

# *Standards Requirements Package 11: Transit Management Subsystem Interfaces*

---

Prepared by the  
*Architecture Development Team*

Lockheed Martin  
Odetics Intelligent Transportation Systems Division

Prepared for:

Federal Highway Administration  
US Department of Transportation  
Washington, D. C. 20590

December 1999

## Table of Contents

<b>1. Introduction to Standards Requirements Documentation</b>	<b>4</b>
<b>2 Introduction to this Standards Package</b>	<b>8</b>
<b>3 Transaction Sets for the TRMS Interfaces</b>	<b>10</b>
3.1.1 Reservation and Fare Payment	10
3.1.2 Fare Enforcement	10
3.1.3 Emergency Notification	11
3.1.4 Secure Area Monitoring	11
3.1.5 Traveler Information	11
3.1.6 Transit Services	12
3.1.7 “Pushed” Data Updates	12
3.2 The Transit Management Subsystem to Transit Vehicle Subsystem Interface	13
3.2.1. Emergency Situations	13
3.2.2. Reservation and Fare Payment	13
3.2.3. Advance Payment for Services	14
3.2.4. Fare Enforcement	15
3.2.5. Traveler Information	15
3.2.6. “Pushed” Data Updates from the Transit Vehicle	16
3.2.7. Driver Instructions and Information	17
3.2.8. Fleet Maintenance Status	17
3.2.9. Update the In-Vehicle Kiosk	18
3.3 Transit Management Subsystem to Parking Management Subsystem	18
3.3.1 Parking Lot Price Data	18
3.4 Transit Management Subsystem to Personal Information Access Subsystem	18
3.4.1 Personal Transit Information	18
3.5 Transit Management Subsystem to External Terminators	19
3.5.1 TRMS to Enforcement Agency	19
3.5.2 TRMS to Multimodal Transportation Service Provider	19
3.5.3 TRMS to Media	20
3.5.4 TRMS to Other TRM	20
3.5.5 TRMS to Weather Service	21
<b>4 Interface Decomposition</b>	<b>22</b>
<b>5 Communications Considerations</b>	<b>41</b>
5.1 Communications Services: Wireline and Wireless	41
5.2 Wireline Communication Elements (w)	41
5.2.1 Wireline for Kiosks at Transit Stops	43
5.3 Wireless Communication Elements (u1 and u2)	43
5.3.1 Wide Area Wireless Communications (u1)	43
5.3.2 Dedicated Short Range Communications (u2)	44
5.3.3 Wireless for Transit Vehicles	45
<b>6 Constraints</b>	<b>47</b>
6.1 Assessment Categories	47
<b>7 Leveled Data Items</b>	<b>49</b>

## Table of Figures

Figure 1. Example of the parts of an interface decomposition.....	7
Figure 2. Subsystems and Architecture Flows for Transit Management .....	9

## Table of Tables

Table 1. Wireline Data Flows for Transit Management Interfaces	43
Table 2. Wireless Data Flows for Transit Management Interfaces	45
Table 3. Constraints on the Architecture Data Flows between Transit Management Interfaces	48

# **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.

## **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, 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 Standards Organization (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 13 packages were identified as covering the high priority standardization needs for the architecture program:

1. Dedicated Short Range Communications (DSRC, formerly “VRC”)
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

These 13 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 ways 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. We have gone through a number of iterations to try and achieve a format that is understandable and useful for SDO's; in the end, while there is not a universal consensus, we have tried to address the substance of most of the comments received.

This Standards Requirements Package has the following main components:

- General introduction to the scope and intent of this package
- Message transaction sets
- Decomposition of the interfaces
- Communications Considerations
- Constraints
- Leveled Data Item definitions

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

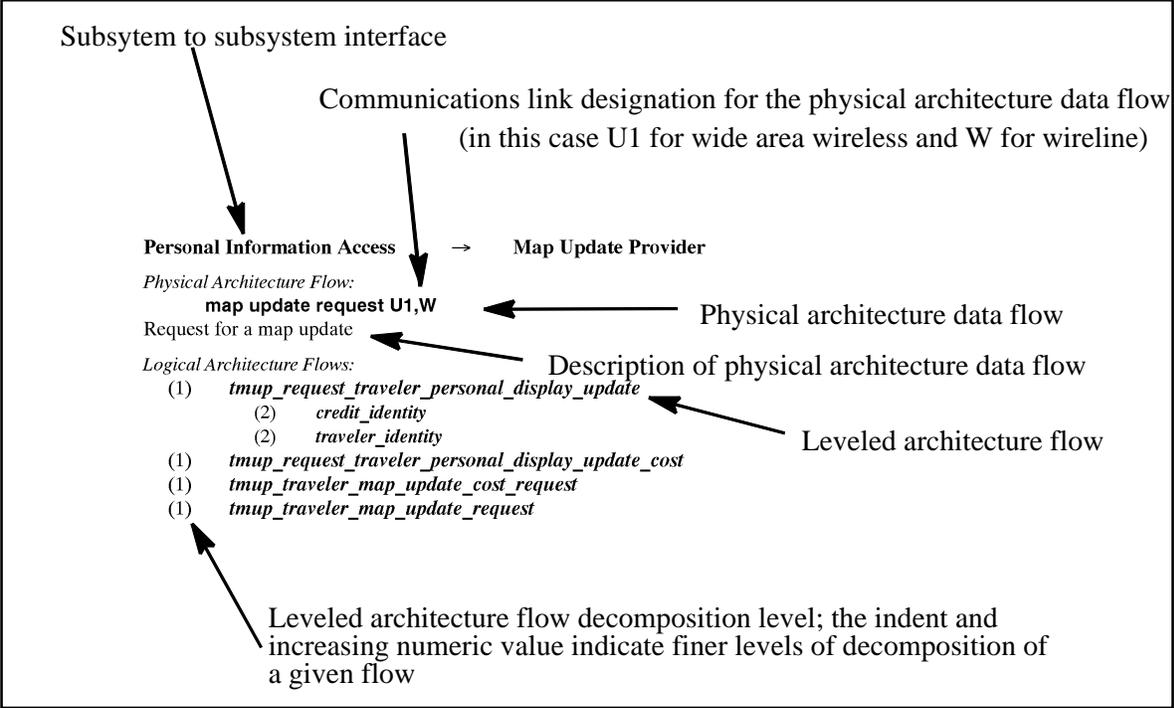
*Message Transaction Sets:* In order to accomplish a given activity, a series of messages usually have to be exchanged between two or more subsystems. These messages, as a group, constitute a message transaction set. The sequencing of the messages is shown via an ISO-style message sequence chart. Typically the physical architecture flow or highest level logical architecture data flows represent individual messages.

*Interface Decomposition:* This is the hierarchy of items that constitute an interface. It starts with the interface between two subsystems itself, which is then decomposed into physical architecture flows. Each of the physical architecture flows is then decomposed into a set of Leveled Architecture Flows. These sets of flows have been created in order to capture the essential information described by the National ITS Architecture on each Subsystem interface of interest. The Leveled Architecture Flows can be thought of as a simplified view of the logical architecture information, removing aggregation of data which does not add value to describing the essential information on the interface, and removing some of the lower level details in the existing data flows. These leveled architecture flows are traceable to flows in the logical architecture. The physical architecture data flows are labeled with the type of communications technology appropriate for that flow. Figure 1 shows an example of an interface decomposition. The leveled data items represent a simplification of the logical architecture information to focus on the essential data on each subsystem interface. They have been developed in order to provide traceability between the ITS standards being developed and the National ITS Architecture. Once a draft standard has been developed, the question that must be addressed is whether the standard addresses completely all elements of the National ITS Architecture interface. Due to the complex hierarchical nature of the Logical Architecture data flows, comparison with standards outputs is very difficult. By creating a simplified view of each interface, it is possible to more effectively trace the standards outputs to the National ITS Architecture.

*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.

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

*Leveled Data Items:* This section provides a set of definitions for each of the leveled data elements included in the Interface Decomposition section. These definitions are simplified versions of the definitions contained in the Logical Architecture Data Dictionary, providing just the essential information to define the key elements of a subsystem interface.



**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 ISO 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 ISO 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 ISO 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 covers the interface between the Transit Management subsystem (TRMS) and the Transit Vehicle subsystem (TRVS), and also the interface between the TRMS and the Remote Traveler Support subsystem (RTS). This is a somewhat unusual combination, in that the TRMS-TRVS interface will invariably be wireless and the TRMS-RTS interface will typically be wireline. However, the functionality that these two interfaces provide is very similar, and hence the grouping. Other interfaces will be included in this SRD as well, such as, the interfaces between TRMS and the Personal Information Access subsystem (PIAS), and Parking Management subsystem (PMS). The interface to PIAS will be a combination of wireless and wireline communications and to PMS will be wireline. Interfaces between TRMS and the terminators (Enforcement Agency, Weather Service, Media, Multimodal Transportation Service Provider, and Other TRM) will also be included in this SRD.

The TRMS-RTS interaction is intended to cover the communications between kiosk-type devices, as well as, panic buttons, closed circuit television (CCTV), and audio equipment, located at roadside transit stops and the Transit Management Center. This equipment would support activities, such as, buying tickets for specific transit trips, finding the time of the next bus arrival, reporting emergency situations at the transit stop and monitoring the secure area, and even requesting general traveler yellow pages-type information. Not all of this functionality would need to be implemented at once, but the basic ticketing/reservation service technology exists now and the other services are reasonable to expect in the near future. Figure 2 shows the relevant subsystems and the architecture flows that define the interfaces considered in this package.

The TRMS-TRVS interface supports a number of transit vehicle management functions, such as reporting vehicle status, providing instructions to the driver, requesting yellow pages services, and allowing emergency assistance requests. In addition, this interface also supports functionality for the travelers, such as ticket purchasing. For this latter activity, the functionality of this interface closely parallels that of the TRMS-RTS interface. Indeed, the ultimate future situation may essentially find intelligent kiosks placed on the transit vehicle and carrying out wireless interactions with the transit management center when necessary.

The other interfaces to Transit Management include Parking Management (requesting park and ride transit services), PIAS (requesting details of a transit route to fulfill origin/destination requirements of a particular transit user), and Planning (providing passenger information and route and schedule data).

The architecture flows in Figure 2 are all rated as requiring “product” level interoperability. This comes from the assumption that all three subsystems involved will be owned by a single transit agency. Thus the primary concern for interoperability is to preserve investment and minimize costs, rather than to connect with other agencies' systems. In cases where this is not true, such as coordinating a private supplier of paratransit services with a public fixed route bus operator, the interoperability requirements would be raised to “regional”.

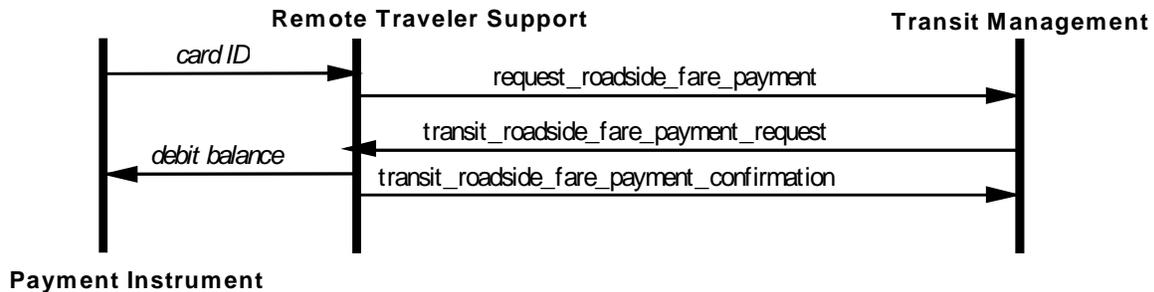
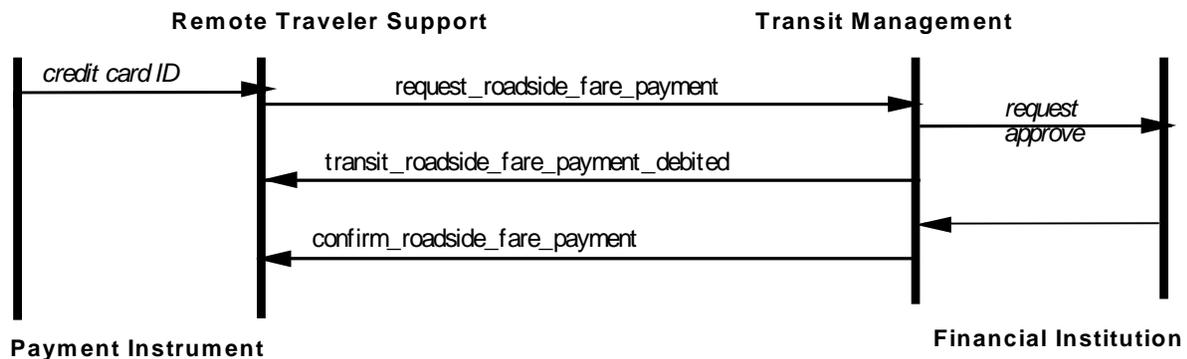


### 3 Transaction Sets for the TRMS Interfaces

Based on the top level logical architecture data flows presented in the previous section, we can define the transaction sets needed to accomplish different ITS tasks. A message sequence chart format along the line of those defined under ISO standardization is used for clarity of presentation. 3.1 The Transit Management Subsystem to Remote Traveler Support Subsystem Interface

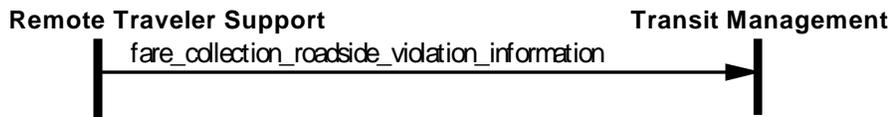
#### 3.1.1 Reservation and Fare Payment

Two versions of roadside fare payment at an RTS are envisioned. The top diagram covers the scenario of paying with a credit card-type device, where an account somewhere in the infrastructure must be debited for the transaction. The second diagram covers the case of a card with a cash balance on it; here the card itself, rather than an account, is debited.



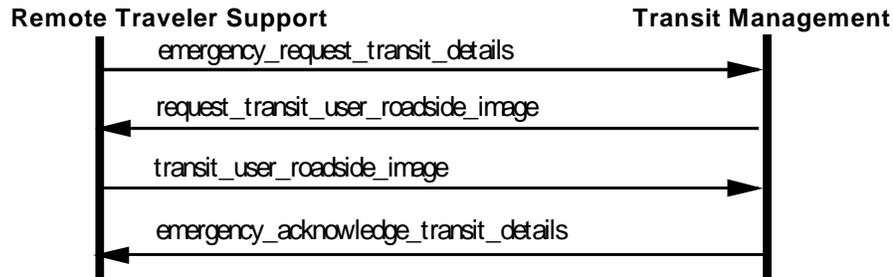
#### 3.1.2 Fare Enforcement

In the case of RTS users who try to violate the fare collection system (for example, through the use of an invalid cash card), the TRMS is notified of the details of the violation.



