This data flow is sent from the Manage Maintenance and Construction function to the Manage Traffic function and contains information regarding restrictions on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This could include height, width, weight, and special restrictions for bridges; both permanent restrictions, and temporary restrictions due to current maintenance and construction activities are included. This information can be used to anticipate incidents, etc.

asset_restrictions_for_transit

This data flow is sent from the Manage Maintenance and Construction function to the Manage Transit function and contains information regarding restrictions on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This could include height, width, weight, and

special restrictions for bridges; both permanent restrictions, and temporary restrictions due to current maintenance and construction activities are included. This information can be used to assist in supporting transit vehicle operations.

authorization_to_use

This data flow describes the restrictions on the use of the data, such as a restriction on a class of users or a restriction on export of the data.

auto_treat equip_status_for_m_and_c

This data flow provides a report to the Manage Maintenance and Construction function of the status of automated roadway treatment systems, such as anti-icing systems, etc. and the adjoining dynamic message sign (DMS) equipment that alerts drivers to these conditions. By monitoring this data flow, the receiving process can assess the health and current status of field equipment and repair if deemed necessary.

auto_treatment_activation_data

This data flow is used within the Manage Maintenance and Construction function and contains data about the conditions and occurrences under which the remotely controlled automated field devices along the roadway that treat the road surface (anti-icing, de-icing, etc.) were activated.

auto_treatment_device_control

This data flow contains control information to remotely control automated field devices along the roadway that treat the road surface (anti-icing, de-icing, etc.).

auto_treatment_system_status_for_archive

This data flow contains the operational status of automated treatment devices located at the roadway including records of equipment activation. This flow is used by the Managed Archived Data function for archival of the occurrences of automated treatment.

basic_mcv_measures_for_maint_sched

This data flow contains the operational status of various systems on the maintenance and construction vehicle, including brake wear, engine temperature, mileage, tire wear, belt wear, engine and brake system status, and safety system status to enable vehicle maintenance scheduling.

center_control_of_on_board_work_zone_devices

This data flow contains control parameters sent from the maintenance and construction center personnel for control of work zone devices that are on a maintenance and construction vehicle. The devices controlled include closed circuit TV, dynamic message signs, highway advisory radio intrusion detection devices, and intrusion alert devices. These parameters may cover things such as device configuration or device reset. For the cctv the control flow also includes pan, tilt, and zoom plus other picture controls.

climatic_scale_surface_trans_weather_forecasts

This data flow contains forecasts of surface transportation related weather trends and weather related events for time horizons and spatial range beyond those of synoptic scale forecasts.

climatic_scale_weather_forecasts

This data flow contains forecasts of atmospheric weather trends and weather related events for time horizons and spatial range beyond those of synoptic scale forecasts.

closure_event_data

This data flow contains data to be used by traffic management to coordinate its overall operations with the HRI closures.

collection_conditions

This data flow describes the conditions under which the data was collected and/or sampled.

collection_equipment

This data flow describes the equipment used to collect the data. This may include a machine type or model or that it was manually collected or produced as a report of another ITS system.

crossing_close_duration

This data flow is used within the Manage Traffic function. It contains the time duration for which a crossing must close to vehicular (roads and highway) traffic to permit the passage of the alternate flow, e.g. railroad, river traffic, aircraft, etc. and is used to influence the control of signalized traffic intersections provided by the Provide Device Control facility.

crossing_close_time

This data flow is used within the Manage Traffic function. It contains the time period before a crossing must close to vehicular (road and highway) traffic to permit the passage of the alternate flow, e.g. railroad, river traffic, aircraft, etc. and is used to influence the control of signalized traffic intersections provided by the Provide Device Control facility.

crossing_data_for_highways

This data flow is used within the Manage Traffic function. It contains data received from a multimodal crossings on highways about when they are going to close and for how long.

crossing_data_for_roads

This data flow is used within the Manage Traffic function. It contains data received from a multimodal crossings on roads about when they are going to close and for how long the closure will last.

crossing_identity

This data flow is used within the Manage Traffic function and contains the identity of a multimodal crossing.

crossing_list

This data flow is used within the Manage Traffic function and contains a list of multimodal crossings to which the accompanying data applies.

current_asset_restrictions

This data flow includes information regarding restrictions on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This could include height, width, weight, and special restrictions for bridges; both permanent restrictions, and

temporary restrictions due to current maintenance and construction activities are included.

current_carbon_monoxide_pollution

This data flow is used within the Manage Traffic function and contains the average level of carbon monoxide pollution as measured by sensors. These sensors may provide general coverage of the geographic area served by the function, or located at the roadside, or measure data for particular vehicle types. The unit of measurement will be in parts per million (ppm).

current_data

This data store is used within the Manage Traffic function to hold data about the current state of traffic on the road (surface street) and freeway network served by the function. It is a sample of the traffic at a single instant in time and is updated periodically from data collected by other processes within both this and other ITS functions.

current_fleet_maintenance_status

This data flow is used within the Manage Maintenance and Construction function and includes information on the maintenance status of all of the maintenance and construction vehicles in the fleet.

current_highway_network_data

This data flow is used within the Manage Traffic function and contains data about traffic conditions on links in the highway network served by the function. This data is used for determining traffic management strategies and is also sent for storage in both the long term and current data stores.

current_hydrocarbon_pollution

This data flow is used within the Manage Traffic function and contains the current level of hydrocarbon pollution as measured by sensors. These sensors may provide general coverage of the geographic area served by the function, or located at the roadside, or measure data for particular vehicle types. The unit of measurement will be in parts per million (ppm).

current_incident_data

This data flow is used within the Manage Traffic function to transfer data about current incidents from the Incident Management facility to the Provide Traffic Surveillance facility for storage.

current_incident_details

This data flow is used within the Manage Traffic function and contains the details of a current incident.

current_nitrous_oxide_pollution

This data flow is used within the Manage Traffic function and contains the average level of nitrous oxide pollution as measured by sensors. These sensors may provide general coverage of the geographic area served by the function, or located at the roadside, or measure data for particular vehicle types. The unit of measurement will be in parts per million (ppm).

current_other_routes_use

This data flow is used within the Provide Driver and Traveler Services function and

contains data about the non-vehicle portion(s) of routes that have been requested by travelers. These route portions will involve the use of modes such as cycling, walking, etc. The data will be stored in ascending route segment number order (i.e. from 1 to the maximum number of route segments).

current_ozone_pollution

This data flow is used within the Manage Traffic function and contains the average level of ozone pollution as measured by sensors. These sensors may provide general coverage of the geographic area served by the function, or located at the roadside, or measure data for particular vehicle types. The unit of measurement will be in parts per million (ppm).

current_particulate_pollution

This data flow is used within the Manage Traffic function and contains the average level of pollution from particulates as measured by sensors. These sensors may provide general coverage of the geographic area served by the function, or located at the roadside, or measure data for particular vehicle types. The unit of measurement will be in parts per million (ppm).

current_pollution_location

This data flow is used within the Manage Traffic function and gives the location coordinates from which a set of current pollution levels have been obtained. The location may be one at which the pollution for the geographic area served by the function is measured, or one at which roadside pollution levels are measured, or one at which pollution data for particular vehicle types is measured. These pollution levels will be defined in an associated set of data flows.

current_road_network_data

This data flow is used within the Manage Traffic function and contains data about traffic conditions on links in the road network served by the function. This data is used for determining traffic management strategies and is also sent for storage in both the long term and current data stores.

current_road_network_use

This data flow is sent from the Provide Driver and Traveler Services function to the Manage Traffic and Manage Maintenance and Construction functions. It contains information about how many vehicles are being guided down each route segment and the average journey time for each route segment provided by guided vehicles. The data will be stored in ascending route segment number order (i.e. from 1 to the maximum number of route segments).

current_roadside_pollution_location

This data flow is used within the Manage Traffic function and contains the location at which an associated set of current roadside atmospheric pollution values have been obtained from sensors.

current_roadway_maintenance_status

This data flow contains information summarizing the current roadway maintenance activities. This also includes maintenance fleet operations affecting the road network such as winter maintenance (snow plow schedules and status).

current_roadway_network_data

This data flow is used within the Manage Traffic function and contains data about traffic conditions on links in the road (surface street) and highway network served by the function. The data is used for determining traffic management strategy and is also sent for in both the long term and current data stores.

current_sulfur_dioxide_pollution

This data flow is used within the Manage Traffic function and contains the average level of sulfur dioxide pollution as measured by sensors. These sensors may provide general coverage of the geographic area served by the function, or located at the roadside, or measure data for particular vehicle types. The unit of measurement will be in parts per million (ppm).

current_weather_observations

This data flow contains weather observations including temperature(ambient and dew point), pressure, wind parameters (direction, speed, and character), humidity, precipitation(amount and type), visibility, light conditions, lightning data, radar data, etc.

data_aggregation

This data flow identifies this data as an aggregation of the original data. This may be in the form of a yes/no flag or a description of the actual aggregation algorithm performed.

data_concept_identifier

This data flow defines a pointer to a common data dictionary or message set template which allows future applications to make better use of the data.

data_reductions

This data flow identifies any reductions that have been made to the original data. This may be in the form of a yes/no flag or a description of the actual reduction algorithm performed.

data_revision

This data flow is a flag to show that the data has been revised from its original version. The purpose of this flag is to notify users of the data from a source agency that the data being sent has been revised from its original state, either to correct an error in the data or fill in missing data.

data_version

This data flow identifies the version of the data when there may be more than one set of similar data. This data flow may be used in conjunction with the data_revision data flow to ensure the quality control in the received data.

date

This data flow is used within many ITS function and contains the calendar date data normally used to indicate currency or effectivity of other data flows. The codification of the data is YYYYMMDD or equivalent.

date_archived

This data flow is the date/time stamp of when the data being described was stored in the permanent archive.

date_created

This data flow is the date/time stamp of when the data being described was created or collected at the source agency.

date_published

This data flow is the date/time stamp of when the data being described was published or made available by the source agency.

device_fault

This data flow contains an indication of a fault in a roadside device. This could be a power failure, or a communications failure.

device_identity

This data flow contains an identifier of devices such as smart probe beacons, automated roadway treatment systems, intrusion detection or alert devices, etc. The identifier would be a code which describes the type of the device.

device_status

This data flow contains the status of a roadside device. The data flow provides an indication of the state of the device as well as configuration data for the device.

dispatch_orders_to_mcv

This data is used within the Manage Maintenance and Construction function and contains dispatch information from the vehicle fleet manager to the maintenance and construction vehicle.

dispatch_response_from_mcv

This data flow is sent from the maintenance and construction vehicle to the vehicle fleet management to acknowledge that the vehicle has been dispatched and is on its way to the location identified in the dispatch request.

dms_advisory_text

This data flow is used within the Manage Traffic function and contains details of the actual advisory text strings that are to be output to drivers and pedestrians using indicators that are dynamic message signs (DMS). The advisory text string may be one of several types depending on the type of information being provided.

dms_auto_treat_info

This data flow is the DMS state which gives warning of activation of the roadway automated treatment device, indicating the condition that warranted the device's activation, or that treatment is in progress.

dms_data_from_mcv

This data flow contains the actual data from which instructions to the driver and traveler can be produced by indicators at dynamic message (DMS) and other types of signs at the roadside.

dms equip_status_for_m_and_c

This data flow provides a report to the Manage Maintenance and Construction function containing the status of dynamic message signs operating at the roadside in the local geographic and/or jurisdictional area(s). By monitoring this data flow, the receiving process can monitor the health and current status of field equipment and repair if deemed necessary.

dms_fault

This data flow is sent to the Manage Traffic function and contains an indication of

a fault in the Dynamic Message Sign device. This could be a power failure, or a communications failure.

dms_highway_open_close

This data flow is used within the Manage Traffic function. It is a DMS state which advises drivers that some or all of the highway(s) ahead is(are) closed. If the highway(s) are open no indication will be given as this is the normal state

dms_identity

This data flow contains a numerical identifier of an individual Dynamic Message Sign.

dms_incident_warning

This data flow is used within the Manage Traffic function and is the DMS state which gives warning of an incident to travelers.

dms_status_for_mcv

This data flow contains the Dynamic Message Sign status for sign control data to be sent to the roadway management function for maintenance and construction. This also includes operating of the sign at the roadside in the geographic and/or jurisdictional area(s) served by the function.

dms_weather_warning

This data flow is used within the Manage Traffic function and is the DMS state which gives warning of weather conditions which are likely to be hazardous to driving.

driver_safety_status

This data flow contains information about the driver's state, including the driver's ability to control the vehicle (alcohol on the breath, too many mistakes, etc.) and injuries or other detectable problems with the vehicle's occupants.

duration

This data flow is used within many ITS function. It contains the expected duration of a particular activity.

env_info_for_road_network

This data flow contains processed environmental and road weather information for use in developing an overview of conditions on the road network. This data is the result of aggregation, fusing, filtering or analysis of the input environmental and weather data. This data flow includes road condition observations and road condition predictions. The data flow includes road weather forecasts and road weather observations.

env_probe_data

This data flow contains environmental conditions (e.g. temperature and precipitation) for a single network segment. The data has been aggregated based upon collection from a number of environmental probes on vehicles. The data also contains metadata describing how and when the data was collected (e.g. does it represent an aggregation of observations over a minute, or over an hour).

env_probe_data_from_transit_vehicle

This data flow provides outputs from an individual environment sensor on a transit vehicle.

env_probe_info_from_emergency

This data flow contains environmental conditions (e.g. temperature and precipitation)

that have been aggregated from individual emergency vehicles acting as probes. The probe information may be provided based upon road segment from which it was collected.

env_sensor_control_by_roadway_treatment_device

This data flow provides control commands for an environmental sensor being controlled by automated treatment devices at the roadway.