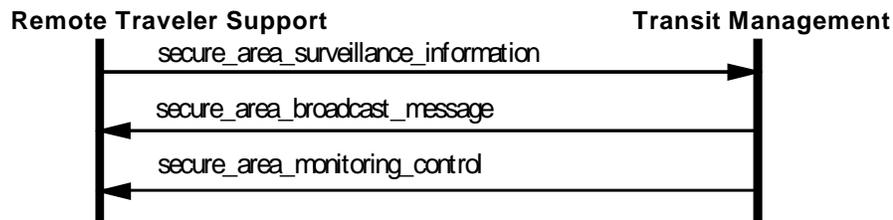
### 3.1.3 Emergency Notification

A traveler may initiate an emergency request for assistance using an in-vehicle, public access (kiosk, panic button), or personal device. If the kiosk or transit stop is equipped with camera surveillance capability, the TRMS can request an image of the traveler to aid emergency and enforcement activities.



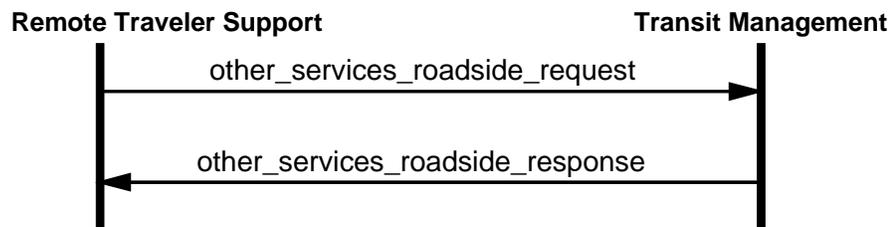
### 3.1.4 Secure Area Monitoring

A traveler may initiate an emergency request for assistance using a public access (panic button) device. Data is also collected from surveillance systems used to monitor the secure areas. This includes video, audio, and other security sensor outputs.



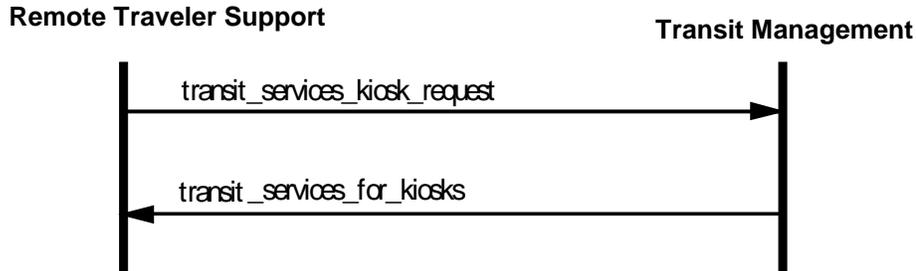
### 3.1.5 Traveler Information

The RTS kiosk system, as a courtesy to the travelers or perhaps as an additional source of funds, can provide information about other services not directly provided by the Transit Agency. This may include yellow pages types of information. These services would not be provided by the TRMS typically, but the information would clear through the TRMS to its kiosk system.

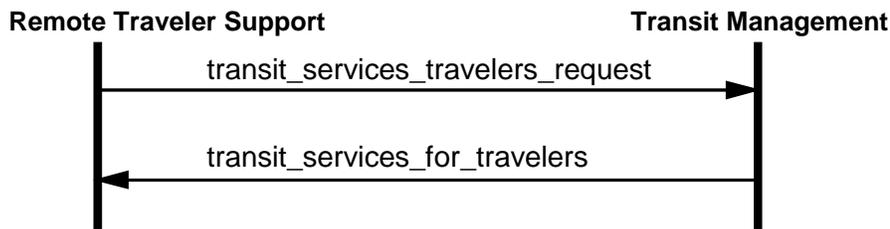


### 3.1.6 Transit Services

Through this function, a traveler may request a list of transit services for presentation at a kiosk. This would list the various services provided by the transit agency to persons at this roadside transit stop, and provide a basis for trip planning.

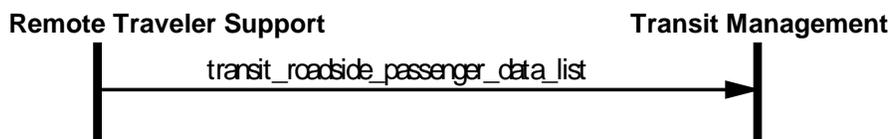


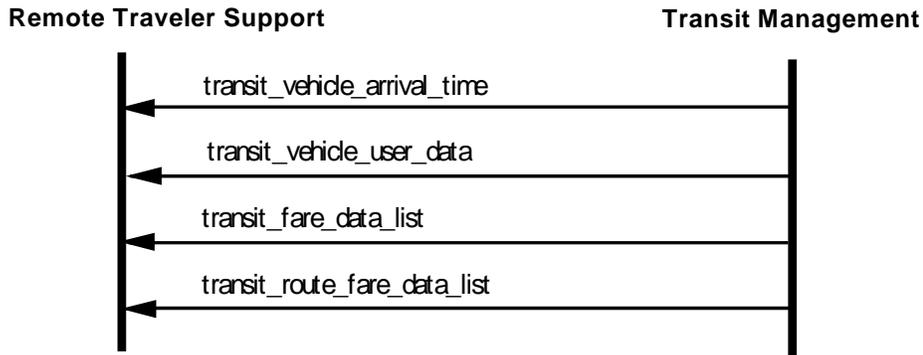
Individual travelers may make kiosk inquiries about the various services provided, based on that travelers' particular needs.



### 3.1.7 "Pushed" Data Updates

These are updates of information at either the TRMS or RTS. This information is provided either on some regular schedule or as available; that is, "pushed" to the recipient. This is contrasted with requested or "pulled" data. The top diagram shows cumulative information about passenger usage of this particular kiosk, and the lower diagram shows a set of messages used to update the local information stored on the kiosk. Note that the lower diagram is not meant to imply any sequencing of these messages.

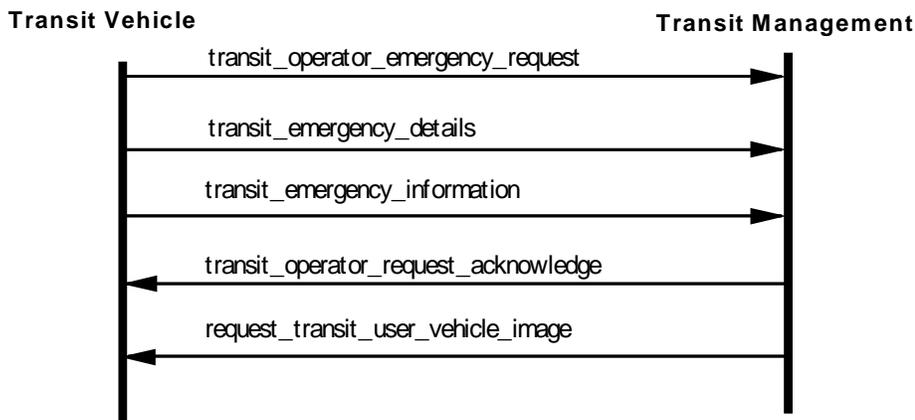




## 3.2 The Transit Management Subsystem to Transit Vehicle Subsystem Interface

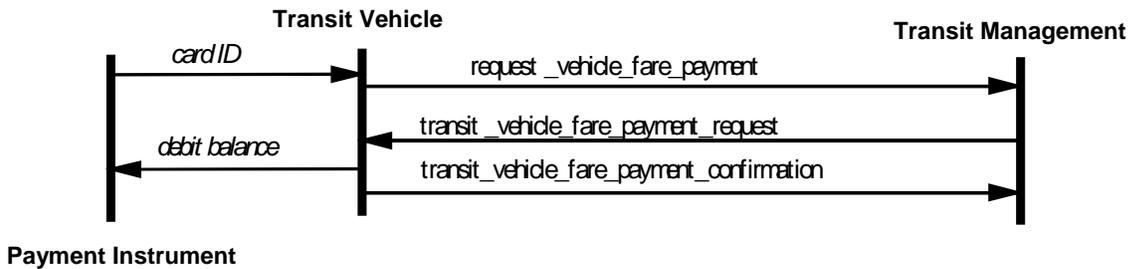
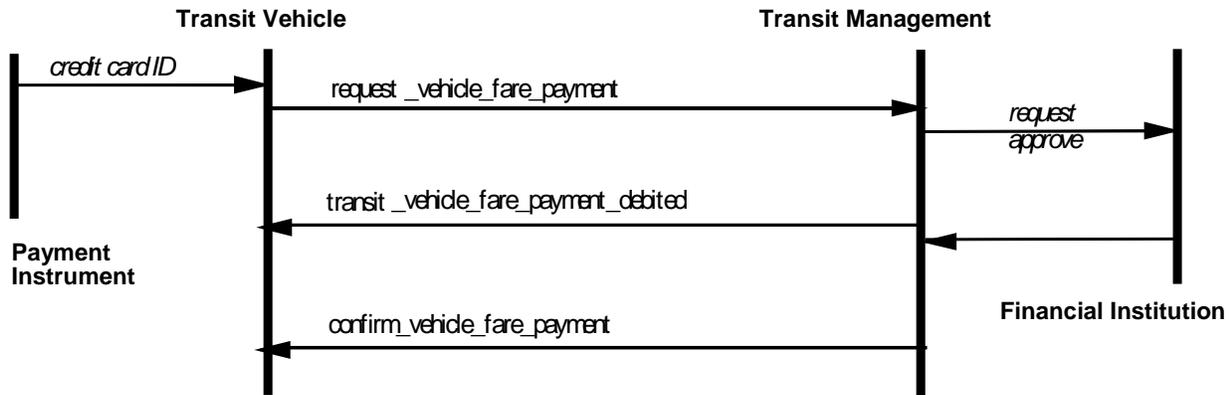
### 3.2.1. Emergency Situations

Emergency situations arising on the transit vehicle can be communicated to the transit management center by either the vehicle operator or a passenger. An acknowledgment is furnished to the operator that the TRMS has received the information and is reacting appropriately. Any one of the top three messages in the diagram below is sufficient to initiate the transit emergency transaction set.



### 3.2.2. Reservation and Fare Payment

Two versions of transit vehicle on-board fare payment are depicted below. The top diagram covers the scenario of paying with a credit card-type device, where an account somewhere in the infrastructure must be debited for the transaction. The second diagram covers the case of a card with a cash balance on it; here the card itself, rather than an account, is debited. Both of these are abnormal on-board fare payment scenarios, required for special services like flexible routed transit or paratransit, where the transaction time and cost (this is wireless!) is warranted. The normal situation is a transaction local to the vehicle, which would not cross this interface.

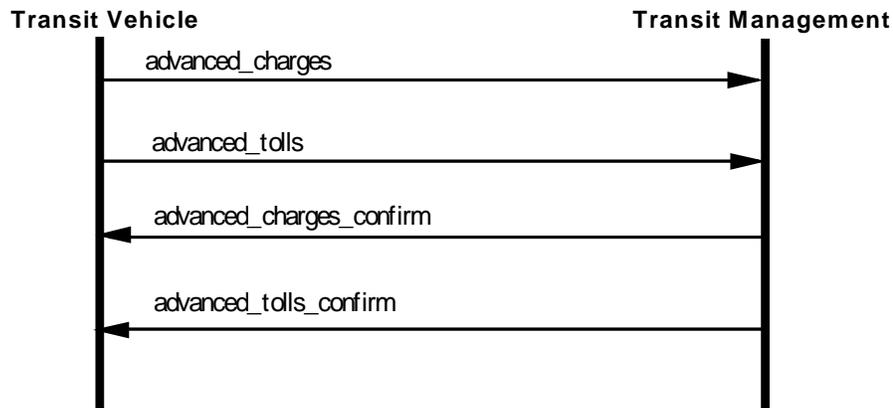


To provide a fare transaction completely within the vehicle, a list of "bad tags" is needed to use for local query on each transaction. The following transaction set would be performed probably at the start of a shift. As such it could be delivered via a beacon / tag interface at the transit vehicle lot, and so would not require utilizing wide area wireless bandwidth.



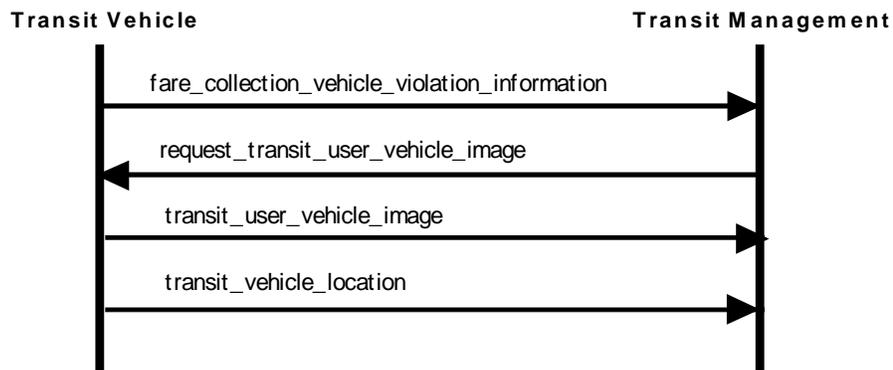
### 3.2.3. Advance Payment for Services

As a part of multimodalism, the ability to make additional travel arrangements beyond the current trip would be a tremendous convenience. This message set supports the advanced reservation of and payment for future segments of a trip. This is not expected to be strictly limited to the transit agency's vehicle services, but would also cover toll and parking fees typically associated with the traveler's personal vehicle. The diagram below shows just the transaction set required to set up and initiate the advance payment process; this message set would then be supplemented by the transaction set in 3.2.2. to carry out the actual financial debiting process.



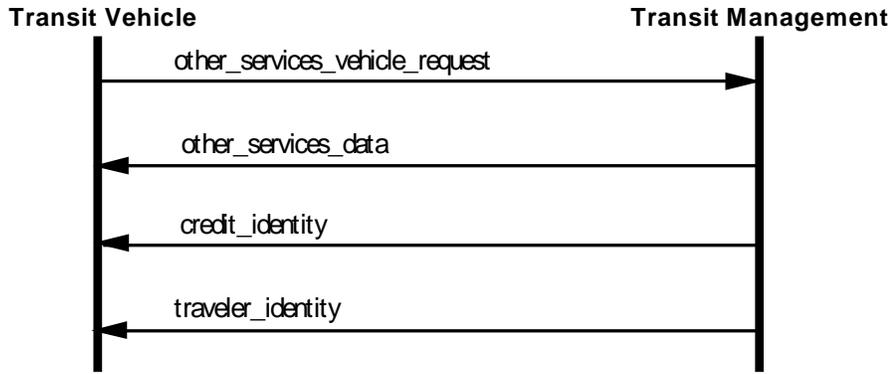
### 3.2.4. Fare Enforcement

In the case of transit vehicle users who try to violate or circumvent the on-board fare collection system (for example, through the use of an invalid cash card), the TRMS is notified of the details of the violation. If future transit vehicles can be equipped with camera surveillance capability, then the TRMS could request an image of the violator to aid enforcement activities.



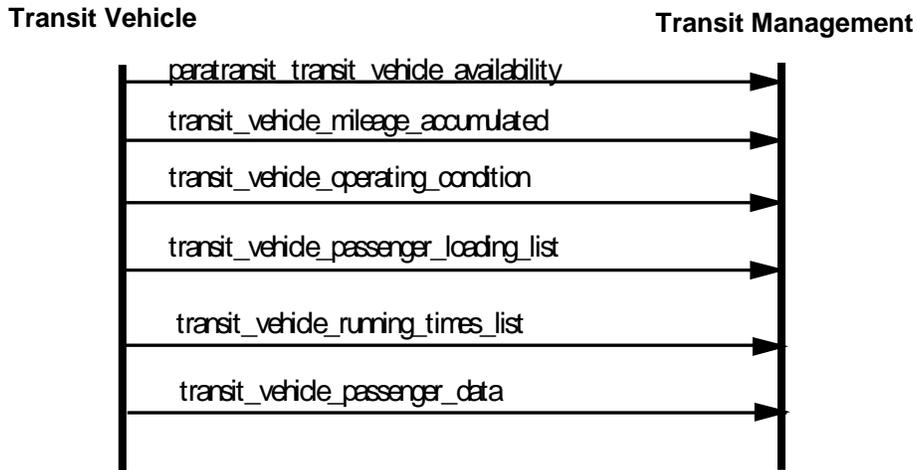
### 3.2.5. Traveler Information

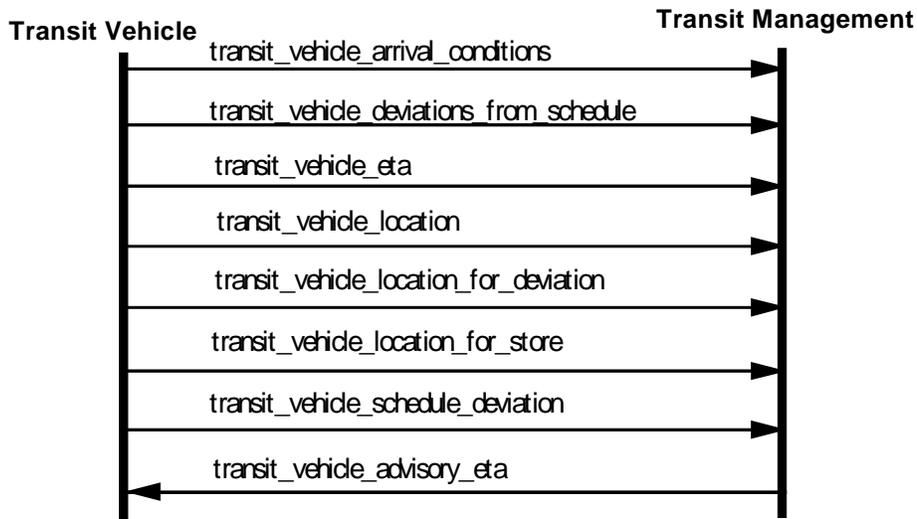
The transit vehicle, as a courtesy to the travelers or perhaps as an additional source of funds, can provide information about other services not directly provided by the Transit Agency. This may include yellow pages types of information. These services would not be provided by the TRMS typically, but the information would clear through the TRMS to its transit fleet. This would require the placement of kiosk-like devices on transit vehicles.



### 3.2.6. "Pushed" Data Updates from the Transit Vehicle

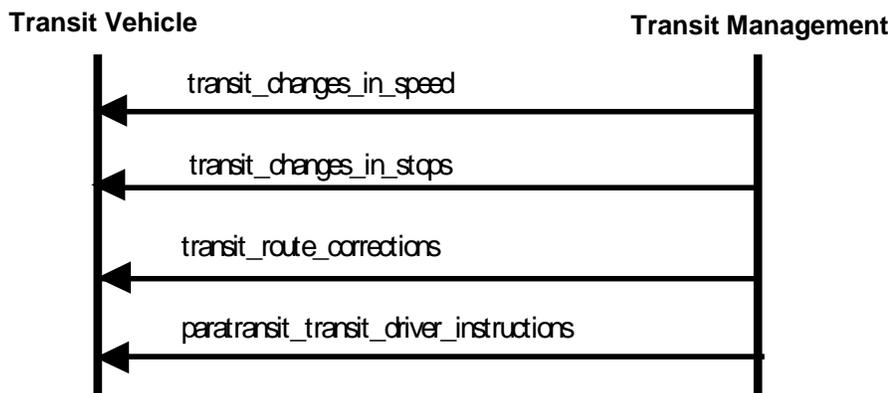
The transit vehicle provides data about the operation of its systems (to aid maintenance), the passenger load (to aid routing and scheduling decisions), and probe information about travel progress (to aid real-time schedule monitoring and to provide data to traffic management). This data is "pushed" to the transit management center either on a regular basis or as certain trigger points are reached. The top diagram below indicates the vehicle sensor measures that are sent to the TRMS (not necessarily in the order shown); the lower diagram shows the probe data messages that the TRVS sends to the TRMS to show its progress against its assigned route. The probe messages are in a number of somewhat redundant forms intended for slightly different uses. In a particular situation, it is unlikely that all would be utilized.



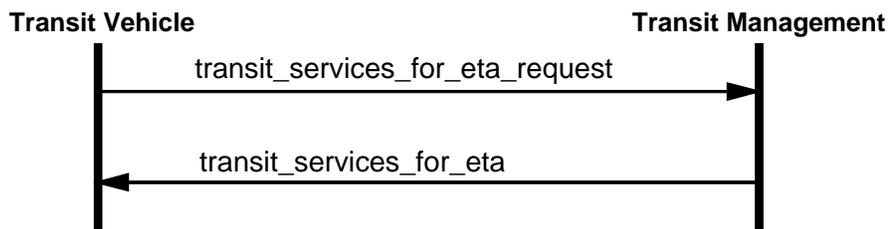


### 3.2.7. Driver Instructions and Information

These are updates sent to the driver of a transit vehicle's trip computer, to indicate changes in route, speed, planned stops, etc. The first messages below are primarily intended for fixed route transit, while the last is for flexible or paratransit.

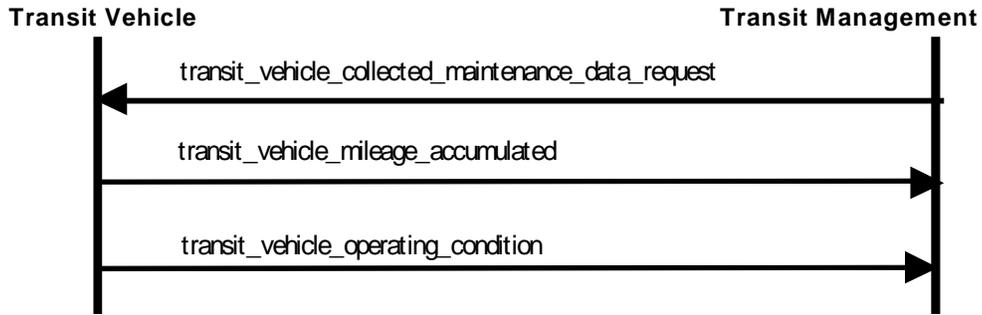


The definition of "driver instructions" is fairly broad as used here. We have included instructions to on-board devices that may aid the driver. The response to the request below contains estimated-time-of-arrival information to support schedule adherence.



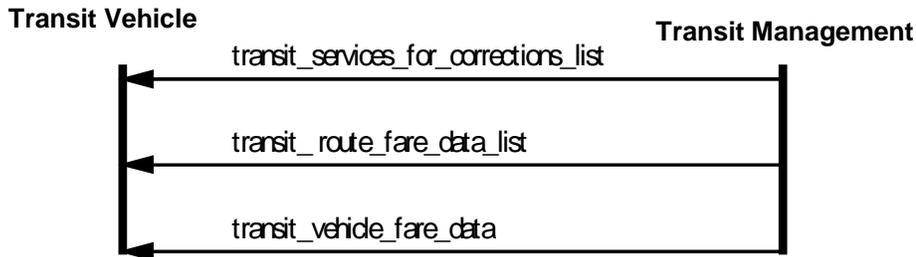
### 3.2.8. Fleet Maintenance Status

The transit operator requests information updates on the maintenance status of fleet vehicles.



### 3.2.9. Update the In-Vehicle Kiosk

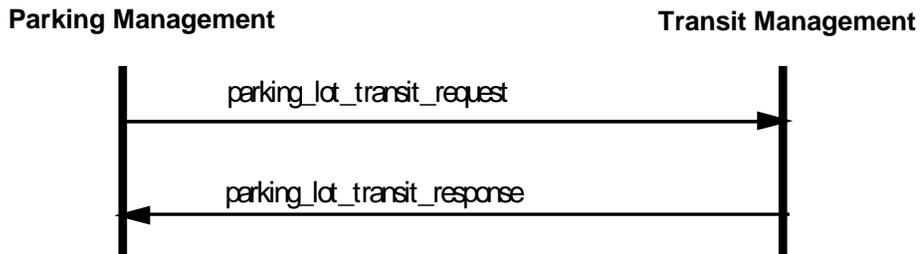
These are messages “pushed” to the transit vehicle. This data updates the databases in the systems that allow travelers to do fare payment and transit trip planning on-board the vehicle.



## 3.3 Transit Management Subsystem to Parking Management Subsystem

### 3.3.1 Parking Lot Price Data

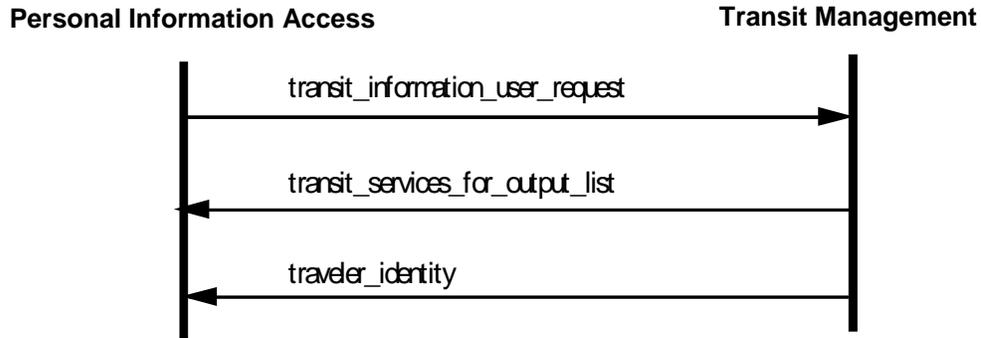
These messages coordinate fare payment and parking lot price data, when a request is made for park and ride transit services to be provided from the parking lot.



## 3.4 Transit Management Subsystem to Personal Information Access Subsystem

### 3.4.1 Personal Transit Information

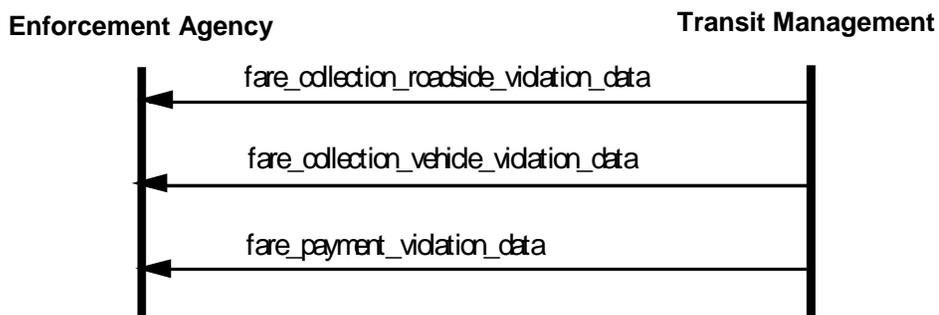
These messages coordinate personalized transit information when requested for a particular fixed route, flexible route, or paratransit system. Special transit routing, real-time schedule information, and availability information may be requested.



### 3.5 Transit Management Subsystem to External Terminators

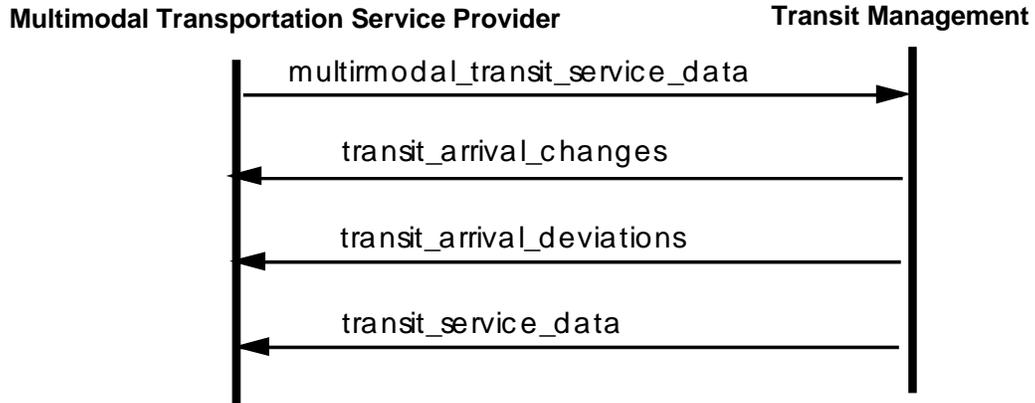
#### 3.5.1 TRMS to Enforcement Agency

These messages are used to notify the enforcement agency of violation of fare payment and collection at the roadside or on the transit vehicle.



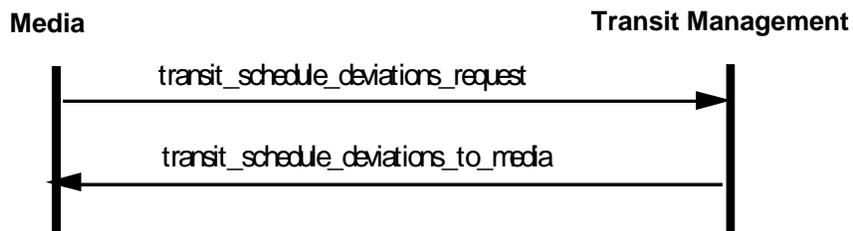
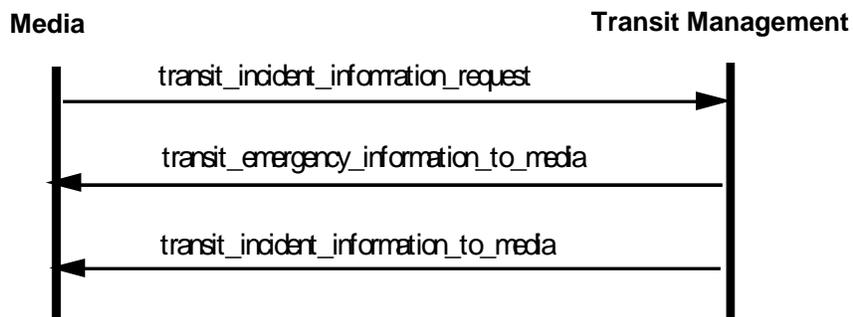
#### 3.5.2 TRMS to Multimodal Transportation Service Provider

These messages provide schedule information for alternate modes of transportation, such as, train, ferry, air, and bus. The data is used to calculate new routes and services for the local regular transit operation, and will enable the two groups of services to be coordinated for the benefit of the traveler.