env_sensor equip_status_for_m_and_c

This data flow provides a report to the Manage Maintenance and Construction function of the status of a set of environmental sensors. By monitoring this data flow, the receiving process can monitor the health and current status of field equipment and repair if deemed necessary.

environment_sensor_attributes

This data flow is used to provide meta data included with environment sensor data for release to the archive. Items of meta data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data, such as status of operational equipment. This meta data may also include flags to identify the presence of privacy sensitive information. Other meta data attributes such as class names, data type, and data concept identifiers may be present when a standard data dictionary or message set template is used as in IEEE P1489 and P1488.

environment_sensor_data

This data flow is used within the Manage Traffic function and contains a set of outputs from individual environment sensors.

environment_sensor_output

This data flow contains the raw data collected from a single sensor. This data flow could include data pertaining to wind, temperature, humidity, precipitation, radiation (sun), visibility, and pavement sensor information

environmental_sensor_control

This data flow provides control commands for an environmental sensor at the roadway.

environmental_sensor_control_for_mcv

This data flow provides control commands for an environmental sensor located on a maintenance and construction vehicle.

environmental_sensor_control_for_roadway

This data flow provides control commands for an environmental sensor at the roadway.

environmental_sensor_data_for_roadway

This data flow provides outputs from an individual environment sensor on a maintenance and construction vehicle.

environmental_sensor_data_from_mcv

This data flow contains environmental sensor data that is collected on-board a maintenance and construction vehicle. The sensor data may come from sensors on-board the vehicle or from sensors at the roadside that have been monitored by the vehicle.

environmental_sensor_data_from_mcv_sensors

This data flow provides outputs from an individual environment sensor on a maintenance and construction vehicle.

environmental_sensor_data_from_roadway

This data flow provides outputs from an individual environment sensor at the roadway.

environmental_sensor_fault_data_from_mcv

This data flow contains environmental sensor fault data that is obtained on-board a maintenance and construction vehicle. The sensor fault data may come from sensors on-board the vehicle or from sensors at the roadside that have been monitored by the vehicle.

environmental_sensor_fault_data_from_mcv_sensors

This data flow provides an indication that an environment sensor has developed a fault, (i.e., it is not operating correctly). The fault will have been found by a process that is local to the sensor itself.

environmental_sensor_fault_data_from_roadway

This data flow provides an indication that an environment sensor has developed a fault, (i.e., it is not operating correctly). The fault will have been found by a process that is local to the sensor itself.

environmental_sensor_status_from_mcv

This data flow contains environmental sensor status that is obtained on-board a maintenance and construction vehicle. The sensor status may come from sensors on-board the vehicle or from sensors at the roadside that have been monitored by the vehicle.

environmental_sensor_status_from_mcv_sensors

This data flow provides a report of the status of an environmental sensor located on a maintenance and construction vehicle. By monitoring this data flow, the receiving process can monitor the health and current status of on-board equipment.

environmental_sensor_status_from_roadway

This data flow provides a report of the status of an environmental sensor. By monitoring this data flow, the receiving process can monitor the health and current status of field equipment.

equipment_status

This data flow describes the status of the equipment at the time of collection.

error_handling

This data flow identifies the error detection or correction algorithms applied to the data to better facilitate reconstruction of the data later.

fam_asset_inventory

This data flow is sent from the Asset Management terminator to the Manage Maintenance and Construction function. It provides information on the transportation infrastructure, including the locations and maintenance condition of each asset, vendor/contractor information, materials information, etc.

fam_asset_maint_and_repair_needs

This data flow is sent from the Asset Management terminator to the Manage Maintenance and Construction function. It provides input on infrastructure repair requirements based on schedules, infrastructure conditions data, etc.

fam_asset_restrictions

This data flow is sent from the Asset Management terminator to the Manage Maintenance and Construction function. It provides information regarding restrictions on transportation asset usage based on infrastructure design, surveys, tests, or analyses. This could include height, width, weight, and special restrictions for bridges; both permanent restrictions, and temporary restrictions due to current maintenance and construction activities are included.

fea_enforcement_parameters

This data flow contains parameters used by the receiving process to determine when speed violations have occurred. The parameters would include the speed above which a speed violation is considered to have occurred.

fea_speed_sensor_control

This data flow provides control commands for speed sensors at the roadway.

ferf_current_fleet_maintenance_status

This data flow is sent from the equipment repair facility to the Manage Maintenance and Construction function and includes information on the maintenance status of all of the maintenance and construction vehicles in the fleet.

ferf_equipment_repair_status

This data flow is sent from the equipment repair facility to the Manage Maintenance and Construction function and includes information on the maintenance and repair status of all of the maintenance and construction support equipment.

ferf_equipment_status_for_tracking

This data flow is sent from the equipment repair facility to the Manage Maintenance and Construction function and includes data on the maintenance and repair status, and location of all of the maintenance and construction support equipment.

ferf_fleet_maintenance_record

This data flow is sent from the equipment repair facility to the Manage Maintenance and Construction function and includes the actual maintenance and repair record of each of the maintenance and construction vehicles in the fleet.

field_device_status_for_archive

This data flow is sent from the Manage Maintenance and Construction function to the Manage Archived Data function and contains information to be archived about the field equipment that require repairs.

field equip_maint_status

This data flow consists of a report to the Manage Traffic function from

the Manage Maintenance and Construction function of the current status of field equipment maintenance activity.

field_equip_status_from_mcv_operator

This data flow consists of data based on inputs from maintenance and construction field personnel concerning the current status of field equipment.

field_equipment_status_from_traffic

This data flow consists of a report to the Manage Maintenance and Construction function from the Manage Traffic function of the field equipment requiring repair and known information about the associated faults. The receiving process will use this data to arrange for repair if deemed necessary.

fleet_activity_schedule

This data flow is used within the Manage Maintenance and Construction function and contains the work activity schedule for use by maintenance and construction vehicle fleet management. This flow includes the schedule, work activity to be performed, the site location, and any special instructions.

fleet_maintenance_availability

This data flow is used within the Manage Maintenance and Construction function and contains information on when the maintenance and construction vehicles will be available for preventive and corrective maintenance.

fleet_maintenance_record

This data flow is used within the Manage Maintenance and Construction function and includes the actual maintenance and repair record of each of the maintenance and construction vehicles in the fleet.

fmcas_m_and_c_administrative_information

This data flow is sent from the Maintenance and Construction Administrative Systems to the Manage Maintenance and Construction function. It provides input on administrative information, including requests and project requirements from contract administration, and other information that could affect scheduling of maintenance and construction activities.

fmcas_m_and_c_personnel_information

This data flow is sent from the Maintenance and Construction Administrative Systems to the Manage Maintenance and Construction function. It provides input on maintenance and construction personnel, including training qualifications and special certifications.

fmcas_m_and_c_regulations

This data flow is sent from the Maintenance and Construction Administrative Systems to the Manage Maintenance and Construction function. It provides input on regulations and rules, including restrictions that could affect scheduling of maintenance and construction activities.

fmcas_resupply_response

This data flow is sent from Maintenance and Construction Administrative Systems to the Manage Maintenance and Construction function, and contains the purchase request status for equipment and consumables resupply.

fomcm_env_sensor_data

This data flow provides outputs from a set of environment sensors that are monitored by another maintenance and construction organization.

fomcm_m_and_c_plan_feedback

This data flow is used by the Manage Maintenance and Construction function to receive feedback regarding proposed work plans from other maintenance and construction facilities whose areas of operation are outside those of the local facility. It contains comments and suggested changes to proposed maintenance and construction work plan schedules and activities. This information will be used to influence the work schedule to minimize impact to other system operations and the transportation system.

fomcm_m_and_c_work_plans

This data flow is used by the Manage Maintenance and Construction function to receive data from other maintenance and construction facilities whose areas of operation are outside those of the local facility. It contains information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.

fomcm_resource_coordination_data

This data flow represents information about resources that is to be shared between maintenance and construction facilities located in different geographic areas. Included in this data flow are requests for use and availability of those resources.

fomcm_road_weather_info

This data flow contains environmental and road weather information that has been formatted for distribution from one maintenance and construction organization to another. The data may be filtered or aggregated prior to this formatting.

fomcm_roadway_maint_status

This data flow is used by the Manage Maintenance and Construction function to receive data from other maintenance and construction facilities whose areas of operation are outside those of the local facility. It contains information summarizing the current roadway maintenance activities. This also includes maintenance fleet operations affecting the road network such as winter maintenance (snow plow schedules and status).

fomcm_work_zone_images

This data flow contains analog or digitized video images of a work zone that are provided to the Manage Maintenance and Construction function from another maintenance and construction agency

fomcm_work_zone_info

This data flow contains a 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 also includes work zone resources availability and status.

fomcv_crew_movements

This data flow is sent from another maintenance and construction vehicle and contains the location of a maintenance and construction field personnel within a work zone area and some form of personnel identifier that would allow transmitting of a warning to the specific personnel based upon detection of intrusion at a certain point within a work zone. The data flow may also contain a maintenance and construction vehicle identifier to allow transmission of warnings to a specific vehicle.

fomecv_env_conditions

This data flow contains environmental sensor data collected on-board another maintenance and construction vehicle. The data may represent the actual sensor output, or may be a filtered or processed version for display to the Maintenance and Construction Field Personnel.

fomecv_vehicle_operational_data

This data flow is received from other vehicles to the Manage Maintenance and Construction function and contains information about the maintenance and construction activity performed by the vehicle. Operational data includes the operational state of the maintenance equipment (e.g., blade up/down, spreader pattern) and a record of the actual work performed. It is used to coordinate efforts between maintenance and construction vehicles.

fomecv_work_zone_intrusion_alert_on_board

This data flow contains a timestamped indication that a work zone intrusion alert has been generated by a device on-board a maintenance and construction vehicle. The data flow could also identify the form in which the alert was given (e.g. audible warning, visual warning, or in-vehicle warning)

fomecv_work_zone_intrusion_detection_on_board

This data flow contains the timestamped output of an on-board intrusion detection device indicating that an intrusion has been detected.

fomecv_work_zone_intrusion_warning_to_crew

This data flow contains a warning sent from another maintenance and construction vehicle to a receiving maintenance and construction vehicle that an intrusion into the work zone has been detected. The data flow may contain the identity of the sending vehicle, the identity of the receiving vehicle, the location of the intrusion, and the identity of the maintenance and construction field personnel that are at risk due to the location and nature of the intrusion.

fro_m_and_c_plan_feedback_from_rail

This data flow is sent from the Rail Operations to the Manage Maintenance and Construction function. It contains comments and suggested changes to proposed maintenance and construction work plan schedules and activities. This information will be used to influence the work schedule to minimize impact to other system operations and the transportation system.

fro_railroad_schedules

This data flow is sent from the Rail Operations to the Manage Maintenance and Construction function. It contains train schedules, maintenance schedules, and other information from the railroad to assist in maintenance and construction activity scheduling.

fsf_equipment_availability

This data flow is sent from the Storage Facility to the Manage Maintenance and Construction function and contains descriptive information about the types, quantities, and status of the maintenance and construction equipment available at the facility.

fsf_equipment_availability_for_fleet_manager

This data flow is sent from the Storage Facility to the Manage Maintenance and Construction function and contains descriptive information about the types, quantities, and status of the maintenance and construction equipment available at the facility to assist the fleet manager in scheduling operations.

fsf_equipment_status_for_tracking

This data flow is sent from the Storage Facility to the Manage Maintenance and Construction function and contains data about the types, quantities, and status of the maintenance and construction equipment at the facility.

fsf_materials_status

This data flow is sent from the storage facility to the Manage Maintenance and Construction function and contains data about the types and quantities of materials available at the facility.

fstws_env_sensor_data

This data flow provides outputs from a set of environment sensors that are monitored by a surface transportation weather service.

fstws_roadway_env_sensor_control

This data flow provides control commands for environmental sensors at the roadway.

fstws_surface_trans_weather_forecasts

This data flow contains surface transportation related forecasts of weather variables, including temperature(surface and pavement), pressure, wind speed, wind direction, humidity, precipitation, roadway visibility, and pavement conditions as well as forecast data attributes. This data flow also contains surface transportation specific advisories for weather related events. The weather forecasts are classified by meteorological scales, each of which cover a range of time and a range of space. The scales are micro (timescale of minutes and horizontal scale of meters), miso (timescale of minutes to an hour before the event and horizontal scale of meters to a kilometer), meso (timescale of several hours before an event and horizontal scale of one to 100 kilometers), synoptic (a timescale of 12 hour to several day horizon and a horizontal scale of 100 to 5000 kilometers) and climatic (a timescale beyond synoptic and a horizontal scale greater than 5000 kilometers).

fstws_surface_trans_weather_observations

This data flow contains surface transportation related weather observations, e.g. temperature, pressure, wind parameters, humidity, precipitation, visibility, pavement temperature, pavement conditions etc. and surface transportation weather observationm attributes (or meta data).

fws_current_weather_observations

This data flow contains current weather observations, e.g. temperature, pressure, wind parameters, humidity, precipitation, visibility, light conditions, lightning data, radar data, etc. and weather observation attributes (or meta data).

fws_env_sensor_data

This data flow provides outputs from a set of environment sensors that are monitored by the weather service.

fws_roadway_env_sensor_control

This data flow provides control commands for environmental sensors at the roadway.

fws_weather_forecasts

This data flow contains forecasts of weather variables, including temperature, pressure, wind speed, wind direction, humidity, precipitation, visibility, and light conditions as well as forecast data attributes. This data flow also contains advisories, watches, or warnings for weather related events. The weather forecasts are classified by meteorological scales, each of which cover a range of time and a range of space. The scales are miso (timescale of minutes to an hour before the event and horizontal scale of meters to a kilometer), meso (timescale of several hours before an event and horizontal scale of one to 100 kilometers), synoptic (a timescale of 12 hour to several day horizon and a horizontal scale of 100 to 5000 kilometers) and climatic (a timescale beyond synoptic and a horizontal scale greater than 5000 kilometers).