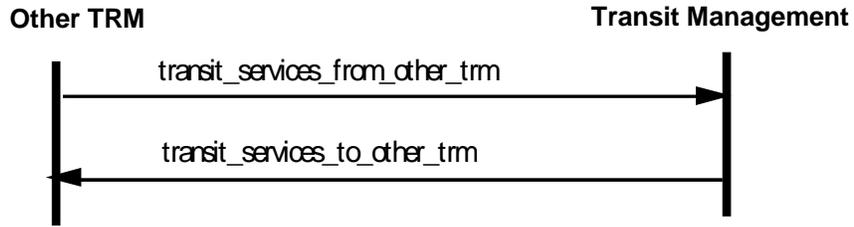
### 3.5.3 TRMS to Media

These messages provide information to the media, which then informs the public, concerning two types of impacts to transit operations. The first involves planned and unplanned incidents in the roadway, i.e., on a transit route. The second includes deviations from published transit schedules due to a variety of reasons, some planned, and some unplanned.



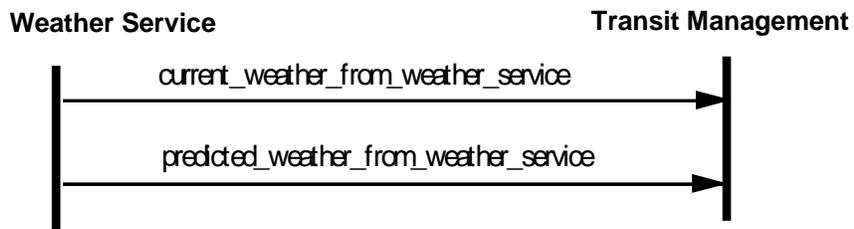
### 3.5.4 TRMS to Other TRM

These messages provide information to aid in coordination between local and regional transit organizations, including schedule, on-time information, and ridership.



### 3.5.5 TRMS to Weather Service

These messages provide accumulated predicted and current weather data, e.g., temperature, pressure, wind speed, precipitation, etc.



## 4 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 data flow in the interface and its description. Each of the physical architecture flows is then decomposed into its constituent leveled data items, which in turn are decomposed hierarchically into more basic leveled architecture flows. The leveled data items are numbered and indented to indicate which are top level flows (1) and which are constituent data flows (numbered 2 and lower). The description of the top level leveled data item is given. The full leveled data item definition for the top level flows and for all the constituent flows is given in Section 7. That section contains the leveled data item entries, listed in alphabetical order, for all of the leveled data items contained in this package. The leveled data items represent a simplification of the logical architecture information to focus on the essential data on each subsystem interface. They are traceable to the original logical architecture data elements, and have been developed in order to provide traceability between the ITS standards being developed and the National ITS Architecture. Once a draft standard has been developed the question that must be addressed is whether the standard completely addresses all elements of the National ITS Architecture interface. Due to the complex hierarchical nature of the Logical Architecture data flows, comparison with standards outputs is very difficult. By creating a simplified view of each interface, it is possible to more effectively trace the standards outputs to the National ITS Architecture.

### Transit Management -> Enforcement Agency

**Physical Architecture Flow: violation notification**

W

Notification to enforcement agency of violation or regulations.

#### Leveled Architecture Flows:

(1) *fare\_collection\_roadside\_violation\_data*

This data item is used by the enforcement agency responsible for dealing with transit fare collection violations. It contains information about a collection violation that has been detected by the Manage Transit function at the roadside, i.e. the transit stop. The data in the flow will enable the notified enforcement agency to take the appropriate action against those who have committed the violation.

(1) *fare\_collection\_vehicle\_violation\_data*

This data item is used by the enforcement agency responsible for dealing with transit fare collection violations. It contains information about a collection violation that has been detected on-board the transit vehicle. The data in the item will enable the notified enforcement agency to take the appropriate action against those who have committed the violation.

(1) *fare\_payment\_violation\_data*

This data item is used by the enforcement agency and contains information about fare payment violations that have been detected. The data in the item will enable the notified enforcement agency to take the appropriate action against those committing the violation.

### Transit Management -> Media

**Physical Architecture Flow: transit incidents for media**

W

Report of an incident impacting transit operations for public dissemination through the media.

#### Leveled Architecture Flows:

(1) *transit\_emergency\_information\_to\_media*

This data item provides information to the media that an emergency has occurred within a transit vehicle.

(1) *transit\_incident\_information\_to\_media*

This data item contains information about an incident that has occurred within part of the transit operations network, e.g. transit stop or mode interchange point.

**Physical Architecture Flow: transit information for media W**

Report of transit schedule deviations for public dissemination through the media.

**Leveled Architecture Flows:**

(1) *transit\_schedule\_deviations\_to\_media*

This data item contains details of deviations from schedule of regular transit services. The information will enable the media to broadcast the details to travelers via such things as local radio, bulletin boards, etc.

**Transit Management -> Multimodal Transportation Service Provider**

**Physical Architecture Flow: intermodal information W**

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

**Leveled Architecture Flows:**

(1) *transit\_arrival\_changes*

This data item contains details of the changes that are currently expected to the arrival time of a transit vehicle at the next modal interchange point. The data is intended to enable the coordination of services between the intermodal and regular transit operations.

(1) *transit\_arrival\_deviations*

This data item contains details of the changes that are currently expected to the arrival time of transit vehicles at the modal interchange point(s). The data is intended to enable the coordination of services between the intermodal and regular transit operations.

(1) *transit\_service\_data*

This data item contains details of the regular transit services provided by the local transit operation. The data is intended for use in the coordination of services between the intermodal and regular transit operations.

**Transit Management -> Other TRM**

**Physical Architecture Flow: TRMS coord W**

Coordination information between local/regional transit organizations including schedule, on-time information and ridership.

**Leveled Architecture Flows:**

(1) *transit\_services\_to\_other\_trm*

This data item contains data for the other transit center about services provided by the local center which have an interface into the area(s) covered by services from the other center.

## Transit Management -> Parking Management

**Physical Architecture Flow:** transit parking lot response W  
Response to transit occupancy inquiries and coordination with parking lots.

### Leveled Architecture Flows:

(1) *parking\_lot\_transit\_response*

This data item contains the response to a request for new or additional park and ride (P+R) transit services to be provided from the parking lot.

## Transit Management -> Personal Information Access

**Physical Architecture Flow:** personal transit information W,U1t  
General and personalized transit information for a particular fixed route, flexible route, or paratransit system.

### Leveled Architecture Flows:

(1) *transit\_services\_for\_output\_list*

This data item contains a list of details of the transit route(s) that fulfill the origin-destination requirements of a particular transit user or traveler's request.

(2) *transit\_route\_number*

(2) *transit\_route\_segment\_cost*

(2) *transit\_route\_segment\_number*

(2) *transit\_stop\_scheduled\_time*

(1) *traveler\_identity*

This data item contains the identity of the traveler who is making a request for information or guidance, so that the results of the request can be sent back to the originating traveler.

**Physical Architecture Flow:** emergency acknowledge W

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

### Leveled Architecture Flows:

(1) *emergency\_acknowledge\_transit\_details*

This data item is used to confirm that the request for emergency services previously sent by the traveler has been received from a kiosk or other device. This data item may also contain the response to input from a panic button that has been activated by a transit user in part of the transit operational network, i.e. not on-board a transit vehicle, or at a transit stop, but in such things as a modal interchange facility, transit depot, etc. The information will be sent out as part of the response to an emergency or incident being detected within the network.

(1) *request\_transit\_user\_roadside\_image*

This data item contains a request for the supply of the image of a transit user who has violated the transit fare payment process at a roadside fare collection point.

**Physical Architecture Flow: secure area monitoring support** W

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

**Leveled Architecture Flows:**

(1) *secure\_area\_broadcast\_message*

This data item contains textual information for transit users in part of the transit operational network, i.e. not on-board a transit vehicle, or at a transit stop, but in such things as a modal interchange facility, transit depot, etc. The information will be sent out as part of the response to an emergency or incident being detected within the network.

(1) *secure\_area\_monitoring\_control*

This data item contains control data for closed circuit television (cctv) systems, or audio equipment, located in the secure area environment. This data may change the pan, tilt, zoom, or other camera or audio operating parameters.

**Physical Architecture Flow: transit fare payment responses** W

Information provided by transit management that supports a fare payment transaction

**Leveled Architecture Flows:**

(1) *confirm\_roadside\_fare\_payment*

This data item is used to confirm that transaction processing of the payment of a transit fare from the roadside, i.e. a transit stop, has been completed.

(2) *transit\_roadside\_fare\_collection\_identity*

(1) *transit\_fare\_data\_list*

This data item contains a list of details of the fares being currently charged for transit services.

(2) *transit\_route\_number*

(2) *transit\_route\_segment\_list*

(3) *transit\_route\_segment\_cost*

(3) *transit\_route\_segment\_number*

(2) *transit\_route\_use\_time*

(2) *transit\_user\_category*

(1) *transit\_roadside\_fare\_payment\_debited*

This data item contains confirmation that the cost of the current transit fare will be deducted by the financial institution from the credit identity previously provided by the payment instrument being used by the transit user on-board a transit vehicle.

(1) *transit\_roadside\_fare\_payment\_request*

This data item contains the request for the cost of the current transit fare to be deducted from the credit currently stored by the transit user's payment instrument, when it is being used at the roadside, i.e. a transit stop.

(2) *transit\_fare*

(1) *transit\_route\_fare\_data\_list*

This data item contains details of the transit user fares for all the transit routes operated by the transit fleet from which the request was made.

(2) *map\_transit\_data*

(2) *transit\_route\_number*

(2) *transit\_route\_segment\_list*

(3) *transit\_route\_segment\_cost*

(3) *transit\_route\_segment\_number*

**Physical Architecture Flow: transit traveler information**

W

Transit information prepared to support transit users and other travelers. It contains transit schedules, real-time arrival information, fare schedules, and general transit service information.

**Leveled Architecture Flows:**

(1) *other\_services\_roadside\_response*

This data item contains the response to the transit user's request from the roadside, i.e. a transit stop, for other (yellow pages) services.

(2) *credit\_identity*

(2) *other\_services\_data*

(2) *traveler\_identity*

(1) *transit\_services\_for\_kiosks*

This data item contains details of the transit services that satisfy a traveler's request and are for output to a kiosk.

(2) *kiosk\_identity*

(2) *transit\_services\_for\_output\_list*

(3) *transit\_route\_number*

(3) *transit\_route\_segment\_cost*

(3) *transit\_route\_segment\_number*

(3) *transit\_stop\_scheduled\_time*

(1) *transit\_services\_for\_travelers*

This data item contains a complete set of all the transit routes and the services that run upon them, including timings, etc. that are provided by the transit fleet from which the data was requested.

(2) *transit\_services\_for\_output\_list*

(3) *transit\_route\_number*

(3) *transit\_route\_segment\_cost*

(3) *transit\_route\_segment\_number*

- (3) *transit\_stop\_scheduled\_time*
- (2) *traveler\_identity*

(1) *transit\_vehicle\_arrival\_time*

This data item contains the estimated time of arrival of a transit vehicle at a stop plus the route and service number on which it is operating.

(1) *transit\_vehicle\_user\_data*

This data item contains data about a transit vehicle for automatic output to transit users at transit stops. The data is output at the transit stop as the vehicle approaches and contains information about the vehicle such as the route number.

- (2) *transit\_route\_number*
- (2) *transit\_vehicle\_time*

## Media -> Transit Management

**Physical Architecture Flow: media information request** W  
Request from the media for current transportation information.

**Leveled Architecture Flows:**

(1) *transit\_incident\_information\_request*  
This data item contains a request for data on incidents to be sent to the Media.

(1) *transit\_schedule\_deviations\_request*  
This data item contains a request for data on details of deviations from schedule of regular transit services.

## Multimodal Transportation Service -> Transit Management Provider

**Physical Architecture Flow: intermodal information** W  
Schedule information for alternate mode transportation providers such as train, ferry, air and bus.

**Leveled Architecture Flows:**

(1) *intermodal\_transit\_service\_data*  
This data item contains details of the services provided by the intermodal transportation service providers. The data is used in the calculation of new routes and services for the local regular transit operation and will enable the two groups of services to be coordinated for the benefit of the traveler.

## Other TRM -> Transit Management

**Physical Architecture Flow: TRMS coord** W  
Coordination information between local/regional transit organizations including schedule, on-time information and ridership.

**Leveled Architecture Flows:**

(1) *transit\_services\_from\_other\_trm*

This data item contains data from another transit center about services which have an interface into the area covered by services from the local center.

### **Parking Management -> Transit Management**

**Physical Architecture Flow: transit parking coordination** W  
Request for coordinated fare payment and parking lot price data.

#### **Leveled Architecture Flows:**

(1) *parking\_lot\_transit\_request*

This data item contains a request for new or additional park and ride (P+R) transit services to be provided from the parking lot.

### **Personal Information Access -> Transit Management**

**Physical Architecture Flow: transit information user request** W,U1t  
Request for special transit routing, real-time schedule information, and availability information.

#### **Leveled Architecture Flows:**

(1) *destination*

This data item defines the destination point for a trip request or a route to be used by a traveler or a vehicle.

(1) *origin*

This data item defines the origin point for a trip request or a route to be used by a traveler or a vehicle.

(1) *traveler\_identity*

This data item contains the identity of the traveler who is making a request for information or guidance, so that the results of the request can be sent back to the originating traveler.

### **Remote Traveler Support -> Transit Management**

**Physical Architecture Flow: emergency notification** W

An emergency request for assistance originated by a traveler using an in-vehicle, public access, or personal device. Sufficient information is provided so that the recipient can determine the location of the emergency as a minimum. Additional information identifying the requestor and requesting device and the nature and severity of the emergency may also be provided (and required) by some systems.

#### **Leveled Architecture Flows:**

(1) *emergency\_request\_transit\_details*

This data item is used to send data about an emergency declared by a traveler at a transit stop using a kiosk or other device. This can also be used by the transit user to alert the transit system operator to an emergency situation or incident within the transit operational network, i.e. not on-board a transit vehicle, or at a transit stop, but in such things as a modal interchange facility, transit depot, etc.

(2) *date*

(2) *time*

(2) *traveler\_identity*

(2) *traveler\_location\_for\_emergencies*

(1) *transit\_user\_roadside\_image*

This data item contains a compressed image of the transit user who has violated the transit fare collection process at the roadside, i.e. at a transit stop. The data will be used in subsequent transit fare violation processing.

**Physical Architecture Flow: secure area surveillance data W**

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

**Leveled Architecture Flows:**

(1) *secure\_area\_surveillance\_information*

This data item represents information about conditions in a secure area environment such as that found in a transit network. This information includes video, audio, and other image data. The data may have been obtained from closed circuit television (cctv), or other systems that are monitoring activity in the transit operational network, i.e. not on-board a transit vehicle, but at a transit stop, or in such things as a modal interchange facility, transit depot, etc. The data can be used for incident detection, etc., using automatic analysis techniques.

**Physical Architecture Flow: transit fare payment requests W**

Information provided from the transit user location that supports fare payments and associated recordkeeping.

**Leveled Architecture Flows:**

(1) *fare\_collection\_roadside\_violation\_information*

This data item is used to send data about a violator of the transit fare collection processes at the roadside, i.e. a transit stop. This data item will contain a digitized video image of the transit user who is trying to violate the fare collection process at the roadside.

(2) *credit\_identity*

(2) *transit\_route\_number*

(2) *transit\_route\_segment\_number*

(2) *transit\_user\_roadside\_image*

(2) *traveler\_identity*

(1) *request\_roadside\_fare\_payment*

This data item is used to request payment of a transit fare from the roadside, i.e. a transit stop.

(2) *credit\_identity*

(2) *transit\_fare*

(2) *transit\_roadside\_fare\_collection\_identity*

(2) *traveler\_identity*

(1) *transit\_roadside\_fare\_payment\_confirmation*

This data item contains confirmation that the previous request for the cost of the current transit fare has been deducted successfully from the credit currently stored by the transit user's payment instrument. The data item is used when the transit user is paying for the transit fare at the roadside.

(1) *transit\_roadside\_passenger\_data\_list*

This data item contains the number of transit users (passengers) who in a twenty four hour period, have passed through a transit stop plus data about the ride which they purchased.

(2) *transit\_passenger\_numbers*

(2) *transit\_route\_stop\_number*

(2) *transit\_route\_use\_time*

(2) *transit\_user\_category*

(2) *transit\_user\_journey\_end*

(2) *transit\_user\_journey\_start*

**Physical Architecture Flow: transit information user request** W

Request for special transit routing, real-time schedule information, and availability information.

**Leveled Architecture Flows:**

(1) *other\_services\_roadside\_request*

This data item contains the transit user's request from the roadside, i.e. a transit stop, for other (yellow pages) services.

(2) *credit\_identity*

(2) *other\_services\_data*

(2) *traveler\_identity*

(1) *transit\_services\_kiosk\_request*

This data item is a request for details of transit services for output to a kiosk.

(2) *destination*

(2) *kiosk\_identity*

(2) *origin*

(1) *transit\_services\_travelers\_request*

This data item is used to request the details of the current transit services for a transit user at the roadside.

(2) *destination*

(2) *origin*

(2) *traveler\_identity*

**Transit Vehicle Subsystem -> Transit Management**

**Physical Architecture Flow: emergency notification** UIt

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

personal device. Sufficient information is provided so that the recipient can determine the location of the emergency as a minimum. Additional information identifying the requestor and requesting device and the nature and severity of the emergency may also be provided (and required) by some systems.

**Leveled Architecture Flows:**

(1) *transit\_emergency\_details*

This data item contains details of emergency requests that have been input on-board a transit vehicle.

(2) *transit\_driver\_emergency\_request*

(2) *transit\_user\_emergency\_request*

(2) *transit\_vehicle\_location*

(3) *transit\_vehicle\_identity*

(3) *transit\_vehicle\_location\_data*

(1) *transit\_emergency\_information*

This data item contains details of emergency requests that have been input on-board a transit vehicle.

(2) *transit\_driver\_emergency\_request*

(2) *transit\_user\_emergency\_request*

(2) *transit\_vehicle\_location*

(3) *transit\_vehicle\_identity*

(3) *transit\_vehicle\_location\_data*

(1) *transit\_operator\_emergency\_request*

This data item contains information about an incident that has been detected on board a transit vehicle or at a transit facility following input from a transit user or transit vehicle driver.

**Physical Architecture Flow: fare and payment status**

U1t,U2

Current fare collection information including the operational status of the fare collection equipment and financial payment transaction data.

**Leveled Architecture Flows:**

(1) *advanced\_charges*

This data item contains data to enable an advanced parking lot charge to be calculated and billed, and can be input by either a driver from a vehicle, or a transit user from on-board a transit vehicle or at the roadside, i.e. a transit stop.

(2) *credit\_identity*

(2) *parking\_lot\_identity*

(2) *parking\_space\_requirements*

(2) *stored\_credit*

(2) *traveler\_identity*

(2) *vehicle\_identity*

(1) ***advanced\_tolls***

This data item contains data to enable an advanced toll to be calculated and billed.

(2) ***credit\_identity***

(2) ***stored\_credit***

(2) ***toll\_route\_segment\_list***

(2) ***vehicle\_identity***

(1) ***fare\_collection\_vehicle\_violation\_information***

This data item is used to send data about a violator of the transit fare collection processes on-board the vehicle. This data item will contain a digitized video image of the transit user who is trying to violate the fare collection process on-board a vehicle. It is assumed that this digitized data will include other data such as date and time, plus camera identity from which the transit vehicle identity can be determined.

(2) ***credit\_identity***

(2) ***stored\_credit***

(2) ***transit\_route\_number***

(2) ***transit\_route\_segment\_number***

(2) ***transit\_user\_vehicle\_image***

(2) ***traveler\_identity***

(1) ***request\_vehicle\_fare\_payment***

This data item requests payment processing of one or more transit fare transactions from on-board a transit vehicle. This item provides for both batch (low value/high usage) fare transactions (e.g. city bus routes) and for high value/low volume, interactive, near real-time transactions (e.g. individualized flexible transit).

(2) ***credit\_identity***

(2) ***stored\_credit***

(2) ***transit\_fare***

(2) ***transit\_route\_number***

(2) ***transit\_vehicle\_fare\_collection\_method***

(2) ***transit\_vehicle\_identity***

(2) ***traveler\_identity***

(1) ***transit\_user\_vehicle\_image***

This data item contains a compressed image of the transit user who has violated the transit fare collection process on-board a transit vehicle. The data will be used in subsequent transit fare violation processing.

(1) ***transit\_vehicle\_fare\_payment\_confirmation***

This data item contains confirmation that the previous request for the cost of the current transit fare has been deducted from the credit currently stored by the transit user's payment instrument and has been completed successfully. The data item is used when the transit user is paying for the transit fare on-board a transit vehicle.

(1) *transit\_vehicle\_location*

This data item provides the exact location of the transit vehicle. It contains the transit vehicle location plus its identity.

(2) *transit\_vehicle\_identity*

(2) *transit\_vehicle\_location\_data*

**Physical Architecture Flow: request for bad tag list**

U1t,U2

Request for list of bad vehicle tag Ids.

**Leveled Architecture Flows:**

(1) *transit\_vehicle\_identity*

This data item contains the identity of an individual transit vehicle. This data is used to identify the source and/or ownership of other data.

**Physical Architecture Flow: transit vehicle conditions**

U1t,U2

Operating conditions of transit vehicle (e.g., mileage).

**Leveled Architecture Flows:**

(1) *transit\_vehicle\_mileage\_accumulated*

This data item contains the total mileage accumulated by a transit vehicle.

(1) *transit\_vehicle\_operating\_condition*

This data item contains the status of transit vehicle's drive-line, e.g. high temperature, low oil pressure, etc., plus other operating conditions such as brake wear, internal lighting failures, incorrect operation of the environmental control unit, etc.

**Physical Architecture Flow: transit vehicle location data**

U1t,U2

Current transit vehicle location and related operational conditions data provided by a transit vehicle.

**Leveled Architecture Flows:**

(1) *transit\_vehicle\_location*

This data item provides the exact location of the transit vehicle. It contains the transit vehicle location plus its identity.

(2) *transit\_vehicle\_identity*

(2) *transit\_vehicle\_location\_data*

(1) *transit\_vehicle\_location\_for\_store*

This data item provides the exact location of the transit vehicle for storage so that it can be used by other facilities and functions within ITS. It contains the transit vehicle location plus its identity.

(2) *transit\_vehicle\_identity*

(2) *transit\_vehicle\_location\_data*

(1) *transit\_vehicle\_passenger\_loading\_list*

This data item contains the number of passengers (transit users) carried by a transit vehicle on each part of its route, i.e. each transit route segment.

- (2) *transit\_route\_number*
- (2) *transit\_route\_segment\_number*
- (2) *transit\_vehicle\_identity*
- (2) *transit\_vehicle\_passengers*

(1) *transit\_vehicle\_running\_times\_list*

This data item contains a list of the times at which it is expected that a transit vehicle will reach the end of each transit route segment on its route and is used to determine any schedule deviations. The end of a transit route segment is usually a transit stop and the data is thus the expected arrival time of a transit vehicle at each of the transit stop(s) along the transit route.

- (2) *transit\_route\_number*
- (2) *transit\_route\_segment\_number*
- (2) *transit\_stop\_scheduled\_time*

**Physical Architecture Flow:** transit vehicle passenger and use data U1t,U2

Data collected on board the transit vehicle pertaining to availability and/or passenger count.

**Leveled Architecture Flows:**

(1) *paratransit\_transit\_vehicle\_availability*

This data item contains the current availability of a transit vehicle for paratransit services. This availability has been computed from processing the inputs from on-board sensors within the transit vehicle.

(1) *transit\_passenger\_numbers*

This data item contains the number of passengers (transit users) carried by a transit vehicle on each of its transit route segments. This data is measured by counting the numbers of passengers that pass the transit fare collection point on a transit vehicle, and is determined independently of any passenger counting process.

(1) *transit\_route\_number*

This data item identifies a regular transit route.

(1) *transit\_route\_segment\_number*

This data item identifies a transit route segment within the transit route on which it lies.

(1) *transit\_route\_use\_time*

This data item contains the time at which the associated transit fare will apply, e.g. weekday morning peak, Sunday, public holiday, etc.

(1) *transit\_user\_category*

This data item contains the category of transit user to which the associated transit fare applies, e.g. adult, child, senior citizen, disabled, etc.

(1) *transit\_vehicle\_identity*

This data item contains the identity of an individual transit vehicle. This data is used to identify the source and/or ownership of other data.

**Physical Architecture Flow:** transit vehicle schedule performance U1t,U2

Estimated times of arrival and anticipated schedule deviations reported by a transit vehicle.

**Leveled Architecture Flows:**

(1) *transit\_vehicle\_arrival\_conditions*

This data item contains the deviations from the published data of a transit service. This data is for output to the intermodal transportation service providers so that adjustments can be made to their services to enable transit users to make their connections at modal interchange points.

(1) *transit\_vehicle\_deviations\_from\_schedule*

This data item contains the deviations of a transit vehicle from its published schedule. It is used in calculating the return to the published schedule where the deviation is major and/or it applies to several vehicles on a particular route.

(1) *transit\_vehicle\_eta*

This data item contains the estimated time of arrival of a transit vehicle at the end of a transit route segment, which is usually a stop, plus the route and service number on which it is operating.

(2) *transit\_route\_number*

(2) *transit\_vehicle\_identity*

(2) *transit\_vehicle\_time*

(1) *transit\_vehicle\_location\_for\_deviation*

This data item provides the exact location of the transit vehicle for the calculation of any return to schedule scenarios. It contains the transit vehicle location plus its identity.

(2) *transit\_vehicle\_identity*

(2) *transit\_vehicle\_location\_data*

(1) *transit\_vehicle\_schedule\_deviation*

This data item contains the deviation of a transit vehicle from its published schedule.

**Physical Architecture Flow: traveler request**

U1t

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

**Leveled Architecture Flows:**

(1) *other\_services\_vehicle\_request*

This data item contains the transit user's request from a transit vehicle for other (yellow pages) services.

(2) *credit\_identity*

(2) *other\_services\_data*

(2) *traveler\_identity*

(1) *transit\_services\_for\_eta\_request*

This data item is used to request the details of the current transit service so that a transit vehicle can calculate its current deviation relative to that schedule.

(2) *transit\_route\_number*

(2) *transit\_route\_schedule\_number*

(2) *transit\_vehicle\_identity*

## Weather Service -> Transit Management

**Physical Architecture Flow:** weather information W

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

### Leveled Architecture Flows:

(1) *current\_weather\_from\_weather\_service*

This data item contains details of the current weather conditions, e.g. temperature, pressure, wind speed, wind direction, humidity, precipitation, visibility, light conditions, etc.

(1) *predicted\_weather\_from\_weather\_service*

This data item contains details of the predicted weather conditions, e.g. temperature, pressure, wind speed, wind direction, humidity, precipitation, visibility, light conditions, etc.

## Transit Management -> Transit Vehicle Subsystem

**Physical Architecture Flow:** bad tag list U1t

List of invalid transit user tags which may have previously failed a fare payment transaction.

### Leveled Architecture Flows:

(1) *credit\_identity*

This data item contains the identity number of a credit card which is to be used to secure preclearance from paying dues, taxes, and other commercial vehicles charges, or by a traveler or driver for payment of current or advanced tolls, fares, parking lot charges, or for yellow pages services.

(1) *transit\_vehicle\_identity*

This data item contains the identity of an individual transit vehicle. This data is used to identify the source and/or ownership of other data.

**Physical Architecture Flow:** driver instructions U1t

Transit service instructions for both transit and paratransit drivers.

### Leveled Architecture Flows:

(1) *paratransit\_transit\_driver\_instructions*

This data item contains the instructions for the transit driver to follow in order that a paratransit service can be executed. The instructions will contain such things as pick-up points, traveler identities, drop off points, etc.

(1) *transit\_changes\_in\_speed*

This data item contains corrections to the desired average speed for each segment in the current regular transit route. This speed value is that which the transit driver must achieve between successive transit stops in order to be compliant with the revised transit schedule. These corrections are intended to enable the transit vehicles on a particular route to return to their scheduled service for that route.

(1) *transit\_changes\_in\_stops*

This data item contains corrections to the stops on the current regular transit route. These corrections may be to delete stops because the route has also been changed, or to add stops so that transit users can use such things as alternative mode transfer facilities. The corrections are intended to enable the transit vehicles on a particular route to return to their scheduled service for that route.

(1) *transit\_route\_corrections*

This data item contains corrections to the current regular transit route. These corrections are intended to enable the transit vehicles on a particular route to return to their scheduled service for that route.

(1) *transit\_services\_for\_corrections\_list*

This data item is used to calculate the corrections to transit vehicle routes and schedules in order to restore a service to normal operation. It contains a complete set of all the transit routes and the services that run upon them, including timings, etc. that are provided by the transit fleet from which the data was requested.