har equip_status_for_m_and_c

This data flow provides a report to the Manage Maintenance and Construction function of the status of the highway advisory radio equipment. This status includes an indication of the current program being broadcast and an indication of the space available for storing messages/ programs on the device. By monitoring this data flow, the receiving process can monitor the health and current status of field equipment and repair if deemed necessary.

har_fault

This data flow contains an indication of a fault in the highway advisory radio device. This could be a power failure, or a communications failure.

har_identity

This data flow contains a numerical identifier of an individual Highway Advisory Radio device.

highway_sign_plan_number

This data flow contains the number of an adaptive plan for the road network controlled by the function. A plan is a set of data that enables a set of sign sequences to be applied to highway indicators to achieve a desired traffic control strategy.

hov_lane_data

This data flow is used within the Manage Traffic function and contains the data obtained from processing the inputs from traffic sensors located on High Occupancy Vehicle (HOV) lanes around the road network.

hov_lane_identity

This data flow is used within the Manage Traffic function to identify individual high occupancy vehicle (hov) lanes used for the control of traffic on roads (surface streets) and highways.

hov_lane_list

This data flow is used within the Manage Traffic function and contains a list of high occupancy vehicle (hov) lanes to which the accompanying data applies.

hov_lane_vehicle_count

This data flow contains a count of the number of vehicles legitimately using High Occupancy Vehicle (HOV) lanes in the road and highway network served by the function. The count shows the actual number of vehicles in a lane, which

is not the same as the vehicle flow rate.

hov_lane_violation_count

This data flow contains the a count of the number of vehicles illegally using High Occupancy Vehicle (HOV) lanes in the road and highway network. The count shows the actual number of illegal vehicles in a lane, which is not the same as the illegal vehicle flow rate, although this can be calculated as an average from successive values of this data flow.

hov_priority

This data flow is used within the Manage Traffic function and contains data about the number of vehicles using high occupancy vehicle (hov) lanes. Data is included about vehicles that are both legal and illegal users.

hov_sensor equip_status_for_m_and_c

This data flow is used within the Manage Maintenance and Construction function to report the status of an HOV sensor. By monitoring this data flow, the receiving process can monitor the health and current status of field equipment and repair if deemed necessary.

hri_closure_data_response

This data flow represents an historical log of HRI closure data.

hri_sensor_data

This data flow provides sensor data, acquired by HRI at grade crossings, that is relevant to the overall traffic surveillance functions of ITS (e.g. grade crossing rail traffic). It contains HRI closure data, status data, and other HRI information.

hri_state

This data flow represents the complete state of an HRI as determined by monitoring the status of the track, traffic and equipment.

hri_state_data

This data flow is used within the Manage Traffic function and contains data about the state of the highway rail intersections as determined by processing the hri sensor data.

hri_status

This data flow represents the complete status of an HRI, including train situation, vehicle traffic, equipment health and predictable near term events.

incident_description

This data flow is used within the Manage Traffic function and contains the description of an incident using a predefined dictionary of character codes.

incident_duration

This data flow is used within the Manage Traffic function and gives the expected duration of an incident from its start time until the time at which it is expected that it will have no further effect on traffic conditions.

incident_info_for_traffic

This data flow is sent from the Manage Maintenance and Construction function to the Manage Traffic function and contains information about incidents detected

by the M&C function.

incident_info_from_emerg

This data flow contains information about incidents detected by the Manage Emergency function.

incident_info_from_traffic

This data flow is used to send details of an incident from the Manage Traffic function to the Manage Maintenance and Construction function.

incident_location

This data flow is used within the Manage Traffic function and contains the location at which an incident will take place (for planned events) or is taking place (for current incidents). The location will be defined in terms of map coordinates to enable it to be referenced spatially within the geographic area served by the local TMC.

incident_number

This data item identifies each incident that has been or is active. Note that each function will have its own copy of this data so that an incident in one function does not have the same number in the other function, i.e. the numbering of incidents is independent in each function.

incident_response_status_from_emerg

This data flow provides the current status of an incident response indicating site management strategies in effect, incident clearance status, the incident command structure that is in place, and points of contact.

incident_severity

This data flow defines the severity of an incident.

incident_start_time

This data flow is used within the Manage Traffic function and shows the time at which an incident will start. The time indicated may include the time an incident is verified, confirmed, or detected. The point at which it starts to have an effect on traffic conditions will be later than this time which is used as the trigger for any corrective or mitigating action, e.g. change in traffic control strategy. Thus in the case of incidents that are some form of special event, the start time may not be the actual event start time. An example would be a baseball game, which could create an incident as spectators arrive for the start of the game. The time at which this happens will be different (before) the actual start of the game but after the time at which the gates open.

incident_traffic_impact

This data flow is used within the Manage Traffic function and contains details of the impact that a particular incident will have on traffic flows.

incident_type

This data flow identifies an incident type using a uniquely defined character code matched to a specific type of incident.

incident_vehicles_involved

This data flow is used within the Manage Traffic and Manage Emergency Services functions and defines the number of vehicles involved in an incident as well as the amount of property damage caused by the incident at the time of the report.

indicator_control_data_for_highways

This data flow is used within the Manage Traffic function and contains the actual data from which instructions to the driver and traveler can be produced by indicators at the roadside on freeways in the geographic and/or jurisdictional area(s) served by the function.

indicator_control_data_for_roads

This data flow is used within the Manage Traffic function and contains the actual data from which instructions to the driver and traveler can be produced by indicators at the roadside on roads (surface streets) in the geographic and/or jurisdictional area(s) served by the function.

indicator_control_storage_data

This data flow is used within the Manage Traffic function to transfer indicator control data from the Provide Device Control facility to Provide Traffic Surveillance facility for loading into the current and long term data stores. It contains the data currently being output to the indicators that are used to control traffic on the roads and highways served by the TMC.

indicator_control_storage_data_for_highways

This data flow is used within the Manage Traffic function and contains the data currently being output to the indicators that are used to control traffic on the freeways in the geographic and/or jurisdictional area(s) served by the function.

indicator_control_storage_data_for_roads

This data flow is used within the Manage Traffic function and contains the data currently being output to the indicators that are used to control traffic on the roads (surface streets) in the geographic and/or jurisdictional area(s) served by the function.

indicator_crossing_control_data_for_highways

This data flow is used within the Manage Traffic function and contains the actual data from which instructions to the driver and traveler can be produced by indicators at multimodal crossings on freeways served by the function.

indicator_crossing_control_data_for_roads

This data flow is used within the Manage Traffic function and contains the actual data from which instructions to the driver and traveler can be produced by indicators at multimodal crossings on roads (surface streets) served by the function.

indicator_crossing_controls

This data flow contains the actual control data to be passed to an indicator that is a multimodal crossing. This will be either the actual indication to be seen by the driver, e.g. red to stop vehicle or green to proceed, or a set of these instructions with duration times put together to form a fixed time signal plan, or an instruction to run using the controller's local intelligence.

indicator equip status from highways for m and c

This data flow is used within the Manage Maintenance and Construction function to detect when an indicator used on the highway has developed a fault, and therefore operating incorrectly. The fault will have been found by a process that may not be local to the indicator itself, and may be located anywhere in the geographic area covered by the indicator.

indicator equip_status_from_roads_for_m_and_c

This data flow is used within the Manage Maintenance and Construction function to detect when an indicator at the roadway has developed a fault, and therefore operating incorrectly. The fault will have been found by a process that may not be local to the indicator itself, and may be located anywhere in the geographic area covered by the indicator.

indicator_fault

This data flow is used within the Manage Traffic function to define the type of fault that has been found in an indicator as it is not operating correctly.

indicator_identity

This data flow is used within the Manage Traffic function to identify individual indicators used for the control of traffic on roads (surface streets) and highways. The indicators can be either intersection signal controllers, pedestrian signal controllers or dynamic message signs (DMS).

indicator_input_storage_data

This data flow is used within the Manage Traffic function to transfer indicator response data from the Provide Device Control facility to the Provide Traffic Surveillance facility. The latter facility will load the data into the current and long term data stores.

indicator_input_storage_data_for_highways

This data flow is used within the Manage Traffic function and contains the response to control data that has been made by indicators on the freeways in the geographic and/or jurisdictional area(s) served by the function.

indicator_input_storage_data_for_roads

This data flow is used within the Manage Traffic function and contains the response to control data that has been made by indicators on the roads (surface streets) in the geographic and/or jurisdictional area(s) served by the function.

indicator_junction_control_data

This data flow is used within the Manage Traffic function and contains the actual data from which instructions to the driver and traveler can be produced by indicators at junctions on roads served by the function.

indicator_junction_controls

This data flow contains the actual control data to be passed to an indicator at a road junction. This will be either the actual indication to be seen by the driver, e.g. red for stop vehicle or green for proceed, or a set of these instructions with duration times put together to form a fixed time signal plan, or an instruction to run using the controller's local intelligence.

indicator_list

This data flow is used within the Manage Traffic function and contains a list of indicators to which a particular traffic control strategy is to be applied. The indicators may be intersection traffic signal controllers, pedestrian signal controllers and/or dynamic message signs (DMS), the latter being used for lane control or advisory message output purposes.

indicator_pedestrian_control_data

This data flow is used within the Manage Traffic function and contains the actual data from which instructions to the driver and traveler can be produced by indicators at pedestrian crossings on roads served by the function.

indicator_pedestrian_controls

This data flow contains the actual control data to be passed to an indicator at a pedestrian crossing. This will be either the actual indication to be seen by the driver and the traveler, e.g. red for stop vehicle or cross now indication, or a set of these instructions with duration times put together to form a fixed time signal plan, or an instruction to run using the controller's local intelligence.

indicator_ramp_control_data

This data flow is used within the Manage Traffic function and contains the actual data from which instructions to the driver and traveler can be produced by indicators at entry ramps to highways served by the function.

indicator_response_state

This data element contains the current state of an indicator that is being used to control traffic on the roads (surface streets) and highways in the geographic area served by the TMC. It is used to check that the indicator is performing as requested and may form the basis for a fault report if it is not. The data flow identifies the indicator state. Examples of typical states are correct operation, not responding, stuck on phase, and phase will not respond.

indicator_road_adaptive_plan_number

This data flow contains the number of an adaptive plan for the road network controlled by the function. A plan is a set of data that enables adaptive control to be applied to some or all of the indicators in a particular way. For example at one or more intersections, certain phases may be added or omitted, etc.

indicator_road_fixed_plan_number

This data flow contains the number of an adaptive plan for the road network controlled by the function. A plan is a set of data that enables fixed time control to be applied to some or all of the indicators in a particular way. Thus each set of plan data will specify particular cycle times, off-sets and phase timings for indicators. There may also be special instructions which may require certain phases may be added or omitted, demand responsive operation may be prohibited, local operation may be enabled, etc.

indicator_type

This data flow is used within the Manage Traffic function and contains the type of indicator to which the accompanying output or input data applies. The type may be either intersection signal controller, pedestrian signal controller, dynamic message sign (DMS) or multimodal crossing.

individual_vehicle_speed

This data flow contains the timestamped speed of an individual vehicle as measured by a speed sensor.

infrastructure_data_for_archive

This data flow is used within the Manage Maintenance and Construction function and consists of raw and processed data concerning the condition of the infrastructure as reported from sensor equipment on

the roadside and onboard maintenance and construction vehicles. This infrastructure includes bridges, culverts, signs, and other roadway infrastructure. The function receiving this flow will process this information and present it to the Manage Archived Data function.

infrastructure_sensor_control_from_m_and_c

This data flow provides control commands from a maintenance and construction center for an infrastructure monitoring sensor at the roadway.

infrastructure_sensor_control_from_mcv

This data flow provides control commands from a maintenance and construction vehicle for an infrastructure monitoring sensor at the roadway.

infrastructure_sensor_control_of_onboard_devices

This data flow provides control commands from a maintenance and construction center for an infrastructure monitoring sensors onboard a maintenance and construction vehicle.

infrastructure_sensor_control_of_roadside_devices

This data flow provides control commands for an infrastructure monitoring sensor at the roadway.

infrastructure_sensor_data_for_m_and_c

This data flow provides data to the Manage Maintenance and Construction function on the condition of the infrastructure as reported by sensor equipment on the roadside. This infrastructure includes bridges, culverts, signs, and other roadway infrastructure. The data can either be in raw data or image form. By monitoring this data flow, the receiving process can assess the current health of the infrastructure, add it to other sources of information, and pass along to other processes for inventory update and repair if deemed necessary.

infrastructure_sensor_data_for_mcv

This data flow provides data to the Manage Maintenance and Construction function on the condition of the infrastructure as reported by sensor equipment on the roadside. This infrastructure includes bridges, culverts, signs, and other roadway infrastructure. The data can either be in raw data or image form. This data is collected from the roadside equipment by the maintenance and construction vehicle and passed along to the center which can then assess the current health of the infrastructure.

infrastructure_sensor_data_from_onboard_devices

This data flow provides data to the Manage Maintenance and Construction function on the condition of the infrastructure as reported by sensor equipment onboard a maintenance and construction vehicle. This infrastructure includes bridges, culverts, signs, and other roadway infrastructure. The data can be in raw data or image form.

infrastructure_sensor_data_from_roadside_devices

This data flow provides data to the Manage Maintenance and Construction function on the condition of the infrastructure as reported by sensor equipment on the roadside. This infrastructure includes bridges, culverts, signs, and other roadway infrastructure. The data can either be in raw data or image form.

infrastructure_sensor equip_status_for_m_and_c

This data flow provides a report to the Manage Maintenance and Construction function of the status of the infrastructure sensor equipment itself. This field equipment includes sensors on bridges, culverts, signs, and other roadway infrastructure. By monitoring this data flow, the receiving process can monitor the configuration, health and current status of field equipment and repair if deemed necessary.