(2) *map\_transit\_data*

(2) *transit\_routes\_data\_list*

(3) *transit\_route\_number*

(3) *transit\_route\_segment\_list*

(4) *transit\_route\_segment\_cost*

(4) *transit\_route\_segment\_number*

(3) *transit\_route\_stop\_number*

(2) *transit\_schedule\_data\_list*

(3) *transit\_route\_number*

(3) *transit\_route\_segment\_list*

(4) *transit\_route\_segment\_cost*

(4) *transit\_route\_segment\_number*

(3) *transit\_route\_stop\_list*

(4) *transit\_route\_stop\_data\_list*

(5) *transit\_route\_schedule\_number*

(5) *transit\_stop\_scheduled\_time*

(4) *transit\_route\_stop\_number*

(3) *transit\_schedule\_identity*

(1) *transit\_services\_for\_eta*

This data item is used in the calculation of transit vehicle estimated times of arrival (eta) at transit stops. It only contains details of the schedule for the transit route that is currently being operated by the vehicle.

(2) *transit\_route\_number*

(2) *transit\_route\_segment\_list*

(3) *transit\_route\_segment\_cost*

(3) *transit\_route\_segment\_number*

(2) *transit\_route\_stop\_list*

(3) *transit\_route\_stop\_data\_list*

(4) *transit\_route\_schedule\_number*

(4) *transit\_stop\_scheduled\_time*

(3) *transit\_route\_stop\_number*

**Physical Architecture Flow: emergency acknowledge**

U1t

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

**Leveled Architecture Flows:**

(1) *request\_transit\_user\_vehicle\_image*

This data item contains a request for the supply of the image of a transit user who has violated the transit fare payment process at an on-board vehicle fare collection point.

(1) *transit\_operator\_request\_acknowledge*

This data item contains an acknowledgment that the previous notification of an emergency to the transit system operator has been received and is being considered for action.

**Physical Architecture Flow: fare management information**

U1t

Transit fare information and transaction data used to manage transit fare processing on the transit vehicle.

**Leveled Architecture Flows:**

(1) *advanced\_charges\_confirm*

This data item shows whether the payment for advanced parking lot charges has been confirmed or not.

(2) *credit\_identity*

(2) *parking\_lot\_cost*

(2) *stored\_credit*

(1) *advanced\_tolls\_confirm*

This data item shows whether the payment for an advanced toll has been confirmed or not.

(2) *credit\_identity*

(2) *stored\_credit*

(2) *toll\_cost*

(1) *transit\_route\_fare\_data\_list*

This data item contains details of the transit user fares for all the transit routes operated by the transit fleet from which the request was made.

(2) *map\_transit\_data*

(2) *transit\_route\_number*

(2) *transit\_route\_segment\_list*

(3) *transit\_route\_segment\_cost*

(3) *transit\_route\_segment\_number*

(1) *transit\_user\_vehicle\_tag\_identity*

This data item provides the identity of a transit user on a transit vehicle for fare payment.

- (2) *credit\_identity*
- (2) *stored\_credit*
- (2) *traveler\_identity*

(1) *transit\_vehicle\_fare\_data*

This data item contains details of the fares currently being charged for regular transit services. It is used in calculating fares that are to be paid by transit users on-board a transit vehicle.

- (2) *transit\_route\_number*
- (2) *transit\_route\_segment\_list*
  - (3) *transit\_route\_segment\_cost*
  - (3) *transit\_route\_segment\_number*
- (2) *transit\_route\_use\_time*
- (2) *transit\_user\_category*

(1) *transit\_vehicle\_fare\_payment\_debited*

This data item contains confirmation that the cost of the current transit fare will be deducted by the financial institution from the credit identity previously provided by the payment instrument being used by the transit user at the roadside. It is only sent when a credit identity has been previously received from the payment instrument.

(1) *transit\_vehicle\_fare\_payment\_request*

This data item contains the request for the cost of the current transit fare to be deducted from the credit currently stored by the transit user's payment instrument, when it is being used on-board a transit vehicle. It is only sent when a value of stored credit has been previously received from the payment instrument.

(1) *transit\_vehicle\_identity*

This data item contains the identity of an individual transit vehicle. This data is used to identify the source and/or ownership of other data.

**Physical Architecture Flow:** request for vehicle measures U1t,U2

Request for vehicle performance and maintenance data collected by onboard sensors.

**Leveled Architecture Flows:**

(1) *transit\_vehicle\_collected\_maintenance\_data\_request*

This data item contains a request for data collected on-board the transit vehicle. The data is produced by sensors analyzing conditions on-board the vehicle during the course of its operation.

**Physical Architecture Flow:** transit schedule information U1t

Current and projected transit schedule adherence.

**Leveled Architecture Flows:**

(1) *transit\_route\_number*

This data item identifies a regular transit route.

(1) ***transit\_vehicle\_identity***

This data item contains the identity of an individual transit vehicle. This data is used to identify the source and/or ownership of other data.

(1) ***transit\_vehicle\_time***

This data item contains the estimated time of arrival of a transit vehicle at the end of the next transit route segment not so far reached during its journey along the transit route.

**Physical Architecture Flow: traveler information** U1t

Traveler information comprised of traffic status, advisories, incidents, responses to traveler requests (e.g., traveler routing, yellow pages), payment information and many other travel-related data updates and confirmations.

**Leveled Architecture Flows:**

(1) ***credit\_identity***

This data item contains the identity number of a credit card which is to be used to secure preclearance from paying dues, taxes, and other commercial vehicles charges, or by a traveler or driver for payment of current or advanced tolls, fares, parking lot charges, or for yellow pages services.

(1) ***other\_services\_data***

This data item contains details of the other (yellow pages) services requested by a traveler or transit user.

(1) ***traveler\_identity***

This data item contains the identity of the traveler who is making a request for information or guidance, so that the results of the request can be sent back to the originating traveler.

## 5 Communications Considerations

This chapter describes relevant requirements and information 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. In addition to actual requirements the section contains some informational notes which are included in brackets.

This section discusses the relevant communications options for the Transit Management Subsystem to Transit Vehicle and to Transit Stop (kiosk) interfaces. The link to the transit vehicle will be a wireless one, most likely wide area wireless but also possibly using dedicated short range communications technology. The interface with kiosks at transit stops is expected to be a wireline one. The interface to PIAS will be a combination of wireless and wireline communications, and to PMS and PS will be wireline.

### 5.1 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.

Brief category terms are used for the type of communications service appropriate for an architecture flow in Table 1 through Table 3. A brief explanation is offered here for the meanings of these abbreviations. More information is offered in the introductory parts of the SRD and in the Communications document.

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.)

### 5.2 Wireline Communication Elements (w)

The interfaces of this standards package are a combination of wireline and wireless interfaces. The primary requirements for the wireline communications layers are that open standards be utilized for the

communications protocols. The following paragraphs provide a discussion of wireline considerations for ITS.

The wireline links represent wide area network communications elements, which can take a number of forms. Typically this 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 for ITS functions. 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 in, for example, 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".

In the near term, we expect that many communication elements will be dedicated, as they primarily are today. 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 (CSP's). 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 timeframe most ITS communications will be provided by CSP's.

For the links to the TMS, the evolving ITS standard is the National Transportation Communications for ITS Protocol (NTCIP). This standard is being developed for the transmission of data and messages between ITS elements. The NTCIP constitutes a set of standards that define common methods of physically interconnecting ITS control equipment, establishes the protocol and procedures for establishing communications between the components, and defines procedures to develop and register common sets of manageable objects related to controlling and managing the components. The standards are being developed by National Electrical Manufacturers Association (NEMA) with support from the US DOT. NTCIP contains a suite of communications protocols, divided into several class profiles, for integrating the various components that may be included in an ITS. The standard defines the elements that allow manufacturer interchangeability of transportation control equipment. Also, a complete end-to-end data handling procedure is defined allowing devices to perform tasks associated with communications between Traffic Management Centers and other field equipment. The initial version of the NTCIP is being developed to support the interface from the TMS to traffic controllers and VMS signs. Work is underway to extend this to other roadside equipment. Plans are also in place to extend the protocol for center to center communications. In the area of center to center communications there are several existing and developing communications standards to choose from for the physical (and data link) layers. These include ATM, Frame Relay, MAN (IEEE 803.6), and FDDI. At the network layers, TCP/IP is a widespread standardized protocol (and is being used in the NTCIP efforts). The key is that by using standard communication protocol suites, the regional integration of the wireline data will most readily be accomplished.

### 5.2.1 Wireline for Kiosks at Transit Stops

Table 1 shows the wireline architecture flows for TRMS to RTS. This corresponds to traveler service kiosks located at transit stops.

**Table 1. RTS<-->TRMS Wireline Data Flows**

Source	Destination	Architecture Flow	Communication Service
Remote Traveler Support	Transit Management	emergency notification	Conversational data, Messaging Data
Remote Traveler Support	Transit Management	secure area surveillance data	Conversational data, Messaging Data
Remote Traveler Support	Transit Management	transit fare payment requests	Conversational data, Messaging data
Remote Traveler Support	Transit Management	transit information user request	Messaging data
Transit Management	Remote Traveler Support	emergency acknowledge	Conversational data, Messaging data
Transit Management	Remote Traveler Support	secure area monitoring support	Conversational data, Messaging data
Transit Management	Remote Traveler Support	transit fare payment responses	Conversational data, Messaging data
Transit Management	Remote Traveler Support	transit traveler information	Messaging data, Multicast data

### 5.3 Wireless Communication Elements (u1 and u2)

Wireless communications is required to interface the TRMS to the TRVS. There are several ways in which this connectivity can be accomplished. A wide area wireless link can be used to have continuous two-way connectivity between TRMS and TRVS. Alternatively, a system of beacons could be used to provide Dedicated Short Range Communications (DSRC) at fixed points (such as transit stops). The choice of communications modality is a local decision driven by cost and functionality requirements (e.g., DSRC links are not effective for transit vehicle security because they do not provide continuous communications capability).

#### 5.3.1 Wide Area Wireless Communications (u1)

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

1. The interfaces 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 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 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 is 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 rest of this chapter is a discussion of how the WAN wireless communication elements will function within the architecture and is informational rather than requirements based.

The wide area network (WAN) wireless communication element, identified as the *u1* link, 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. We assume and require that the 2-way ITS wireless communication network will have the necessary coverage for a particular user service application, and that the wireless network will be internetworked to the wireline wide area communications network. The following sections discuss various options that might be deployed.

A key concept in the ITS architecture is that communications technology is a “commodity” that can conceptually be considered separately from ITS subsystems and their architecture defined functions. The benefit of this concept is that the investment in ITS subsystem functions can be made relatively stable and secure while still allowing rapid evolution and adaptation to evolving communication technologies.

This requires that communication modules in ITS subsystems be replaceable at low cost -- so that the benefits of rapidly evolving communications technologies can be incorporated into ITS deployments. An essential element to this concept is communication standards so that the interface between the communication modules and the ITS modules in an ITS subsystem and across subsystems are well defined. These standards must be *open* (as opposed to *proprietary*), so that multiple vendors will be able to provide functionally equivalent communication modules, and the cost of acquiring these communication modules will be contained by competition.

Both broadcast modalities and two-way are supported in the architecture for various appropriate applications. This approach allows attractive early deployments using mature and emerging one-way data services (e.g., pager technology and FM subcarrier), yet also supports use or evolution towards more functionally rich two-way modalities.

### **5.3.2 Dedicated Short Range Communications (u2)**

The *u2* link is required to provide service between tetherless 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, and the isolation of various users from jamming each other is based on range between user and base station, more than different frequencies. When the data flow is one directional, it is typically a broadcast function. 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 (DSRC) 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 5.8 GHz band is being considered. 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.]

### 5.3.3 Wireless for Transit Vehicles

Table 2 shows the wireless architecture flows for Transit Management communications in this standards package. Both u1 and u2 are shown in this table.

**Table 2. Wireless Data Flows for Transit Management Interfaces**

Source	Destination	Architecture Flow	Communication Service
Personal Information Access	Transit Management	transit information user request	Messaging data
Transit Management	Personal Information Access	personal transit information	Messaging data
Transit Management	Transit Vehicle Subsystem	bad tag list	Messaging data
Transit Management	Transit Vehicle Subsystem	driver instructions	Messaging data
Transit Management	Transit Vehicle Subsystem	emergency acknowledge	Conversational data, Messaging data
Transit Management	Transit Vehicle Subsystem	fare management information	Messaging data
Transit Management	Transit Vehicle Subsystem	request for vehicle measures	Messaging data
Transit Management	Transit Vehicle Subsystem	transit schedule information	Messaging data
Transit Management	Transit Vehicle Subsystem	transit traveler information	Messaging data

<b>Source</b>	<b>Destination</b>	<b>Architecture Flow</b>	<b>Communication Service</b>
Transit Vehicle Subsystem	Transit Management	emergency notification	Messaging data
Transit Vehicle Subsystem	Transit Management	fare and payment status	Conversational data, Messaging data
Transit Vehicle Subsystem	Transit Management	request for bad tag list	Conversational data, Messaging data
Transit Vehicle Subsystem	Transit Management	transit traveler request	Conversational data, Messaging data
Transit Vehicle Subsystem	Transit Management	transit vehicle conditions	Messaging data
Transit Vehicle Subsystem	Transit Management	transit vehicle location data	Conversational data, Messaging data, location data
Transit Vehicle Subsystem	Transit Management	transit vehicle passenger and use data	Conversational data, Messaging data
Transit Vehicle Subsystem	Transit Management	transit vehicle schedule performance	Conversational data, Messaging data

## 6 Constraints

This chapter identifies constraints placed upon Physical Architecture flows.

### 6.1 Assessment Categories

The following categories have been used in rating the constraints that exist on the physical data 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 during emergencies. The data channels required must be operational even when there is an emergency which might place other loads on the interface. A private communication channel or frequency may be required to satisfy the requirement.

##### b. Reliability(R)

This category encompasses both the concepts of reliability and availability. Data must be delivered reliably. Loss can not be tolerated. The communications 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.

The data flows with constraints follow in Table 3. The following coding scheme is utilized for the constraint categories:

**E** - *Emergency Priority*

**R** - *Reliability*

**T** - *Timing*

**S** - *Financial Security*

**P** - *Personal Privacy*

**Table 3. Constraints on the Architecture Data Flows between Transit Management Interfaces**

Source	Destination	Architecture Flow	Interconnects	Communication Service	Special Constraints
Remote Traveler Support	Transit Management	secure area surveillance data	W	Conversational data, Messaging Data	E,T
Remote Traveler Support	Transit Management	transit fare payment requests	W	Conversational data, Messaging data	F
Remote Traveler Support	Transit Management	transit information user request	W	Messaging data	P
Transit Management	Remote Traveler Support	secure area monitoring support	W	Conversational data, Messaging data	E,T
Transit Management	Remote Traveler Support	transit fare payment responses	W	Conversational data, Messaging data	F
Transit Management	Remote Traveler Support	transit traveler information	W	Messaging data, Multicast data	
Transit Management	Transit Vehicle Subsystem	bad tag list	U1t	Messaging data	
Transit Management	Transit Vehicle Subsystem	transit traveler information	U1t	Messaging data	P
Transit Vehicle Subsystem	Transit Management	fare and payment status	U1t,U2	Conversational data, Messaging data	F,T
Transit Vehicle Subsystem	Transit Management	request for bad tag list	U1t,U2	Conversational data, Messaging data	F,T
Transit Vehicle Subsystem	Transit Management	transit traveler request	U1t	Conversational data, Messaging data	P

## 7 Leveled Data Items

This section contains the leveled data item (LDI) definitions for all the leveled data item elements listed in this standards requirements package. The LDI's are given in alphabetical order.