infrastructure_sensor_output

This data flow contains the raw data collected from a single sensor. This data flow could include data pertaining to the condition of bridges, culverts, signs, and other roadway infrastructure. It includes metadata describing the type of data, quality of the data, etc.

infrastructure_sensor_status_for_m_and_c

This data flow provides a report to the Manage Maintenance and Construction function of the status of infrastructure sensor equipment on the roadside. This field equipment includes sensors on bridges, culverts, signs, and other roadway infrastructure. By monitoring this data flow, the receiving process can monitor the configuration, health and current status of field equipment, add it to other sources of information, and pass along to other processes for inventory update and repair if deemed necessary.

infrastructure_sensor_status_for_mcv

This data flow provides a report to the Manage Maintenance and Construction function of the status of infrastructure sensor equipment on the roadside. This field equipment includes sensors on bridges, culverts, signs, and other roadway infrastructure. This data is collected from the roadside equipment by the maintenance and construction vehicle and passed along to the center which monitors the configuration, health and current status of the field equipment.

infrastructure_sensor_status_of_onboard_devices

This data flow provides a report to the Manage Maintenance and Construction function of the status of infrastructure sensor equipment onboard a maintenance and construction vehicle.

infrastructure_sensor_status_of_roadside_devices

This data flow provides a report to the Manage Maintenance and Construction function of the status of infrastructure sensor equipment on the roadside. This field equipment includes sensors on bridges, culverts, signs, and other roadway infrastructure.

intersection_blocked

This data flow contains information, obtained from sensors in the intersection, regarding blockage of the hri by a vehicle or other object. This data will be used by the traffic management functions to begin incident management procedures.

intrusion_alert_device_control

This data flow contains control parameters for intrusion alert devices that have been installed in work zones or maintenance areas. These parameters may cover things such as device configuration or device reset.

intrusion_alert_device_status

This data flow contains the status of an intrusion alert device that is located in a work zone or maintenance area. This status includes the configuration of the device and an indication of any device faults.

intrusion_detection_device_control

This data flow contains control parameters for intrusion detection devices that have been installed in work zones or maintenance areas. These parameters may cover things such as device configuration or device reset.

intrusion_detection_device_output

This data flow contains the output of an intrusion detection device indicating that an intrusion of the work zone perimeter has been detected. The output may consist of simple binary information (intrusion present or not), or it may contain information regarding the nature of the intrusion, location of the intrusion, etc.

intrusion_detection_device_status

This data flow contains the status of an intrusion detection device that is located in a work zone or maintenance area. This status includes the configuration of the device and an indication of any device faults.

lane_dms_controls

This data flow contains the actual control data to be passed to an indicator that is a lane control sign. This will be the actual indication that the lane is or is not to be used.

link_data_from_avl

This data flow contains the link journey and queue times calculated by processing the times at which AVL data was collected from vehicles on the road (surface street) and highway network served by the function.

link_data_from_tags

This data flow is used within the Manage Traffic function. It contains the link journey and queue times calculated by processing the times at which tag data was collected from vehicles on the road (surface street) and highway network served by the function.

link_delay

This data flow is used within the Manage Traffic function and contains the calculated delay for vehicles driving along a particular link in the road and highway network served by the function. This delay is the additional time it will take above that recorded during free flow conditions to travel from one end of the link to the other and will either be calculated from sensor and/or probe data, or produced by the predictive model process within the function.

link_environment_conditions

This data flow contains environment conditions (e.g. rain, wind, sun, etc) computed for a single link

link_identity

An identifier assigned to a link is where a link is a topological connection between two nodes. Link-IDs may be arbitrary, or may be assigned by convention to assure that multiple occurrences of the same ID will not occur within one network or within the universe of similar networks or databases.

link_journey_time

This data flow is used within the Manage Traffic function and contains the current journey time for vehicles on a particular link. This will have been determined using sensor data that measures traffic on the road and highway network served by the function or produced by the predictive model process.

link_list

This data flow is used within the Manage Traffic function and contains a list of links for which data is being provided. These links will comprise all of those on both the road (surface street) and highway network served by the function.

link_list_for_highways

This data flow is used within the Manage Traffic function and contains a list of links for which data is being provided. These links will comprise all of those on the highway network served by the function.

link_list_for_roads

This data flow is used within the Manage Traffic function and contains a list of links for which data is being provided. These links will comprise all of those on the road (surface street) network served by the function.

link_occupancy

This data item contains an average measure of occupancy, for a single link or sequence of links in the transportation network. The data is measured in seconds and may subsequently be converted to give a percentage value, the percentage of time for which the detector was occupied by a vehicle.

link_queue_time

This data flow is used within the Manage Traffic function and contains the current queuing time for vehicles on a particular link. This will have been determined using sensor data that measures traffic on the road and highway network served by the function or produced by the predictive model process.

link_speed

This data item contains an average measure of vehicle speed, for a single link or sequence of links in the transportation network.

link_state_data

This data flow is used within the Manage Traffic function and contains data about traffic conditions on each link within the road (surface street) and highway network in the geographic area served by the TMC. The data will apply to all links regardless of whether it is used for other purposes such as strategy selection, parking lot management, etc.

link_strategy_data

This data flow is used within the Manage Traffic function and contains processed data from sensors on a link that forms part of the road and highway network served by the TMC. The data is used as one of the inputs for the selection of the most appropriate traffic control strategy by the Provide Device Control facility.

link_traffic_conditions

This data flow contains processed sensor data providing traffic conditions for a single link.

link_type

This data flow is used within the Manage Traffic function and contains an identifier to show the type of link to which associated data applies. The link type varies according to how it fits into the road and highway network. It can be all or part of a surface street, a lane of a surface street, a lane on a highway, or all of a highway, and can have other characteristics such as high occupancy vehicles (hov) use only, etc.

list_size

This data flow is a general parameter used throughout ITS functions to specify the number of data items included in a data flow. For example it can be the number of indicators in a strategy selection message, or the number of data items that have been collected in a particular time period.

location_identity

This data element is used by many of the ITS functions to communicate the location of any transportation feature, entity, or event in an unambiguous and mutually understandable way. The Society of Automotive Engineer's Information Report SAE J2374 describes a suite of alternative location referencing interface profiles for use in Intelligent Transportation Systems. The location referencing interface profiles included in J2374 are in varying states of development and will continue to evolve as ITS user requirements and results of computer and field tests become available. The current set of interface profiles includes:

- Geometry Profile
- Geographic Coordinate Profile
- Grid Profile
- Linear Referencing Profile
- Cross-streets Profile
- Address Profile

The profiles, when incorporated into relevant standards, will provide a common language for the expression of location between the different elements of an integrated transportation system.

m_and_c_activity_schedule

This data store is used within the Manage Maintenance and Construction function and contains the current schedule for maintenance and construction activities.

m_and_c_activity_schedule_for_archive

This data flow is used within the Manage Maintenance and Construction function and contains the current schedule for maintenance and construction activities for archival.

m_and_c_activity_status

This data store is used within the Manage Maintenance and Construction function and contains the current status of M&C activities, including work status, materials availability, vehicle fleet status, asset status, field equipment maintenance status, and work zone status.

m_and_c_activity_status_for_archive

This data flow is used within the Maintenance and Construction function and

contains the current status of M&C and activities, including work status, materials availability, vehicle fleet status, asset status, field equipment maintenance status, etc. This status is created for later archival.

m_and_c_center_identity

This data flow contains the identity of a maintenance and construction fleet management center that is exchanging information with its fleet of vehicles.

m_and_c_equipment_quantity

This data flow contains the quantity of equipment (cones, portable dynamic message signs, etc.) often used to support construction and maintenance activities.

m_and_c_equipment_type

This data flow contains the type of equipment (cones, portable dynamic message signs, etc.) often used to support construction and maintenance activities.

m_and_c_fleet_manager_status

This data flow is used by the fleet management function to report the status of the fleet of maintenance and construction vehicles. It includes for each vehicle the type, equipment configuration, location, operational status, maintenance record, work activity status, and crew/operator status. Additionally, incident information and road network information are included.

m_and_c_fleet_status

This data flow is used within the Manage Maintenance and Construction function and contains a list of the maintenance and construction fleet vehicles available for use.

m_and_c_maint_resource_needs_for_archive

This data flow consists of a report to be archived consisting of the maintenance and construction resources requested by emergency, traffic, and from within the Manage Maintenance and Construction function. These resources include portable dynamic message signs, cones, and other assets.

m_and_c_materials_quantity

This data flow contains the quantity of materials (sand, salt, etc.) often used to support construction and maintenance activities.

m_and_c_materials_type

This data flow contains the type of materials (sand, salt, etc.) often used to support construction and maintenance activities.

m_and_c_materials_usage_rate

This data flow contains the rate of application of materials (sand, salt, etc.) often used to support construction and maintenance activities.

m_and_c_plan_feedback

This data flow contains comments and suggested changes to proposed maintenance and construction work plan schedules and activities. This information will be used to influence the work schedule to minimize impact to other system operations and the transportation system.

m_and_c_plan_feedback_from_emerg

This data flow is sent from the Manage Emergency Services function to the Manage Maintenance and Construction function. It contains comments and suggested changes to proposed maintenance and construction work plan schedules and activities. This information will be used to influence the work schedule to minimize impact to other system operations and the transportation system.

m_and_c_plan_feedback_from_traffic

This data flow is sent from the Manage Traffic function to the Manage Maintenance and Construction function. It contains comments and suggested changes to proposed maintenance and construction work plan schedules and activities. This information will be used to influence the work schedule to minimize impact to other system operations and the transportation system.

m_and_c_plan_feedback_from_transit

This data flow is sent from the Manage Transit function to the Manage Maintenance and Construction function. It contains comments and suggested changes to proposed maintenance and construction work plan schedules and activities. This information will be used to influence the work schedule to minimize impact to other system operations and the transportation system.

m_and_c_resource_request_from_emerg

This data flow is used to request maintenance and construction resources to include portable signs, cones, and other assets that can be used to assist in incident management and clearance, including hazard removal, repair of damage, and any other incident response.

m_and_c_resource_request_from_traffic

This data flow is used to request maintenance and construction resources to include portable signs, cones, and other assets that can be used to divert traffic, create detours, and otherwise manage traffic. It also includes requests for any other assets that may be needed to support of incident management.

m_and_c_resource_response_to_traffic

This data flow is sent to the Manage Traffic function from the Manage Maintenance and Construction function to provide the status of the requested resources, including availability and deployment status.

m_and_c_roadway_maint_needs_for_archive

This data flow is used within the Manage Maintenance and Construction function and provides information for archival concerning the roadway maintenance plan, materials, and vehicle requirements, together with the time and date needed for later analysis.

m_and_c_status_from_mcv_operator

This data flow is sent from the maintenance and construction vehicle operator via on-board systems to the vehicle fleet operator and contains the current maintenance and construction status information such as work data, operator status, vehicle_status, and crew status to the vehicle fleet manager.

m_and_c_view_of_road_network

This data flow is used within the Manage Maintenance and Construction function and contains a view of the road network appropriate for assisting the maintenance and construction center personnel, the vehicle fleet

manager when dispatching and routing vehicles, and the automated Maintenance Decision Support function. This information represents a consolidation of inputs from private vehicle probes, road network information including travel times, route usage, and incidents and incident response, and environmental information collected from the Manage Traffic and Manage Emergency Services functions. A listing of incident and weather data is provided, as well as a listing by link of road network data, roadway conditions, etc.

m_and_c_winter_maint_needs_for_archive

This data flow is used within the Manage Maintenance and Construction function and provides information for archival concerning the winter treatment plan, materials, and vehicle requirements, together with the time and date needed for later analysis

m_and_c_work_performance

This data flow is used within the Manage Maintenance and Construction function and contains data about the status of the work activity performed in the field, including a work activity identifier, progress against expectations, work issues, etc.

m_and_c_work_plans

This data flow contains information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.

m_and_c_work_plans_for_emerg

This data flow is sent from the Manage Maintenance and Construction function to the Manage Emergency Services function. It contains information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.

m_and_c_work_plans_for_info_provider

This data flow is sent from the Manage Maintenance and Construction function to the Provide Driver and Traveler Services function. It contains information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.

m_and_c_work_plans_for_traffic

This data flow is sent from the Manage Maintenance and Construction function to the Manage Traffic function. It contains information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.

m_and_c_work_plans_for_transit

This data flow is sent from the Manage Maintenance and Construction function to the Manage Transit function. It contains information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.

materials_availability_for_status

This data flow is used within the Manage Maintenance and Construction function and contains data about the types and quantities of materials available at the storage facilities. It is used to assist in determining the current status of materials usage and availability in maintenance and construction activities.

materials_status

This data flow is used within the Manage Maintenance and Construction function and contains information about the types and quantities of materials used for construction and maintenance activities.

mcv_crew_status

This data flow is used within the Manage Maintenance and Construction function and contains data about the field personnel working on a given maintenance and construction activity. It includes some form of personnel identifiers, vehicle assignments, and other pertinent crew status.

mcv_dispatch_instructions

This data is used within the Manage Maintenance and Construction function and contains dispatch instructions, including corrective actions, from the vehicle fleet manager based on input parameters from center personnel.

mcv_equipment_configuration

This data flow contains the configuration of the equipment on a maintenance and construction vehicle. For example, this could include the types of special attachments to the vehicle that transform a snowplow truck into some other type of maintenance vehicle during the summer.

mcv_infrastructure_sensor_control

This data flow provides control commands from a maintenance and construction center for infrastructure monitoring sensors located on maintenance and construction vehicles and on roadside equipment.

mcv_infrastructure_sensor_data

This data flow provides data to the Manage Maintenance and Construction function on the condition of the infrastructure as reported by sensors on maintenance and construction vehicles and roadside equipment. This infrastructure includes bridges, culverts, signs, and other roadway infrastructure. The data can be in raw data or image form. The data is collected by the maintenance and construction vehicle and passed along to a center which can then assess the current health of the infrastructure.