### **advanced\_charges**

This data item contains data to enable an advanced parking lot charge to be calculated and billed, and can be input by either a driver from a vehicle, or a transit user from on-board a transit vehicle or at the roadside, i.e. a transit stop.

### **advanced\_charges\_confirm**

This data item shows whether the payment for advanced parking lot charges has been confirmed or not.

### **advanced\_fare\_details**

This data item contains details of the transit ride for which a driver wishes to make an advanced payment.

### **advanced\_parking\_lot\_charges**

This data item contains data to enable an advanced parking lot charge to be calculated and billed.

### **advanced\_tolls**

This data item contains data to enable an advanced toll to be calculated and billed.

### **advanced\_tolls\_and\_fares\_response**

This data item contains the result of the requested advanced toll and/or transit fare payment transaction from a driver.

### **advanced\_tolls\_confirm**

This data item shows whether the payment for an advanced toll has been confirmed or not.

### **advisory\_data\_request**

This data item is used to request that advisory data be output to a driver or a traveler in a vehicle. The scope and transit route number data will be provided by the driver or transit user, while the vehicle location will be provided automatically.

### **ahs\_operational\_data**

This data item contains details of the number of vehicles that have been checked into the automatic highway system (ahs), plus details about the use of ahs lanes during the previous time period, e.g. one (1) hour.

### **air\_services**

This data item contains details of the regular and charter air services available to travelers.

### **air\_services\_request**

This data item contains a request for details of the regular and charter air services available to travelers.

### **area\_air\_quality\_index**

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

### **commercial\_operational\_information**

This data item contains information about the number of commercial vehicles passing each roadside checking facility and how many are passing or failing their checks. This information is obtained from the roadside facility log.

### **commercial\_violation\_data**

This data item contains information about violations of commercial vehicle electronic credential and tax filing payment procedures etc.

### **confirm\_intermodal\_service**

This data item contains a request for provision of an alternate mode service as part of a traveler's proposed trip.

**confirm\_roadside\_fare\_payment**

This data item is used to confirm that transaction processing of the payment of a transit fare from the roadside, i.e. a transit stop, has been completed.

**credit\_identity**

This data item contains the identity number of a credit card which is to be used to secure preclearance from paying dues, taxes, and other commercial vehicles charges, or by a traveler or driver for payment of current or advanced tolls, fares, parking lot charges, or for yellow pages services.

**current\_device\_static\_data**

This data item contains of some or all of the current static data consisting of signal data (timings, permitted phase changes, etc.), VMS data, which items of traffic data are used by certain processes, etc.

**current\_weather\_from\_weather\_service**

This data item contains details of the current weather conditions, e.g. temperature, pressure, wind speed, wind direction, humidity, precipitation, visibility, light conditions, etc.

**date**

This data item specifies a calendar date that is normally used to indicate currency or effectivity of other data.

**destination**

This data item defines the destination point for a trip request or a route to be used by a traveler or a vehicle.

**driver\_map\_update\_payment\_request**

This data item contains a request that payment be made for an update of the navigable map database used for on-line vehicle guidance. The payment will be made by debiting the credit identity with the cost through the financial institution terminator.

**driver\_map\_update\_payment\_response**

This data item contains the response to a previous request from the driver that payment be made for an update of the navigable map database used for on-line vehicle guidance.

**emergency\_acknowledge\_transit\_details**

This data item is used to confirm that the request for emergency services previously sent by the traveler has been received from a kiosk or other device. This data item may also contain the response to input from a panic button that has been activated by a transit user in part of the transit operational network, i.e. not on-board a transit vehicle, or at a transit stop, but in such things as a modal interchange facility, transit depot, etc. The information will be sent out as part of the response to an emergency or incident being detected within the network.

**emergency\_information**

This data item provides information about current incidents.

**emergency\_information\_request**

This data item contains a request for data on emergencies to be sent to the Media. The request must specify the type and severity of emergency desired to be reported on, and the geographic area(s) to which it should relate.

**emergency\_request\_driver\_acknowledge**

This data item acknowledges that the request for emergency services previously sent by the driver has been received.

**emergency\_request\_personal\_traveler\_acknowledge**

This data item confirms that the request for emergency services previously sent by the traveler has been received from a personal device and is therefore sent to the Provide Driver and Traveler Services function for output.

**emergency\_request\_transit\_details**

This data item is used to send data about an emergency declared by a traveler at a transit stop using a kiosk or other device. This can also be used by the transit user to alert the

transit system operator to an emergency situation or incident within the transit operational network, i.e. not on-board a transit vehicle, or at a transit stop, but in such things as a modal interchange facility, transit depot, etc.

**emergency\_request\_traveler\_acknowledge**

This data item is used to confirm that the request for emergency services previously sent by the traveler has been received from a kiosk or other device.

**emergency\_request\_vehicle\_acknowledge**

This data item acknowledges that the request for emergency services previously sent automatically by the vehicle through processes in the Provide Vehicle Control and Monitoring function has been received.

**emergency\_request\_vehicle\_details**

This data item sends data about an emergency automatically declared by a vehicle to the Manage Emergency Services function.

**emergency\_vehicle\_operational\_data**

This data item contains information about the movements of emergency vehicles whilst attending incidents, and therefore shows the usage of green wave routes, the times at which the vehicles passed various points in the road and highway network etc.

**fare\_collection\_roadside\_violation\_data**

This data item is used by the enforcement agency responsible for dealing with transit fare collection violations. It contains information about a collection violation that has been detected by the Manage Transit function at the roadside, i.e. the transit stop. The data in the flow will enable the notified enforcement agency to take the appropriate action against those who have committed the violation.

**fare\_collection\_roadside\_violation\_information**

This data item is used to send data about a violator of the transit fare collection processes at the roadside, i.e. a transit stop. This data item will contain a digitized video image of the transit user who is trying to violate the fare collection process at the roadside.

**fare\_collection\_vehicle\_violation\_data**

This data item is used by the enforcement agency responsible for dealing with transit fare collection violations. It contains information about a collection violation that has been detected on-board the transit vehicle. The data in the item will enable the notified enforcement agency to take the appropriate action against those who have committed the violation.

**fare\_collection\_vehicle\_violation\_information**

This data item is used to send data about a violator of the transit fare collection processes on-board the vehicle. This data item will contain a digitized video image of the transit user who is trying to violate the fare collection process on-board a vehicle. It is assumed that this digitized data will include other data such as date and time, plus camera identity from which the transit vehicle identity can be determined.

**fare\_payment\_violation\_data**

This data item is used by the enforcement agency and contains information about fare payment violations that have been detected. The data in the item will enable the notified enforcement agency to take the appropriate action against those committing the violation.

**ferry\_services**

This data item contains details of the sea and river ferry services available to travelers.

**ferry\_services\_request**

This data item contains a request for details of the sea and river ferry services available to travelers.

**from\_media\_incident\_information\_request**

This data item contains a request for data on incidents to be sent to the Media. The request must specify whether all, current or predicted incidents are required, in the latter case state

the time period by date and hour range, and the geographic area(s) to which it should relate.

**from\_media\_traffic\_information\_request**

This data item contains a request from the Media for traffic information. The request must specify the type of information required (flow/congestion) and the geographic area(s) to which it should relate.

**from\_media\_transit\_vehicle\_deviations\_request**

This data item contains a request for data on schedule deviations of specific transit vehicles or routes.

**incident\_data**

This data item contains current incident information.

**incident\_data\_request**

This data item contains a request for data on incidents to be sent to the Media. The request must specify whether all, current or predicted incidents are required, in the latter case state the time period by date and hour range, and the geographic area(s) to which it should relate.

**intermodal\_service\_confirmation**

This data item contains confirmation that a previous request from a traveler for an alternate mode service has been accepted.

**intermodal\_transit\_service\_data**

This data item contains details of the services provided by the intermodal transportation service providers. The data is used in the calculation of new routes and services for the local regular transit operation and will enable the two groups of services to be coordinated for the benefit of the traveler.

**kiosk\_identity**

This data item identifies a particular kiosk.

**link\_performance\_data**

This data item contains speed and occupancy on each link within the road (surface street) and highway network in the geographic area relevant to the user.

**link\_state\_data\_for\_broadcast**

This data item contains speed and occupancy on each link within the road (surface street) and highway network in the geographic area relevant to the user.

**location\_identity**

This data item contains the location of any transportation feature, entity, or event in an unambiguous and mutually understandable way.

**map\_transit\_data**

This data item forms part of the store of digitized map data. It contains data which enables maps of the transit route network to be produced. These will be produced to suit the geometry of the actual display unit on which the data will be shown in either visual or hardcopy format.

**network\_static\_data**

This data item is sent from the Manage Traffic function to the Plan System Deployment function and contains some or all of the current static data used for the management of incidents.

**origin**

This data item defines the origin point for a trip request or a route to be used by a traveler or a vehicle.

**other\_services\_data**

This data item contains details of the other (yellow pages) services requested by a traveler or transit user.

**other\_services\_roadside\_request**

This data item contains the transit user's request from the roadside, i.e. a transit stop, for

other (yellow pages) services.

**other\_services\_roadside\_response**

This data item contains the response to the transit user's request from the roadside, i.e. a transit stop, for other (yellow pages) services.

**other\_services\_vehicle\_request**

This data item contains the transit user's request from a transit vehicle for other (yellow pages) services.

**paratransit\_transit\_driver\_instructions**

This data item contains the instructions for the transit driver to follow in order that a paratransit service can be executed. The instructions will contain such things as pick-up points, traveler identities, drop off points, etc.

**paratransit\_transit\_vehicle\_availability**

This data item contains the current availability of a transit vehicle for paratransit services. This availability has been computed from processing the inputs from on-board sensors within the transit vehicle.

**parking\_lot\_current\_state**

This data item contains the identity of the parking lot plus its current status and occupancy.

**parking\_lot\_operational\_data**

This data item contains counts of the number of spaces used in the parking lot and the parking lot state during the previous time period, i.e. since the data was last sent.

**parking\_lot\_storage\_data**

This data item contains occupancy and state data for one or more parking lots in a local geographic area.

**parking\_lot\_transit\_request**

This data item contains a request for new or additional park and ride (P+R) transit services to be provided from the parking lot.

**parking\_lot\_transit\_response**

This data item contains the response to a request for new or additional park and ride (P+R) transit services to be provided from the parking lot.

**pollution\_advisory\_data**

This data item contains advisory data about area and roadside pollution levels.

**pollution\_operational\_data\_list**

This data item contains data about the levels of pollution detected by roadside, wide area, and individual vehicle sensors located in the geographic area served by the function.

**predicted\_highway\_network\_data**

This data item contains data about predicted traffic conditions on links in the highway network served by the function.

**predicted\_incidents\_for\_advisories**

This data item contains data about predicted incidents for use in advisory messages that are requested by and output to drivers and transit users in vehicles. The data will be restricted to those incidents which impact the local road and highway network.

**predicted\_parking\_lot\_data**

This data item contains predicted parking lot states produced by the predictive model process.

**predicted\_road\_network\_data**

This data item contains data about predicted traffic conditions on links in the road network served by the function.

**predicted\_weather\_from\_weather\_service**

This data item contains details of the predicted weather conditions, e.g. temperature, pressure, wind speed, wind direction, humidity, precipitation, visibility, light conditions, etc.

**prediction\_data\_for\_advisories**

This data item is used to provide advisory messages to drivers and transit users in vehicles showing predictions of traffic data for route segments on the road and highway network served by the Manage Traffic function. Data will only be provided where it is relevant to the current location of the vehicle from which the request originated.

**rail\_services**

This data item contains details of the heavy rail services (i.e. those which do not form part of a transit operation) available to travelers.

**rail\_services\_request**

This data item contains a request for details of the heavy rail services (i.e. those which do not form part of a transit operation) available to travelers.

**request\_roadside\_fare\_payment**

This data item is used to request payment of a transit fare from the roadside, i.e. a transit stop.

**request\_transit\_user\_roadside\_image**

This data item contains a request for the supply of the image of a transit user who has violated the transit fare payment process at a roadside fare collection point.

**request\_transit\_user\_vehicle\_image**

This data item contains a request for the supply of the image of a transit user who has violated the transit fare payment process at an on-board vehicle fare collection point.

**request\_vehicle\_fare\_payment**

This data item requests payment processing of one or more transit fare transactions from on-board a transit vehicle. This item provides for both batch (low value/high usage) fare transactions (e.g. city bus routes) and for high value/low volume, interactive, near real-time transactions (e.g. individualized flexible transit).

**roadway\_environment\_conditions**

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

**secure\_area\_broadcast\_message**

This data item contains textual information for transit users in part of the transit operational network, i.e. not on-board a transit vehicle, or at a transit stop, but in such things as a modal interchange facility, transit depot, etc. The information will be sent out as part of the response to an emergency or incident being detected within the network.

**secure\_area\_monitoring\_control**

This data item contains control data for closed circuit television (cctv) systems, or audio equipment, located in the secure area environment. This data may change the pan, tilt, zoom, or other camera or audio operating parameters.

**secure\_area\_surveillance\_information**

This data item represents information about conditions in a secure area environment such as that found in a transit network. This information includes video, audio, and other image data. The data may have been obtained from closed circuit television (cctv), or other systems that are monitoring activity in the transit operational network, i.e. not on-board a transit vehicle, but at a transit stop, or in such things as a modal interchange facility, transit depot, etc. The data can be used for incident detection, etc., using automatic analysis techniques.

**source\_identity**

This data item defines the logical identifier of a source of information.

**time**

This data item contains the current time of day and will be associated with other data flows and (possibly) a date.

**to\_enforcement\_agency\_parking\_violation\_data**

This data item contains information about parking lot charge payment violations. The data

will enable the notified enforcement agency to take the appropriate action against those committing the violation.

**to\_enforcement\_agency\_toll\_violation\_data**

This data item contains information about toll violations. The data will enable the notified enforcement agency to take the appropriate action against those committing the violation.

**to\_enforcement\_agency\_traffic\_violation\_data**

This data item contains information about high occupancy vehicle (hov) lane use and pollution violations that have been detected by processes within the Manage Traffic function. The data in this item will enable the notified enforcement agency to take the appropriate action against those committing the violations.

**toll\_cost**

This data item defines the cost of the toll for a particular vehicle through a toll plaza, thus giving it the ability to use the toll segment governed by the toll plaza.

**toll\_segment\_identity**

This data item contains the identity number of a toll segment, which may not be the same physical entity as a route segment or a link as used by traffic management processes.

**toll\_segment\_users**

This data item contains a calculation of the number of users of a toll segment.

**traffic\_data\_for\_deployment**

This data item is used to provide data on the traffic flowing in the road network, plus that which is predicted to flow in the network.