mcv_infrastructure_sensor_status

This data flow provides a report to the Manage Maintenance and Construction function of the status of infrastructure sensors collected from vehicle sensors on maintenance and construction vehicles and roadside equipment. This field equipment includes sensors on bridges, culverts, signs, and other roadway infrastructure. By monitoring this data flow, the receiving process can monitor the configuration, health and current status of field equipment, add it to other sources of information, and pass along to other processes for inventory update and repair if deemed necessary.

mcv_materials_status

This data flow is used within the Manage Maintenance and Construction function and contains information about the types of materials stored on-board the vehicle and the materials usage rates for use by the vehicle fleet manager.

mcv_operational_data

This data flow is used within the Manage Maintenance and Construction function and contains information about the maintenance and construction activity performed by the vehicle. Operational data includes the operational state of the maintenance equipment (e.g., blade up/down, spreader pattern) and a record of the actual work performed for use by the vehicle fleet manager.

mcv_operator_status

This data flow is used within the Manage Maintenance and Construction function and contains data about the operator or a maintenance and construction vehicle, including some form of personnel identifier, vehicle assignment, and other pertinent driver status.

mcv_status_from_operator

This data flow is sent from the maintenance and construction vehicle operator via on-board systems to the vehicle fleet operator and contains the current status of the maintenance and construction vehicle, as reported by the operator.

mcv_vehicle_systems_control_by_fleet_manager

This data flow is used by the maintenance and construction vehicle fleet manager to remotely control the systems onboard the maintenance and construction vehicle, and includes control data to support materials dispersion and other functions depending upon the type of vehicle. These control parameters include device configuration, system reset, or activation.

mcv_vehicle_type

This data flow is used within the Manage Maintenance and Construction function and contains information about the type of maintenance and construction vehicle. This flow represents an identifier to distinguish between snowplows, bucket trucks, salt/sand trucks, etc.

mcv_winter_dispatch_instructions

This data is used within the Manage Maintenance and Construction function and contains dispatch instructions for vehicle operators from the fleet manager based on input parameters from center personnel, specifically for winter conditions. This could include a treatment route, treatment application rates, start and end times, and other treatment instructions.

mcv_work_activity_status

This data flow is used within the Manage Maintenance and Construction function and contains data about the status of the work activity performed in the field, including a work activity identifier, progress against expectations, work issues, etc.

mdss_recommended_actions_for_operator

This data flow is used within the Manage Maintenance and Construction function and contains the recommended roadway treatment actions output from the maintenance decision support system function.

meso_scale_surface_trans_weather_forecasts

This data flow contains forecasts of surface transportation related weather variables and weather related events at time horizons from one to several hours and spatial horizon of one to 100 km. The time horizon is defined as the time

between the observations on which the forecast is based (alternatively, when the forecast process is started) and the time that the forecast applies to. Weather forecasts of this scale could include 'nowcasts'.

meso_scale_weather_forecasts

This data flow contains forecasts of atmospheric weather variables and weather related events at time horizons from one to several hours and spatial horizon of one to 100 km. The time horizon is defined as the time between the observations on which the forecast is based (alternatively, when the forecast process is started) and the time that the forecast applies to. Weather forecasts of this scale could include 'nowcasts'.

methods_applied

This data flow defines any methods that have been applied to the original data and includes a description of the actions performed on the data, e.g. aggregations, summarizations, transformations, privacy data stripped, etc.

micro_scale_surface_trans_weather_forecasts

This data flow contains forecasts of surface transportation related weather variables and weather related events at a time horizon of several minutes and a spatial horizon of several meters or less. The time horizon is defined as the time between the observations on which the forecast is based (alternatively, when the forecast process is started) and the time that the forecast applies to.

miso_scale_surface_trans_weather_forecasts

This data flow contains forecasts of surface transportation related weather variables and weather related events at time horizons from approximately minutes to an hour, and a spatial horizon of meters to a kilometer. The time horizon is defined as the time between the observations on which the forecast is based (alternatively, when the forecast process is started) and the time that the forecast applies to. Weather forecasts of this scale could include 'nowcasts'.

miso_scale_weather_forecasts

This data flow contains forecasts of atmospheric weather variables and weather related events at time horizons from approximately minutes to an hour, and a spatial horizon of meters to a kilometer. The time horizon is defined as the time between the observations on which the forecast is based (alternatively, when the forecast process is started) and the time that the forecast applies to. Weather forecasts of this scale could include 'nowcasts'.

need_date

This data flow contains the calendar date on which a specific activity or item is needed.

need_time

This data flow contains the time at which a specific activity or item is needed.

node_list

This data flow is used within the Manage Traffic function and contains a list of nodes for which data is being provided. These nodes will comprise all of those on both the road (surface street) and highway network served by the function.

o_d_matrix

This data flow contains an origin-destination (o-d) matrix that has been derived from the other traffic data, such as that obtained from video images of traffic. It will apply to the road (surface street) and highway network in the geographic area served by the function. The data will comprise a list of o-d pairs and the

traffic flow between them, where the pairs will be identified by link identities.

on_board_work_zone_device_status

This data flow contains the status of all work zone devices monitored or controlled on-board a maintenance and construction vehicle. These devices include dynamic message signs, highway advisory, radios, closed circuit television cameras, intrusion detection devices, and intrusion alert devices.

operational_data_for_mcv

This data flow is used within the Manage Maintenance and Construction function and contains information about the maintenance and construction activity performed by the vehicle. Operational data includes the operational state of the maintenance equipment (e.g., blade up/down, spreader pattern, equipment configuration) and a record of the actual work performed.

owner_entities

This data flow identifies the source or owning agency of the data which may be used as a point of contact when trying to make use of the data.

parking_lot_calculated_occupancy

This data flow contains the current occupancy of a parking lot, i.e. the number of vehicles present, calculated from traffic sensors located at its entrance(s) and exit(s).

parking_lot_current_occupancy

This data flow is used within the Manage Traffic function and contains the parking lot identity and current occupancy.

parking_lot_identity

This data flow is used within the Provide Electronic Payment Services and Manage Traffic function. It contains the identity of an individual parking lot so that its charges can be defined and a control strategy applied to its use.

parking_lot_input_data

This data flow is used within the Manage Traffic function and contains data that is used to calculate the occupancy of parking lots.

parking_lot_list

This data flow is used within the Manage Traffic function and contains a list of parking lots to which a particular strategy is to be applied. The strategy will either promote or discourage the use of the parking lots to generally improve traffic flow conditions in the geographic area controlled by the TMC.

parking_lot_state

This data flow contains the current state of a parking lot. It will have been determined from data provided by either the parking lot operator, the parking service provider, or a comparison of the actual occupancy of the parking lot determined from vehicle detectors sited at the lot entrance(s) and exit(s) with threshold values for each status condition. The state is stored as a character code. Some of the messages the data could describe about parking lots might include spaces, almost full, full, or closed.

parking_lot_storage_data

This data flow is used within the Manage Traffic function and contains occupancy and state data for all the parking lots in the geographic area served by the function.

pedestrian_data

This data flow is used within the Manage Traffic function and contains a list of indicators for which pedestrian demands have been found to be present. These indicators are in fact traffic signal controllers that are capable of servicing the pedestrian demand and enabling pedestrians to cross the road or highway in a safe and coordinated manner. This data is used to determine the traffic control strategy for signalized traffic intersections.

pedestrian_demand

This data flow is used within the Manage Traffic function. It contains processed pedestrian surveillance data obtained from sensors within the road (surface street) and highway network served by the TMC. The data is used to determine the traffic control strategy for signalized traffic intersections.

pedestrian_sensor_data

This data flow is used within the Manage Traffic function and contains the pedestrian data obtained from processing the other inputs from sensors around the road network.

perishability_date

This data flow is the date/time stamp of when the data being described will be removed from the archive, either the local source agencies storage or the permanent archive store.

personal_identification_status

This data flow provides information about the status of any personal identifiers associated with the described data. This data flow describes either the presence of personal information, or whether the identifying data has been hashed (replaced with system unique codes) or stripped out completely.

planned_event_data

This data flow is used within the Manage Traffic function to transfer data about planned events from the Incident Management facility to the Provide Traffic Surveillance facility for storage.

planned_event_details

This data flow is used within the Manage Traffic function and contains the details of a planned event.

pollution_state_area_collection

This data flow is used within the Manage Traffic function and contains the current states of the various types of pollution within the atmosphere in the geographic area served by the function. It also contains a summary indication of the area air quality.

pollution_state_roadside_collection

This data flow is used within the Manage Traffic function and contains the digitized values of pollution levels obtained from roadside sensors in the geographic area served by the function.

predicted_road_network_data

This data flow is used within the Manage Traffic function and contains data about predicted traffic conditions on links in the road network served by the function. This data is produced by the predictive model process.

private_vehicle_occupants

This data item is used within the Manage Traffic function and contains a count of the number of occupants in a vehicle as measured by a detector located on, or near to the highway, as the vehicles pass by its sensor.

processed_data

This data flow is used within the Manage Traffic function and contains traffic sensor data that has been processed ready for storage in both the current and historical data stores.

processed_infrastructure_sensor_data

This data flow consists of processed information concerning the condition of the roadway infrastructure and is based on data from sensor equipment located on the roadside and onboard maintenance and construction vehicles.

processed_speed_sensor_data

This data flow represents speed sensor data from one or more sensors that has been processed at the roadside to provide aggregated speed information for the vehicles being measured by the sensors. The information could be provided ready for viewing at the receiving process (e.g. as a histogram of speed) or it could be provided in a form that requires additional processing at the receiving process before the information is displayed to operators.

quality_control_attribute

This data flow identifies the data quality control screening technique applied to the data by the source function. Screening techniques may include flagging suspicious or anomalous data or removal of erroneous or suspicious values.

rail_schedules_data

This data flow contains information about scheduled rail operations for a specific locality and time frame. It includes train and maintenance schedules that may have an impact on traffic management.

ramp_controls

This data flow is used within the Manage Traffic function and contains the actual control data to be passed to a ramp meter controller. The state will show either a proceed (green) or stop (red) state dependent on what has been determined as the best strategy for traffic entering the highway via the ramp.

ramp_data

This data flow is used within the Manage Traffic function and contains data which is used to control access to freeways etc. from ramps.

ramp_identity

This data flow is used within the Manage Traffic function to identify individual ramp metering equipment used for the control of traffic entering highways.

ramp_list

This data flow is used within the Manage Traffic function and contains a list of the ramps to which a particular traffic control strategy is to be applied. The ramps are served by ramp metering equipment which has the ability to control vehicle access to the highway.

ramp_signal_state

This data flow is used within the Manage Traffic function to indicate the required state of the ramp meter controllers at the entrance to the highway ramps controlled by the TMC.

record_size

This data flow identifies the number of records contained within the set of data being described, held within either the local agencies storage or in the permanent archive.

resource_needs_from_scheduler

This data flow is used within the Manage Maintenance and Construction function and contains the resources needed by the function that schedules maintenance and construction activities.

road_conditions

This data flow contains current and forecasted road conditions. Road conditions includes surface or subsurface temperature, state(e.g. dry, wet, ice, snow, flooded), and residual chemical factors of the road surface as well as visibility near the road surface. This data is provided by road segment.

road_network_info_to_mcv

This data flow is used within the Manage Maintenance and Construction function and contains a view of the road network for the maintenance and construction vehicle systems. This information includes travel times, route usage, and incidents and incident response, and environmental information.

road_segment_conditions

This data flow contains current and forecasted road conditions for a single road segment. Road conditions includes temperature, state(e.g. dry, wet, ice, snow, flooded), and residual chemical factors of the road surface as well as visibility near the road surface.

road_segment_weather_conditions

This data flow contains current and forecasted road weather conditions for a single road segment. Road weather conditions includes temperature, humidity, precipitation, as well as wind conditions near the road surface.

road_weather_conditions

This data flow contains current and forecasted road weather conditions. Road weather conditions includes temperature, humidity, precipitation, as well as wind conditions near the road surface. This data is provided by road segment.

road_weather_info_for_emergency

This data flow contains environmental and road weather information that has been formatted for distribution to the manage emergency services function. The data may be filtered or aggregated prior to this formatting.

road_weather_info_for_isp

This data flow contains environmental and road weather information that has been formatted for distribution to the provide driver and traveler services function. The data may be filtered or aggregated prior to this formatting.

road_weather_info_for_traffic

This data flow contains environmental and road weather information that has been formatted for distribution to the manage traffic function. The data may be filtered or aggregated prior to this formatting.

road_weather_info_for_transit

This data flow contains environmental and road weather information that has been formatted for distribution to the manage transit function. The data may be filtered or aggregated prior to this formatting.

roadside_crew_warning_given

This data flow contains a time-stamped indication that an intrusion warning was generated via a roadside device, along with details of the warning (to whom was it sent or how was it sent)

roadside_device_status

This data flow is used to collect device status data, including fault information, from roadside devices such as smart probe beacons, CCTVs, in-vehicle signing equipment, automated roadway treatment systems, etc.

roadway_environment_conditions

This data flow contains processed environment sensor information which provides a summary of environment conditions referenced to a link.

roadway_maint_action_req_from_emerg

This data flow is sent by the Manage Emergency Services function to the Manage Maintenance and Construction function and contains a request for action. This includes a request for hazard removal, field equipment repair, and other roadway maintenance.

roadway_maint_action_req_from_traffic

This data flow is sent by the Manage Traffic function to the Manage Maintenance and Construction function and contains a request for action. This includes a request for hazard removal, field equipment repair, and other roadway maintenance.

roadway_maint_plan

This data flow consists of the selected roadway maintenance plan, including the type of activity to be performed (field equipment repair, grass-cutting, etc.), schedule, etc. and is provided to assist the maintenance and construction activities scheduling function.

roadway_maint_status_for_emerg

This data flow is sent from the Manage Maintenance and Construction function to the Manage Emergency Services function and contains information summarizing the current roadway maintenance activities. This also includes maintenance fleet operations affecting the road network such as winter maintenance (snow plow schedules and status).

roadway_maint_status_for_info_provider

This data flow is sent from the Manage Maintenance and Construction function to the Provide Driver and Traveler Services function and contains information summarizing the current roadway maintenance activities. This also includes maintenance fleet operations affecting the road

network such as winter maintenance (snow plow schedules and status).

roadway_maint_status_for_traffic

This data flow is sent from the Manage Maintenance and Construction function to the Manage Traffic function and contains information summarizing the current roadway maintenance activities. This also includes maintenance fleet operations affecting the road network such as winter maintenance (snow plow schedules and status).

roadway_maint_status_for_transit

This data flow is sent from the Manage Maintenance and Construction function to the Manage Transit function and contains information summarizing the current roadway maintenance activities. This also includes maintenance fleet operations affecting the road network such as winter maintenance (snow plow schedules and status).

roadway_traffic_conditions

This data flow contains sensor information which has been processed to provide traffic conditions for a link.

roadway_treatment_system_control

This data flow is used within the Manage Maintenance and Construction function and contains control information to remotely control automated field devices along the roadway that treat the road surface (anti-icing, de-icing, etc.) and the environmental sensors that indicate when activation of those devices is required.

route_identity

This data flow contains the identity of a route that is to be used for either on-line vehicle or traveler guidance. The data is for internal use within the function and identifies the route when the driver or traveler subsequently accepts it for use.

route_segment_description

This data flow is used within the Provide Driver and Traveler Services function and contains a description of the physical details for the entire route segment. This data is used to provide information from which guidance can be produced in a form which is understood by the driver, e.g. lane selection, right/left turns, etc.

route_segment_end_point

This data flow is used within the Provide Driver and Traveler Services function and the Manage Traffic function. It contains the location of the end of a route segment.

route_segment_estimated_travel_time

This data flow contains the estimated time it will take a vehicle to travel the route segment taking account of the expected conditions defined in other data.

route_segment_guided_travelers

This data flow contains the number of travelers being guided along a route segment in one minute of real time. This data only applies to non-vehicle route segments and those not provided by transit services. The travelers may not actually be on the segment at the time the data is used, but will have it included in their current personal guidance data.

route_segment_guided_vehicles

This data flow contains the number of vehicles being guided along a route segment in one minute of real time. The vehicles may not actually be on the segment at the time the data is used, but will have it included in their current route guidance data. This data flow will only apply to those route segments that are used by road vehicles other than transit vehicles.

route_segment_identity

This data flow contains the identity number of a route segment. A link may not be the same physical entity as a surface street or highway link (defined elsewhere), but in some cases they could be the same.

route_segment_journey_time

This data flow contains the average route segment journey time calculated from data being provided by guided vehicles. These vehicle are acting as probes in the road network by reporting their position to request fresh (updated) guidance at the beginning of each new route segment on their current route.

route_segment_report_position_points

This data flow is used within the Provide Driver and Traveler Services function and contains a list of any points other than those at the route segment start and end where the vehicle's position is to be reported.

route_segment_start_point

This data flow is used within the Provide Driver and Traveler Services function and the Manage Traffic function. It contains the location of the start of a route segment.

route_segment_total_number

This data flow is used define the total number of route segments in the road (surface street) and highway network served by the Manage Traffic function. This may be different from that served by the Provide Driver and Traveler Services function, and in this instance is used to define the number of route segments for which probe vehicle data is being provided to the Manage Traffic function, or the total number of route segments used by non-vehicle modes (walking, cycling, etc.) for which journey times are available.

route_segment_type

This data flow contains the definition of the type of route segment which will depend on the types of use it will support. The data flow may describe but not be limited to messages such as any type of vehicle, commercial vehicles only, transit vehicles only, commercial and transit vehicles, private cars and vans only, bicycles only, all pedestrians, no vehicles, disabled pedestrians, road route segment, and highway route segment.

route_segment_use_prediction

This data flow is used within the Provide Driver and Traveler Services function. It contains data about the number of guided vehicles that will be using a route segment over a set of time periods.

route_segment_way_point

This data flow is used within the Provide Driver and Traveler Services function and contains the location of a point part way along a route segment at which a vehicle's position is to be reported.

safety_data_for_fleet_mgmt

This data flow contains data about vehicle safety, including the status of the driver

in terms of their ability to control the vehicle, and the status of the vehicle, in terms of its continued ability to operate in a safe manner.

safety_data_for_mcv

This data flow contains data about vehicle safety, including the status of the driver in terms of their ability to control the vehicle, and the status of the vehicle, in terms of its continued ability to operate in a safe manner.

security

This data flow identifies any special security constraints on the data described by these attributes. This data flow may include an indication of whether the data is to be stored or sent encrypted.

selected_emergency_strategy

This data flow is used within the Manage Traffic function to specify the type of traffic control strategy to be applied to some or all of the road (surface streets) and highway traffic control units controlled by a TMC. The strategy will be based on the emergency vehicle route provided by the route selection facility in the Provide Driver and Traveler Services function. It will give preemption to the emergency vehicle(s) by ensuring that they are given the proceed indication (green signal) as they approach each individual intersection, pedestrian and ramp meter control unit along the emergency vehicle route. Another feature of the strategy may be the direction of other vehicles to use particular lanes on a surface street or highway so that the emergency vehicle(s) have a lane for their sole use.

selected_emergency_vehicle_strategy

This data flow is used within the Manage Traffic function and contains the strategy which has been selected to enable preemption to be given to emergency vehicles through the road (surface street) and highway network controlled by the TMC. It will cover intersection controllers, pedestrian controllers, dynamic message signs (DMS) that control lane use and ramp metering controllers. The strategies for each of these individual types of unit will be sent out as the strategies to their individual control processes. The strategy may be applied to some or all of the units on the roads and highways in the geographic area served by the TMC.

selected_highway_control_strategy

This data flow is used within the Manage Traffic function and contains the strategy which has been selected for implementation at some or all of the indicators on the highways in the geographic and jurisdictional area(s) served by the function. The strategy may be one of several depending on that which is best suited to control of traffic on the highways.

selected_parking_lot_control_strategy

This data flow is used within the Manage Traffic function and contains the strategy which has been selected for implementation at parking lots to control their use. The strategy will be designed to promote or discourage the use of a parking lot by directing vehicles to or away from it through the use of dynamic message signs (DMS). The decision on which strategy to employ will depend upon such things as the overall traffic management strategy, the need to restrict vehicle use because of a number of factors e.g. congestion, pollution, and the desire to encourage travelers to make use of alternative modes of transport by using park and ride (P+R) facilities. The strategy may be applied to some or all of the parking lots in the geographic area served by the TMC.

selected_parking_lot_strategy_type

This data flow is used within the Manage Traffic function to specify the type of strategy to be applied to some or all of the parking lots controlled by a TMC. The strategy type will be designed to promote or discourage the use of a particular parking lot and thus may either 'open' or 'close' the lot, indicate the state of the lot, i.e. the number of spaces remaining, or give priority to vehicles that are part of car or van pools.

selected_ramp_control_strategy

This data flow is used within the Manage Traffic function and contains the strategy which has been selected for implementation at highway entry ramps by the local ramp metering equipment. The strategy may be either 'open', 'closed' or 'admit vehicles when not congested' and may be applied to some or all of the ramps in the geographic area served by the TMC.

selected_ramp_strategy_type

This data flow is used within the Manage Traffic function and contains the strategy which has been selected for implementation by ramp metering equipment. The strategy may typically be one which either permanently opens or closes the ramp, or enables traffic to join the highway under certain conditions. These would be things such as low congestion on the highway, or situations where additional traffic entering the highway will not increase the level of congestion such that free flow conditions break down. An override will be provided to enable the ramp to be opened if closing it will cause unacceptable congestion to the surrounding surface streets.

selected_road_control_strategy

This data flow is used within the Manage Traffic function and contains the strategy which has been selected for implementation at some or all of the indicators on the roads in the geographic and jurisdictional area(s) served by the function. The strategy may be one of several depending on that which is best suited to control of traffic on the roads.

selected_roadway_control_strategy

This data flow is used within the Manage Traffic function and contains the strategy which has been selected for implementation at traffic signal and lane use control devices on the roads in the geographic and jurisdictional area(s) served by the function. In this context, roadway means roads (surface streets) and highways.

selected_strategy

This data flow is used within the Manage Traffic function to transfer the current traffic control strategies being implemented on highways and roads (surface streets) from the Provide Device Control facility to the Provide Traffic Surveillance facility for loading into the store of long term data.

selected_strategy_type

This data flow specifies the type of traffic control strategy to be applied to some or all of the road (surface street) and highway indicators controlled by a TMC.

sensor_device_status

This data flow is used to collect the status of an individual sensor at the roadside. This status includes the configuration of the sensor as well as fault indications. By monitoring this data flow, the receiving process can monitor the health and current status of field equipment.

sensor_fault_data

This data flow is used to show that a sensor has developed a fault or that it is not operating correctly. The fault will have been found by a process that is local to the sensor itself.

sensor_identity

This data flow contains an identifier of an individual sensor or a sensor managed by a sensor station. The identifier is either the actual equipment identifier or a code indicating the type of the sensor (e.g., wind, temperature, precipitation, traffic flow, etc).

sensor_output_data

This data flow is used within the Manage Traffic function and contains information obtained from data analyzed by traffic sensors. It is sent to the process traffic data store for current and long term data.

sensor_status

This data flow is used to collect sensor status data from the roadside.

smart_probe equip_status_for_m_and_c

This data flow contains an indication to the Manage Maintenance and Construction function that the output of the vehicle smart probe beacon is faulty. This may be due to faulty data received from a vehicle smart probe by the beacon, or the beacon itself may be malfunctioning. By monitoring this data flow, the receiving process can monitor the health and current status of field equipment and repair if deemed necessary.

speed_data_for_m_and_c_speed_monitoring

This data flow contains speed data obtained from processing the inputs from sensors around the road network.

speed_data_for_traffic_speed_monitoring

This data flow is used within the Manage Traffic function and contains speed data obtained from processing the inputs from sensors around the road network.

speed_sensor_control

This data flow provides control commands for a single speed sensor at the roadway. These commands can be used to configure the sensor and to define the conditions under which vehicle speed is output to the driver (e.g. a warning may be given only when the speed exceeds the limit set by the control command).

speed_sensor_control_from_m_and_c

This data flow provides control commands for speed sensors at the roadway.

speed_sensor_control_from_traffic

This data flow provides control commands for speed sensors at the roadway.

speed_sensor_data

The data flow represents the output of a single speed sensor located at the roadway.

speed_sensor_log_for_m_and_c

This data flow contains a log of speed sensor information. The data flow may provide periodic summaries of the speed of vehicles as measured by the sensors (e.g. a processed view such as a speed profile). The data flow may provide actual sensor readings that can be filtered and analyzed by the Monitor Vehicle Speed in Work Zone process.

speed_sensor_log_for_traffic

This data flow contains a log of speed sensor information. The data flow may provide periodic summaries

of the speed of vehicles as measured by the sensors (e.g. a processed view such as a speed profile). The data flow may provide actual sensor readings that can be filtered and analyzed by the Monitor Vehicle Speed in Work Zone process.

speed_sensor_status_for_m_and_c

This data flow provides a report of the status of a set of speed sensors. The status flow provides the sensor configuration as well as a fault indication.

By monitoring this data flow, the receiving process can monitor the health and current status of the field equipment.

speed_sensor_status_for_traffic

This data flow provides a report of the status of a set of speed sensors. The status flow provides the sensor configuration as well as a fault indication.