**traffic\_data\_kiosk\_request**

This data item contains the request for the provision of traffic data for output at a kiosk.

**traffic\_data\_personal\_request**

This data item contains the request for the provision of traffic data for output at a traveler's personal device.

**traffic\_data\_request\_from\_media**

This data item contains a request from the Media for traffic information. The request must specify the type of information required (flow/congestion) and the geographic area(s) to which it should relate.

**transit\_arrival\_changes**

This data item contains details of the changes that are currently expected to the arrival time of a transit vehicle at the next modal interchange point. The data is intended to enable the coordination of services between the intermodal and regular transit operations.

**transit\_arrival\_deviations**

This data item contains details of the changes that are currently expected to the arrival time of transit vehicles at the modal interchange point(s). The data is intended to enable the coordination of services between the intermodal and regular transit operations.

**transit\_changes\_in\_speed**

This data item contains corrections to the desired average speed for each segment in the current regular transit route. This speed value is that which the transit driver must achieve between successive transit stops in order to be compliant with the revised transit schedule. These corrections are intended to enable the transit vehicles on a particular route to return to their scheduled service for that route.

**transit\_changes\_in\_stops**

This data item contains corrections to the stops on the current regular transit route. These corrections may be to delete stops because the route has also been changed, or to add stops so that transit users can use such things as alternative mode transfer facilities. The corrections are intended to enable the transit vehicles on a particular route to return to their scheduled service for that route.

**transit\_deviation\_kiosk\_request**

This data item requests for data on current transit service deviations for output to a kiosk.

**transit\_deviations\_for\_kiosks**

This data item contains current transit service deviations for output to a kiosk.

**transit\_deviations\_for\_personal\_devices**

This data item contains current transit service deviations for a particular route. This data will be output to a traveler's personal device.

**transit\_deviations\_personal\_request**

This data item is a request for data on current transit service deviations for output to a traveler's personal device. When a portable device is being used by the traveler. The request can be modified so that only the data for a transit route specified by the traveler from the portable device is requested.

**transit\_emergency\_details**

This data item contains details of emergency requests that have been input on-board a transit vehicle.

**transit\_emergency\_information**

This data item contains details of emergency requests that have been input on-board a transit vehicle.

**transit\_emergency\_information\_to\_media**

This data item provides information to the media that an emergency has occurred within a transit vehicle.

**transit\_fare\_data\_list**

This data item contains a list of details of the fares being currently charged for transit services.

**transit\_incident\_information\_request**

This data item contains a request for data on incidents to be sent to the Media.

**transit\_incident\_information\_to\_media**

This data item contains information about an incident that has occurred within part of the transit operations network, e.g. transit stop or mode interchange point.

**transit\_operator\_emergency\_request**

This data item contains information about an incident that has been detected on board a transit vehicle or at a transit facility following input from a transit user or transit vehicle driver.

**transit\_operator\_request\_acknowledge**

This data item contains an acknowledgment that the previous notification of an emergency to the transit system operator has been received and is being considered for action.

**transit\_passenger\_numbers**

This data item contains the number of passengers (transit users) carried by a transit vehicle on each of its transit route segments. This data is measured by counting the numbers of passengers that pass the transit fare collection point on a transit vehicle, and is determined independently of any passenger counting process.

**transit\_passenger\_operational\_data\_list**

This data item contains information about the number of passengers (transit users) who have used transit stops and vehicles being operated. There are therefore two sets of data, one showing the numbers of passengers using each transit stop and the other showing the number of passengers on-board transit vehicles on each route segment.

**transit\_roadside\_fare\_payment\_confirmation**

This data item contains confirmation that the previous request for the cost of the current transit fare has been deducted successfully from the credit currently stored by the transit user's payment instrument. The data item is used when the transit user is paying for the transit fare at the roadside.

**transit\_roadside\_fare\_payment\_debited**

This data item contains confirmation that the cost of the current transit fare will be deducted by the financial institution from the credit identity previously provided by the payment instrument being used by the transit user on-board a transit vehicle.

**transit\_roadside\_fare\_payment\_request**

This data item contains the request for the cost of the current transit fare to be deducted from the credit currently stored by the transit user's payment instrument, when it is being used at the roadside, i.e. a transit stop.

**transit\_roadside\_passenger\_data\_list**

This data item contains the number of transit users (passengers) who in a twenty four hour period, have passed through a transit stop plus data about the ride which they purchased.

**transit\_route\_corrections**

This data item contains corrections to the current regular transit route. These corrections are intended to enable the transit vehicles on a particular route to return to their scheduled service for that route.

**transit\_route\_fare\_data\_list**

This data item contains details of the transit user fares for all the transit routes operated by the transit fleet from which the request was made.

**transit\_route\_number**

This data item identifies a regular transit route.

**transit\_route\_segment\_number**

This data item identifies a transit route segment within the transit route on which it lies.

**transit\_route\_use\_time**

This data item contains the time at which the associated transit fare will apply, e.g. weekday morning peak, Sunday, public holiday, etc.

**transit\_routes\_data\_list**

This data item contains a list of the details of the routes being provided by the transit operation. The list of route segments contains the identity of each link in the road and freeway network associated with the segment to enable them to be output on top of a display of digitized map data.

**transit\_running\_data\_for\_advisories**

This data item contains data on the current state of transit operations for use in driver and transit user advisory output messages. The messages will only contain data that is relevant to the vehicle's current location.

**transit\_schedule\_data\_list**

This data item contains a list of the schedule of services on each transit vehicle route and the cost to the transit user of the use of each route segment.

**transit\_schedule\_deviations\_request**

This data item contains a request for data on details of deviations from schedule of regular transit services.

**transit\_schedule\_deviations\_to\_media**

This data item contains details of deviations from schedule of regular transit services. The information will enable the media to broadcast the details to travelers via such things as local radio, bulletin boards, etc.

**transit\_service\_data**

This data item contains details of the regular transit services provided by the local transit operation. The data is intended for use in the coordination of services between the intermodal and regular transit operations.

**transit\_services\_for\_advisories**

This data item provides details of transit services that are relevant to a driver or transit user who is requesting advisory information from a vehicle.

**transit\_services\_for\_corrections\_list**

This data item is used to calculate the corrections to transit vehicle routes and schedules in order to restore a service to normal operation. It contains a complete set of all the transit routes and the services that run upon them, including timings, etc. that are provided by the transit fleet from which the data was requested.

**transit\_services\_for\_eta**

This data item is used in the calculation of transit vehicle estimated times of arrival (eta) at transit stops. It only contains details of the schedule for the transit route that is currently being operated by the vehicle.

**transit\_services\_for\_eta\_request**

This data item is used to request the details of the current transit service so that a transit vehicle can calculate its current deviation relative to that schedule.

**transit\_services\_for\_kiosks**

This data item contains details of the transit services that satisfy a traveler's request and are for output to a kiosk.

**transit\_services\_for\_output\_list**

This data item contains a list of details of the transit route(s) that fulfill the origin-destination requirements of a particular transit user or traveler's request.

**transit\_services\_for\_travelers**

This data item contains a complete set of all the transit routes and the services that run upon them, including timings, etc. that are provided by the transit fleet from which the data was requested.

**transit\_services\_from\_other\_trm**

This data item contains data from another transit center about services which have an interface into the area covered by services from the local center.

**transit\_services\_kiosk\_request**

This data item is a request for details of transit services for output to a kiosk.

**transit\_services\_to\_other\_trm**

This data item contains data for the other transit center about services provided by the local center which have an interface into the area(s) covered by services from the other center.

**transit\_services\_travelers\_request**

This data item is used to request the details of the current transit services for a transit user at the roadside.

**transit\_user\_category**

This data item contains the category of transit user to which the associated transit fare applies, e.g. adult, child, senior citizen, disabled, etc.

**transit\_user\_payments\_transactions**

This data item contains records of all payment transactions for the provision of other (yellow pages) services to transit users.

**transit\_user\_roadside\_image**

This data item contains a compressed image of the transit user who has violated the transit fare collection process at the roadside, i.e. at a transit stop. The data will be used in subsequent transit fare violation processing.

**transit\_user\_vehicle\_image**

This data item contains a compressed image of the transit user who has violated the transit fare collection process on-board a transit vehicle. The data will be used in subsequent transit fare violation processing.

**transit\_user\_vehicle\_tag\_identity**

This data item provides the identity of a transit user on a transit vehicle for fare payment.

**transit\_vehicle\_arrival\_conditions**

This data item contains the deviations from the published data of a transit service. This data is for output to the intermodal transportation service providers so that adjustments can be

made to their services to enable transit users to make their connections at modal interchange points.

**transit\_vehicle\_arrival\_time**

This data item contains the estimated time of arrival of a transit vehicle at a stop plus the route and service number on which it is operating.

**transit\_vehicle\_collected\_maintenance\_data\_request**

This data item contains a request for data collected on-board the transit vehicle. The data is produced by sensors analyzing conditions on-board the vehicle during the course of its operation.

**transit\_vehicle\_deviations\_from\_schedule**

This data item contains the deviations of a transit vehicle from its published schedule. It is used in calculating the return to the published schedule where the deviation is major and/or it applies to several vehicles on a particular route.

**transit\_vehicle\_eta**

This data item contains the estimated time of arrival of a transit vehicle at the end of a transit route segment, which is usually a stop, plus the route and service number on which it is operating.

**transit\_vehicle\_fare\_data**

This data item contains details of the fares currently being charged for regular transit services. It is used in calculating fares that are to be paid by transit users on-board a transit vehicle.

**transit\_vehicle\_fare\_payment\_confirmation**

This data item contains confirmation that the previous request for the cost of the current transit fare has been deducted from the credit currently stored by the transit user's payment instrument and has been completed successfully. The data item is used when the transit user is paying for the transit fare on-board a transit vehicle.

**transit\_vehicle\_fare\_payment\_debited**

This data item contains confirmation that the cost of the current transit fare will be deducted by the financial institution from the credit identity previously provided by the payment instrument being used by the transit user at the roadside. It is only sent when a credit identity has been previously received from the payment instrument.

**transit\_vehicle\_fare\_payment\_request**

This data item contains the request for the cost of the current transit fare to be deducted from the credit currently stored by the transit user's payment instrument, when it is being used on-board a transit vehicle. It is only sent when a value of stored credit has been previously received from the payment instrument.

**transit\_vehicle\_identity**

This data item contains the identity of an individual transit vehicle. This data is used to identify the source and/or ownership of other data.

**transit\_vehicle\_location**

This data item provides the exact location of the transit vehicle. It contains the transit vehicle location plus its identity.

**transit\_vehicle\_location\_for\_deviation**

This data item provides the exact location of the transit vehicle for the calculation of any return to schedule scenarios. It contains the transit vehicle location plus its identity.

**transit\_vehicle\_location\_for\_store**

This data item provides the exact location of the transit vehicle for storage so that it can be used by other facilities and functions within ITS. It contains the transit vehicle location plus its identity.

**transit\_vehicle\_mileage\_accumulated**

This data item contains the total mileage accumulated by a transit vehicle.

**transit\_vehicle\_operating\_condition**

This data item contains the status of transit vehicle's drive-line, e.g. high temperature, low oil pressure, etc., plus other operating conditions such as brake wear, internal lighting failures, incorrect operation of the environmental control unit, etc.

**transit\_vehicle\_passenger\_loading\_list**

This data item contains the number of passengers (transit users) carried by a transit vehicle on each part of its route, i.e. each transit route segment.

**transit\_vehicle\_running\_times\_list**

This data item contains a list of the times at which it is expected that a transit vehicle will reach the end of each transit route segment on its route and is used to determine any schedule deviations. The end of a transit route segment is usually a transit stop and the data is thus the expected arrival time of a transit vehicle at each of the transit stop(s) along the transit route.

**transit\_vehicle\_schedule\_deviation**

This data item contains the deviation of a transit vehicle from its published schedule.

**transit\_vehicle\_time**

This data item contains the estimated time of arrival of a transit vehicle at the end of the next transit route segment not so far reached during its journey along the transit route.

**transit\_vehicle\_user\_data**

This data item contains data about a transit vehicle for automatic output to transit users at transit stops. The data is output at the transit stop as the vehicle approaches and contains information about the vehicle such as the route number.

**traveler\_current\_condition\_request**

This data item contains a request for details of the current conditions, e.g. weather, events, incidents, etc. The request includes the identity of the kiosk from which the request was input by the traveler so that the response can be correctly returned.

**traveler\_identity**

This data item contains the identity of the traveler who is making a request for information or guidance, so that the results of the request can be sent back to the originating traveler.

**traveler\_map\_update\_payment\_request**

This data item contains a request that payment be made for an update of the navigable map database used by the traveler for on-line personal guidance. The payment will be made by debiting the credit identity with the cost through the financial institution terminator.

**traveler\_map\_update\_payment\_response**

This data item contains the response to a previous request from the traveler that payment be made for an update of the navigable map database used for on-line traveler guidance.

**traveler\_payment\_confirmation**

This data item contains the information that the payment for a confirmed trip has been successfully completed, or that the total cost can now be deducted from the credit stored on the traveler's payment instrument.

**traveler\_payment\_information**

This data item contains details of the components of a trip which a traveler has obtained from the input of data to a kiosk.

**traveler\_personal\_current\_condition\_request**

This data item contains a request for details of the current conditions, e.g. weather, events, incidents, etc. The request includes the identity of the personal device from which the request was input by the traveler so that the response can be correctly returned.

**traveler\_personal\_display\_update\_payment\_request**

This data item contains a request that payment be made for an update of the digitized map data used as background to the displays of traffic and travel information on a traveler's personal device.

**traveler\_personal\_display\_update\_payment\_response**

This data item contains the response to a previous request from the traveler that payment be made for an update of the digitized map data used as background to the displays of traffic and travel information on a traveler's personal device.

**traveler\_personal\_payment\_confirmation**

This data item indicates the payment for a confirmed trip has been successfully completed, or that the total cost can now be deducted from the credit stored on the traveler's payment instrument.

**traveler\_personal\_transaction\_confirmation**

This data item confirms any reservations made by the traveler from a personal device. These reservations will be based on information obtained by the traveler from previous data input and output through the device.

**traveler\_transaction\_confirmation**

This data item confirms any reservations made by the traveler.

**traveler\_transaction\_request**

This data item contains data input by the traveler at a kiosk to make reservations for various other (yellow pages) services.

**traveler\_yellow\_pages\_data**

This data item contains details of other (yellow pages) services which is to be sent to the traveler interface facility.

**traveler\_yellow\_pages\_information\_request**

This data item contains a request for data on other (yellow pages) services to be provided to a traveler at the identified kiosk. As no filtering components are included, all the data currently available will be provided.

**vehicle\_identity**

This data item contains the identity of a vehicle.

**yellow\_pages\_advisory\_data**

This data item provides yellow pages data to drivers and transit users in vehicles and/or confirmation of a previously requested reservation.

**yellow\_pages\_data**

This data item provides information on yellow pages services in three forms comprising that of general interest, more specific items and transaction information.