By monitoring this data flow, the receiving process can monitor the health and current status of the field equipment.

speed_violation_notification_for_m_and_c

This data flow contains an indication that a speed violation has been identified. The data flow would not contain the identification of the violating vehicle.

speed_violation_notification_for_traffic

This data flow contains an indication that a speed violation has been identified. The data flow would not contain the identification of the violating vehicle.

standard_data_attribute

This data flow is used to identify the presence and use of meta-data attributes for data as defined in an industry standard such as IEEE P1489, Standard for Data Dictionaries for Intelligent Transportation Systems.

standard_message_attribute

This data flow is used to identify the presence and use of meta-data attributes for messages as defined in an industry standard such as IEEE P1488, Standard for Message Set Template for Intelligent Transportation Systems.

station_id

This data flow contains the identifier of a specific piece of field equipment.

status_of_other_work_zones

This data flow contains the current status of other work zones, including field personnel status, maintenance and construction vehicle status, and activity status.

storage_facility_id

This data flow is used within the Manage Maintenance and Construction function and contains the unique facility identification number assigned to each maintenance and construction storage facility.

stored_incident_data

This data flow is used within the Manage Traffic function. It contains the current incidents and planned events at a single point in time.

strategy_data

This data flow is used within the Manage Traffic function. It contains processed surveillance data which is used to determine the traffic control strategy for the road

and highway network served by the function.

strategy_data_for_highways

This data flow is used within the Manage Traffic function. It contains processed traffic data, plus data about the closure of multimodal crossings, which is used to determine the traffic control strategy for the highway network served by the function.

strategy_data_for_roads

This data flow is used within the Manage Traffic function. It contains processed traffic and pedestrian surveillance data, plus data about the closure of multimodal crossings, which is used to determine the traffic control strategy for the road network served by the function.

suggested_route_to_mcv

This data flow provides a suggested route for a dispatched vehicle that takes into account current traffic conditions, the current location and routes of other vehicles, and any road restrictions. This data flow identifies the maintenance and construction vehicle and provides turn-by-turn route information.

surface_trans_weather_advisories

This data flow provides an indication of surface transportation related weather situations that cause significant impact upon the surface transportation network. Examples of these might be frost warnings or high profile vehicle advisories for strong winds. Advisories are issued for significant events that are occurring, are imminent, or have a very high probability of occurrence.

surface_trans_weather_forecast_details

This data flow contains forecasts of specific surface transportation related weather variables including temperature (ambient, dew point and pavement), pressure, wind parameters (direction, speed, and character), humidity, precipitation, roadway visibility, light conditions, and pavement conditions. The data flow also contains weather variable attributes such as ensemble statistics, initialization time of forecast, source of boundary conditions, means of forecast, the application location of the forecast and the applicable time of the forecast.

surface_trans_weather_observations

This data flow contains surface transportation related weather observations including temperature(ambient, dew point and pavement), pressure, wind parameters (direction, speed, and character), humidity, precipitation (amount and type), roadway visibility, light conditions, pavement conditions, etc.

surface_trans_weather_scale_forecast_data_attributes

This data flow contains meta data about the meteorological scale surface transportation weather forecast including persistence of an observation or previous forecast, numerical model used, model output statistics (MOS), and any description of how forecast types are combined.

synoptic_scale_surface_trans_weather_forecasts

This data flow contains forecasts of surface transportation related weather and weather related events at time horizons from 12 hours to several days and spatial horizon of 100 to 5000 kilometers. The time horizon is defined as the time between the observations on which the forecast is based (alternatively, when the forecast process is started) and the time that the forecast applies to.

synoptic_scale_weather_forecasts

This data flow contains forecasts of atmospheric weather and weather related events at time horizons from 12 hours to several days and spatial horizon of 100 to 5000 kilometers. The time horizon is defined as the time between the observations on which the forecast is based (alternatively, when the forecast process is started) and the time that the forecast applies to.

tam_asset_status_update_for_asset_mgmt

This data flow from the Manage Maintenance and Construction function to Asset Management contains the M&C data to be used in updating the status of assets in the inventory. The data contains information about work zones, maintenance needs, maintenance and construction schedules and status, etc.

tam_infrastructure_data_for_analysis

This data flow consists of raw and processed data from the Manage Maintenance and Construction function to Asset Management regarding the condition of the infrastructure as reported from sensor equipment on the roadside and onboard maintenance and construction vehicles. This infrastructure includes bridges, culverts, signs, and other roadway infrastructure. By monitoring this data flow, Asset Management can assess the health of the infrastructure.

tea_enforcement_request_from_m_and_c

This data flow contains a request for speed enforcement based upon collecting vehicle speed data that is in excess of the posted speed limit or are creating an unsafe condition based upon the current environmental conditions. The data flow would contain the location where speed enforcement is needed and could contain detailed information of the vehicle speeds collected from sensors at the roadway or a report of aggregated speeds.

tea_speed_sensor_status

This data flow provides a report of the status of a set of speed sensors. The status flow provides the sensor configuration as well as a fault indication. By monitoring this data flow, the receiving process can monitor the health and current status of the field equipment.

tea_speed_violation_notification

This data flow contains the information needed to identify that a speed violation has occurred. It would contain a timestamp, the speed of the vehicle, and some form of identification of the vehicle, such as a vehicle image of sufficient resolution to uniquely identify the vehicle (e.g. by license plate identification).

terf_basic_mcv_measures_for equip_repair

This data flow contains the operational status of various systems on the maintenance and construction vehicle, including brake wear, engine temperature, mileage, tire wear, belt wear, engine and brake system status, and safety system status to be presented to an equipment repair facility.

terf_fleet_maintenance_availability

This data flow is sent from the Manage Maintenance and Construction function to the equipment repair facility and contains information on when the maintenance and construction vehicles will be available for preventive and corrective maintenance.

terf_mdss_recommended_actions

This data flow is sent from the Manage Maintenance and Construction function to the equipment repair facility and contains recommended actions for preparing the equipment, such as reconfiguring the vehicles to support specific maintenance and construction activities.

terf_vehicle_utilization_information

This data flow is sent from the Manage Maintenance and Construction function to the equipment repair facility and contains information on maintenance and construction vehicle utilization to assist in predicting vehicle repair or replacement needs.

time

This data flow is used within many ITS functions. It contains the current time of day and will be associated with other data flows and (possibly) a date.

timestamp

This data flow represents the time and date at which some piece of ITS data has been measured, sensed, or created.

tm_m_and_c_work_plans_for_media

This data flow is sent from the Manage Maintenance and Construction function to the Media. It contains information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.

tm_road_weather_info

This data flow contains environmental and road weather information that has been formatted for distribution to the Media terminator. The data may be filtered or aggregated prior to this formatting.

tm_roadway_maint_status_for_media

This data flow is sent from the Manage Maintenance and Construction function to the Media and contains information summarizing the current roadway maintenance activities. This also includes maintenance fleet operations affecting the road network such as winter maintenance (snow plow schedules and status).

tm_work_zone_images

This data flow contains analog or digitized video images of a work zone that are being released for external viewing, in this case to the media.

tm_work_zone_info

This data flow contains a summary of maintenance and construction work zone activities that have been tailored for providing to the media. This information includes 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. The data flows also contains work zone resource status.

tmcas_m_and_c_administrative_request

This data flow is sent from the Maintenance and Construction function to the Maintenance and Construction Administrative Systems, and contains a request for administrative information that could affect scheduling of maintenance and construction activities, such as regulations, personnel qualifications, supply purchase request status, and the like.

tmcas_m_and_c_work_performance

This data flow is sent from the Maintenance and Construction function to the Maintenance and Construction Administrative Systems, and contains project status and work performance information to support contract administration.

tmcas_resupply_request

This data flow is sent from the Manage Maintenance and Construction function to the Maintenance and Construction Administrative Systems, and contains requests for resupply of equipment and consumables.

tmcas_work_zone_info

This data flow contains a summary of maintenance and construction work zone activities that have been tailored for providing to a maintenance and construction administrative system. This information includes the nature of the maintenance or construction activity, location, expected time(s) and duration of work zone activity, and work zone resource status.

tmtsp_m_and_c_work_plans_for_mtsp

This data flow is sent from the Manage Maintenance and Construction function to the Multimodal Transportation Service Provider. It contains information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.

tomcm_env_sensor_data

This data flow provides outputs from a set of environment sensors that are monitored by the maintenance and construction function.

tomcm_m_and_c_plan_feedback

This data flow is used by the Manage Maintenance and Construction function to send feedback regarding proposed work plans to other maintenance and construction facilities whose areas of operation are outside those of the local facility. It contains comments and suggested changes to proposed maintenance and construction work plan schedules and activities. This information will be used to influence the work schedule to minimize impact to other system operations and the transportation system.

tomcm_m_and_c_work_plans

This data flow is used by the Manage Maintenance and Construction function to send data to other maintenance and construction facilities whose areas of operation are outside those of the local facility. It contains information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.

tomcm_resource_coordination_data

This data flow represents information about resources that is to be shared between maintenance and construction facilities located in different geographic areas. Included in this data flow are requests for use and availability of those resources.

tomcm_road_weather_info

This data flow contains environmental and road weather information that has been formatted for distribution to other maintenance and construction organizations. The data may be filtered or aggregated prior to this formatting.

tomcm_roadway_maint_status

This data flow is used by the Manage Maintenance and Construction function to send data to other maintenance and construction facilities whose areas of operation are outside those of the local facility. It contains information summarizing the current roadway maintenance activities. This also includes maintenance fleet operations affecting the road network such as winter maintenance (snow plow schedules and status).

tomcm_work_zone_images

This data flow contains analog or digitized video images of a work zone that are being released for external viewing, in this case to another maintenance and construction management agency.

tomcm_work_zone_info

This data flow contains a summary of maintenance and construction work zone activities that have been tailored for providing to another maintenance and construction organization. This information includes 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. The data flows also contains work zone resource status.

tomcv_crew_movements

This data flow is sent to another maintenance and construction vehicle and contains the location of a maintenance and construction field personnel within a work zone area and some form of personnel identifier that would allow transmitting of a warning to the specific personnel based upon detection of intrusion at a certain point within a work zone. The data flow may also contain an identifier of the sending maintenance and construction vehicle to allow transmission of warnings to be sent back to this specific vehicle.

tomcv_env_conditions

This data flow contains environmental sensor data collected on-board a maintenance and construction vehicle. The data may represent the actual sensor output, or may be a filtered or processed version for display to the operator of another maintenance and construction vehicle.

tomcv_vehicle_operational_data

This data flow is sent to other vehicles from the Manage Maintenance and Construction function and contains information about the maintenance and construction activity performed by the vehicle. Operational data includes the operational state of the maintenance equipment (e.g., blade up/down, spreader pattern) and a record of the actual work performed. It is used to coordinate efforts between maintenance and construction vehicles.

tomcv_work_zone_intrusion_alert_on_board

This data flow contains a timestamped indication that a work zone intrusion alert has been generated by a device on-board a maintenance and construction vehicle. The data flow could also identify the form in which the alert was given (e.g. audible warning, visual warning, or in-vehicle warning)

tomcv_work_zone_intrusion_detection_on_board

This data flow contains the timestamped output of an on-board intrusion detection device indicating that an intrusion has been detected. This intrusion detection is sent to another maintenance and construction vehicle.

tomcv_work_zone_intrusion_warning_to_crew

This data flow contains a warning sent by a maintenance and construction vehicle to another maintenance and construction vehicle that an intrusion into the work zone has been detected. The data flow may contain the identity of the sending vehicle, the identity of the receiving vehicle, the location of the intrusion, and the identity of the maintenance and construction field personnel that are at risk due to the location and nature of the intrusion.

traffic_flow_state

This data flow is used within the Manage Traffic function. It contains data showing the current traffic flow conditions on roads (surface streets), freeways and ramps served by the function. It also includes flows in high occupancy vehicle (hov) lanes from the same area. The data is a subset of that in the current and historical data stores and is used as a means of 'packaging' the data for distribution to users such as ISP's.

traffic_management_storage_data

This data flow is used within the Manage Traffic function. It contains the indicator control and response states plus the selected traffic control strategy(ies) for the road (surface street) and highway network served by the function. The data is a subset of that in the current and historical data stores.

traffic_sensor_data

This data flow is used within the Manage Traffic function and contains the data obtained from processing the inputs from sensors around the road network.

traffic_sensor equip_status_for_m_and_c

This data flow provides a report to the Manage Maintenance and Construction function of the status of a traffic sensor. By monitoring this data flow, the receiving process can monitor the health and current status of field equipment. By monitoring this data flow, the receiving process can monitor the health and current status of field equipment and repair if deemed necessary.

traffic_sensor_output

This data flow is the output of a single sensor. The output is either raw or aggregated data calculated over a period of time from that sensor.

traffic_sensor_status

This data flow is used to report the status of a sensor. By monitoring this data flow, the receiving process can monitor the health and current status of field equipment.

traffic_video_camera_number

This data flow is used within the Manage Traffic function. It contains the identity of a high resolution video camera used for traffic surveillance.

traffic_video_image

This data flow is used within the Manage Traffic function and contains a video image of sufficient fidelity to support operator monitoring applications. This image can be a by-product of a machine vision application or the end-product of a system dedicated to traffic surveillance.

traffic_video_image_data

This data flow is used within the Manage Traffic function. It contains the video image

which is used by a roadside device to measure traffic flow measures.

transit_vehicle_identity

This data flow is used within the Manage Transit function and contains the identity of an individual transit vehicle. This data is used by processes within the function to identify the source and/or ownership of other data.

tro_m_and_c_work_plans_for_rail

This data flow is sent from the Manage Maintenance and Construction function to the Rail Operations. It contains information about scheduled maintenance and construction work activities including anticipated closures and impact to the roadway, alternate routes, anticipated delays, closure times, and durations.

tro_railroad_schedule_feedback

This data flow is sent from the Manage Maintenance and Construction function to the Rail Operations. It contains comments and suggested changes to proposed rail schedules for train and rail maintenance activities.

tro_road_weather_info

This data flow contains environmental and road weather information that has been formatted for distribution to the Rail Operations terminator. The data may be filtered or aggregated prior to this formatting.

tsf_equipment_availability_request

This data flow is sent from the Manage Maintenance and Construction function to the storage facility, and contains a request for equipment inventory information, including the availability, suitability for use, and current status of equipment at the facility.

tsf_materials_status_request

This data flow is sent from the Manage Maintenance and Construction function to the storage facility, and contains a request for an update on data about the types and quantities of the materials available at the storage facility.

tstws_asset_treatment_info

This data flow is sent from the Manage Maintenance and Construction function to the Surface Transportation Weather Service and contains basic road facility and treatment information that supports forecasts for road conditions.

tstws_env_info

This data flow contains processed environmental and road weather information. This data is the result of aggregation, fusing, filtering or analysis of the input environmental and weather data. This data flow includes road condition observations and road condition predictions. The data flow includes road weather forecasts and road weather observations.

tstws_env_sensor_data

This data flow provides outputs from a set of environment sensors that are monitored by the maintenance and construction function.

tstws_roadway_env_sensor_data

This data flow provides a set of outputs from environment sensors at the roadway.

tstws_roadway_env_sensor_status

This data flow provides a report of the status of a set of environmental

sensor. By monitoring this data flow, the receiving process can monitor the health and current status of field equipment.

tstws_trans_weather_info_request

This data flow contains a request for transportation weather information. This request may specify the area of interest (a geographic area, particular routes within a region, or specific road segments) or the desired type of information (e.g. temperature, roadway visibility). The request may specify observation or forecast information. For forecast information the request may specify the 'scale' of the forecast (i.e. the spatial resolution and time horizon of the forecast).

tws_env_info

This data flow contains processed environmental and road weather information. This data is the result of aggregation, fusing, filtering or analysis of the input environmental and weather data. This data flow includes road condition observations and road condition predictions. The data flow includes road weather forecasts and road weather observations.

tws_env_sensor_data

This data flow provides outputs from a set of environment sensors that are monitored by the maintenance and construction function.

tws_roadway_env_sensor_data

This data flow provides a set of outputs from environment sensors at the roadway.

tws_roadway_env_sensor_status

This data flow provides a report of the status of environmental sensors at the roadway. By monitoring this data flow, the receiving process can monitor the health and current status of field equipment.

unit_number

This data flow is used within the Manage Traffic function to provide an identification number of a particular piece of equipment, e.g. intersection signal controller, pedestrian signal controller, dynamic message sign (DMS), ramp meter, parking lot, road/highway link, toll segment, traffic sensor, etc.

vehicle_attitude_data

This data flow is used within the Provide Vehicle Monitoring and Control function and contains data about a vehicle's attitude, e.g. upright, rolled to the left, right, nose down, etc.

vehicle_count

This data item contains a count of the number of vehicles which have been detected by a detector located on the highway or at a parking lot entrance or exit, as the vehicles flow over its sensor. The units are vehicles-per-hour (veh/hr).

vehicle_headway

This data item contains the measure of time between two successive vehicles in a traffic lane as they pass a point on the roadway. Measurements are taken from front bumper of vehicle to front bumper of other vehicle in seconds

vehicle_id_for_mcv

This data flow is used within the Manage Maintenance and Construction function and contains the unique vehicle identification number assigned to each maintenance and construction vehicle.

vehicle_location_for_mcv

This data flow is sent from the Provide Driver and Traveler Services function to the Manage Maintenance and Construction function and contains a vehicle's location as computed from data input to sensors controlled by the process that determines vehicle location. This is a high precision data flow that enables the location of a maintenance and construction vehicle to be pin-pointed to a high degree of accuracy.

vehicle_location_for_mcv_tracking

This data flow is within the Manage Maintenance and Construction function and contains the current location of a maintenance and construction vehicle, together with the time and date to which the location applies for use in tracking the maintenance and construction vehicle fleet.

vehicle_motion_data

This data flow is used within the Provide Vehicle Monitoring and Control function and contains data about the motion of a vehicle, e.g. forwards, to the left, etc.

vehicle_occupancy

This data item contains a count of the time for which a vehicle occupied the point in the surface street or highway at which a detector is located. The data is measured in seconds and may subsequently be converted to give a percentage value, the percentage of time for which the detector was occupied by a vehicle.

vehicle_proximity_data

This data flow is used within the Provide Vehicle Control and Monitoring function and contains information on the closeness of any other vehicle or object to the vehicle in any direction.

vehicle_queue_length

This data item contains a measure of the length of queue as measured by a traffic sensor. This may be on the roadway (surface street or highway), or at specific locations such as the entrance to a parking lot. The data contains the approximate number of vehicles, based on the average vehicle length and the position of the detector relative to a fixed point from which the queue needs to be measured.

vehicle_safety_status

This data flow contains data about the extent of a vehicle's collision damage.

vehicle_security_status

This data flow contains the status of the vehicle's security systems, which include the lock system and/or alarm system. This data flow could be a coded representation of the status (e.g. LE- locks engaged, LD-locks disengaged).

vehicle_sign equip_status_for_m_and_c

This data flow is used within the Manage Maintenance and Construction function and contains an indication that a fault has been found with the equipment that outputs in-vehicle sign data at the roadside. By monitoring this data flow, the receiving process can monitor the health and current status of field equipment and repair if deemed necessary.

vehicle_smart_probe_data

This data flow contains data which provides information about conditions in the vicinity of the smart probe. These conditions, which may be the indication of a hazard on the road or freeway that has been detected by sensors on-board the vehicle. The type of information measured could comprise but not be limited to such things as, temperature, fog, ice, snow, and road condition

(e.g. wet, icy, dry). The data may be provided as distinct elements with actual measured values (e.g. temperature) or it could provide conditions from a list of codes.

vehicle_smart_probe_data_for_storage

This data flow is used within the Manage Traffic function. It contains the processed vehicle smart probe data collected from a roadside unit, which in turn have received data output by suitably equipped vehicles as they pass by.

vehicle_smart_probe_data_indication

This data flow contains the data from a vehicle smart probe, processed to provide an indication of the type of hazard that the vehicle found on the road or freeway. The indication may include: bridge down, i.e. broken, or in some way hazardous to traffic; earth or mud slide; fog, smoke or mist reducing visibility; the road surface is icy; road covered by a liquid, e.g. oil, which makes it hazardous to traffic; obstacle on road, e.g. fallen tree, telegraph pole, etc.; road subsidence, i.e. part of the road surface has fallen away.

vehicle_smart_probe_data_source

This data flow is used within the Manage Traffic function. It contains the identity and location of the roadside unit that has collected a particular vehicle smart probe data.

vehicle_smart_probe_data_source_identity

This data flow is used within the Manage Traffic function. It contains the identity of the roadside unit that has collected a particular vehicle smart probe data.

vehicle_smart_probe_data_source_location

This data flow is used within the Manage Traffic function. It contains the location of the roadside unit that has collected a particular vehicle smart probe data.

vehicle_smart_probe_stored_data

This data flow is used within the Manage Traffic function. It contains the processed vehicle smart probe data collected from roadside units.

vehicle_speed

This data item contains the speed of a vehicle which has been detected by a detector located on the highway as the vehicle flowed over its sensor.

vehicle_status_details

This data flow contains the operational status of the vehicle as determined from on-board sensors.

vehicle_status_details_for_emissions

This data flow is sent from the Provide Vehicle Control and Monitoring function to the Manage Traffic function. It contains the operational status of the vehicle which is important because the levels of pollution vary according to how long the vehicle has been running, i.e. how warm is the engine, and what it is actually doing, e.g. is it stationary, or pulling away from a stop.

vehicle_system_status

This data flow contains the operational status of various systems within the vehicle, such as braking, engine, and safety devices. This data flow could be a coded representation of the system status (e.g. engine not at operating temperature, driver in control of the vehicle, vehicle under

automatic control, vehicle in acceleration mode, i.e. speed increasing, vehicle in deceleration mode, i.e. speed decreasing, vehicle in braking mode, i.e. brakes on, potential vehicle fault, i.e. there is a fault but it doesn't affect operations, vehicle safety fault, i.e. the vehicle has a fault affecting its safety) or it could be a set of parameters with values associated.

vehicle_utilization_information

This data flow is used within the Manage Maintenance and Construction function and contains information on maintenance and construction vehicle utilization to assist in predicting vehicle repair or replacement needs.

video_device equip_status_for_m_and_c

This data flow provides a report to the Manage Maintenance and Construction function of the status of CCTV equipment at the roadside. By monitoring this data flow, the receiving process can monitor the health and current status of field equipment and repair if deemed necessary.

weather_advisories

This data flow provides an indication of weather situations that cause significant inconveniences but do not meet warning criteria and, if caution is not exercised, could lead to life-threatening situations. Advisories are issued for significant events that are occurring, are imminent, or have a very high probability of occurrence.

weather_forecast_details

This data flow contains forecasts of specific atmospheric weather variables including temperature (ambient and dew point), pressure, wind parameters (direction, speed, and character), humidity, precipitation, visibility, and light conditions. The data flow also contains weather variable attributes such as ensemble statistics, initialization time of forecast, source of boundary conditions, means of forecast, the application location of the forecast and the applicable time of the forecast.

weather_observation_attributes

This data flow contains meta data about weather observations. This meta data includes time of observation, observation facility characteristics, and identification of filtering or assimilation performed on the observations.

weather_scale_forecast_data_attributes

This data flow contains meta data about the meteorological scale forecast including persistence of an observation or previous forecast, numerical model used, model output statistics (MOS), and any description of how forecast types are combined.

weather_warnings

This data flow provides a localized warning of severe or hazardous weather conditions that may impact (or constitute a hazard for) the majority of people in a given areas. Warnings are given for summer weather related events such as hail, hurricanes, thunderstorms, tornados, storm surges, excess heat, high winds, heavy rain etc. Warnings are given for winter weather related events such as winter storms(blizzards, heavy snow, or ice), freezing rain, flash freezing, extreme cold temperatures or windchill, frost, etc.

weather_watches

This data flow provides an indication that a region is may experience severe weather conditions in the near future. A weather watch is intended to alert the public to the possibility that severe weather conditions (mainly severe thunderstorms) may develop later such that a warning may be

issued. Watches are most frequently issued to advise of the potential for the development of severe thunderstorms during the summer season, but they may also be issued in advance of severe winter storms.

wide_area_pollution_data

This data flow is used within the Manage Traffic function as a means of transferring current pollution data from the Manage Emissions facility to the Provide Traffic Surveillance facility. It contains data about the current levels of pollution obtained from the store of pollution data in the area covered by the Traffic Management Center (TMC).

winter_dispatch_orders_to_mcv

This data is used within the Manage Maintenance and Construction function and contains dispatch information from the vehicle fleet manager to the maintenance and construction vehicle for winter conditions.

winter_maint_action_req_from_traffic

This data flow is sent by the Manage Traffic function to the Manage Maintenance and Construction function and contains a request for action. This includes a request for treatment of icy roads, and other winter roadway treatment.

winter_treatment_plan

This data flow consists of the selected winter maintenance treatment plan, including the type of activity to be performed, schedule, etc. and is provided to assist the maintenance and construction activities scheduling function.

work_zone_activity_plan

This data flow is used within the Manage Maintenance and Construction function and contains the work activity schedule for use by construction activities in work zones. This flow includes the schedule, work activity to be performed, the site location, and any special instructions.

work_zone_data_for_archive

This data flow contains data that describes the current status of work zone activities, including work status, resource status, device status, and sensor data. This status is created for later

work_zone_data_for_status

This data flow contains an overall status of work zone activity created by combining inputs from work zone devices being monitored or controlled, work zone sensors (such as speed monitoring or intrusion detection sensors) and maintenance and construction field personnel. The data flow also contains work zone plans and work zone information status collected from work zones under the control of other maintenance and construction organizations. This data flow represents the formatting, filtering, and aggregation of these data inputs to create the overall status.

work_zone_device_status

This data flow contains the status of all roadside devices monitored or controlled by the maintenance and construction management function. These devices include dynamic message signs, highway advisory, radios, closed circuit television cameras, intrusion detection devices, and intrusion alert devices. The data flow provides configuration data on the devices as well as device fault indication.

work_zone_equipment_status

This data flow contains the status of maintenance and construction equipment

assigned to a specific work zone. Each equipment status would also contain an equipment identifier.

work_zone_identifier

This data flow contains an identifier that is assigned to a particular work zone for status and reporting purposes.

work_zone_images

This data flow contains a high resolution digitized image of a portion of a work zone taken from a particular point on the road or freeway network.

work_zone_images_for_isp

This data flow contains analog or digitized video images of a work zone that are being released for external viewing, in this case to an information service provider.

work_zone_images_for_traffic

This data flow contains analog or digitized video images of a work zone that are being released for external viewing, in this case to a traffic management agency.

work_zone_info_for_emergency

This data flow contains a summary of maintenance and construction work zone activities that have been tailored for providing to an emergency management organization. This information includes 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. The data flows also contains work zone resource status.

work_zone_info_for_isp

This data flow contains a summary of maintenance and construction work zone activities that have been tailored for providing to a traveler information organization. This information includes 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.

work_zone_info_for_traffic

This data flow contains a summary of maintenance and construction work zone activities that have been tailored for providing to a traffic management organization. This information includes 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. The data flows also contains work zone resource status.

work_zone_info_for_transit

This data flow contains a summary of maintenance and construction work zone activities that have been tailored for providing to a transit management organization. This information includes 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.

work_zone_intrusion_alert

This data flow contains a timestamped indication that a work zone intrusion alert has been generated. The data flow could also identify the form in which the alert was given (e.g. audible warning, visual warning, or in-vehicle warning)

work_zone_intrusion_alert_on_board

This data flow contains a timestamped output of an on-board intrusion alert device indicating that an intrusion alert has been given to field personnel.

work_zone_intrusion_alert_on_board_for_in_vehicle_signing

This data flow contains data for use in producing an in-vehicle signage display that provides as alert that the vehicle is approaching too fast, or is too close to a maintenance and construction vehicle.

work_zone_intrusion_detected

This data flow contains an indication from an intrusion detection sensor that an intrusion into the perimeter of the work zone has occurred.

work_zone_intrusion_detection_for_on_board

This data flow contains the output of an intrusion detection device indicating that an intrusion of the work zone perimeter has been detected. This intrusion detection from a roadside device is sent to a process on-board a maintenance and construction vehicle.

work_zone_intrusion_video_image

This data flow contains timestamped high resolution digitized video images of a work zone. These images are used to identify that a work zone intrusion has taken place.

work_zone_intrusion_warning_data

This data flow contains a summary view of work zone intrusion data.

work_zone_intrusion_warning_notification

This data flow contains a timestamped indication that a work zone intrusion warning has been generated on-board a maintenance and construction vehicle.

work_zone_personnel_status

This data flow contains the status of personnel who are currently working in a work zone. The data flow would attach some form of personnel identifier to the status indication.

work_zone_resource_status

This data flow contains the status of work zone resources, including personnel, vehicles, and equipment.

work_zone_status_from_mcv

This data flow contains inputs on work zone status provided by the maintenance and construction field personnel on-board a maintenance and construction vehicle. These inputs include field personnel status, vehicle status, and work activity status. The work zone status inputs include 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_vehicle_status

This data flow contains the status of maintenance and construction vehicles at a specific work zone. The data flow would also contain a vehicle identifier.

work_zone_warning_given_on_board

This data flow contains a timestamped indication that an on-board device monitoring crew movements has generated an intrusion warning alert. The data flow would contain to whom was sent or how it was sent)