

Standards Requirements Package 3: Information Service Provider Wireless Interfaces

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Table of Contents

1. Introduction to Standards Requirements Documentation	1
1.1. Standards Requirements Document Executive Summary	1
1.2. Constructing a Standards Requirements Package	2
2. Introduction: Information Service Provider Wireless Interfaces	4
3. Transaction Sets for the Information Service Provider Wireless Interfaces	6
3.1. Pre-Trip Travel Information	6
3.2. Driver Advisory	8
3.3. Route Guidance	10
3.4. Traveler Services Information	14
4. Interface Decomposition	16
4.1. Personal Information Access -> Information Service Provider	16
4.2. Information Service Provider -> Personal Information Access	20
4.3. Vehicle -> Information Service Provider	30
4.4. Information Service Provider -> Vehicle	33
5. Communications Layer Requirements	38
5.1. Wireless Communication Elements	38
5.2. Dedicated and Shared Communications	38
5.3. Architecture Robustness to Spatially Different Deployments	39
6. Constraints	42
6.1. Assessment Categories	42
6.2. Architecture Flow Constraints	43
7. Data Dictionary Elements	44

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 provides 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 11 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 to Transit Vehicles and Transit Stops

These 11 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 SDOs; 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
- Data dictionary element (DDE) definitions and sizes

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 its constituent logical architecture data flows, which in turn are decomposed until we reach primitive data elements. The physical architecture data flows are labeled with the type of communications technology appropriate for that flow. The logical architecture primitive elements are labeled with their size in bytes. Figure 1 shows an example of an interface decomposition.

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.

Data Dictionary Elements: entries taken directly from the logical architecture data dictionary. Each DDE provides a description of the data flow, and a definition of its composite data elements. For a more in depth examination of each data flow and the functions(or pspecs) that use it, it is necessary to refer to the logical architecture documentation.

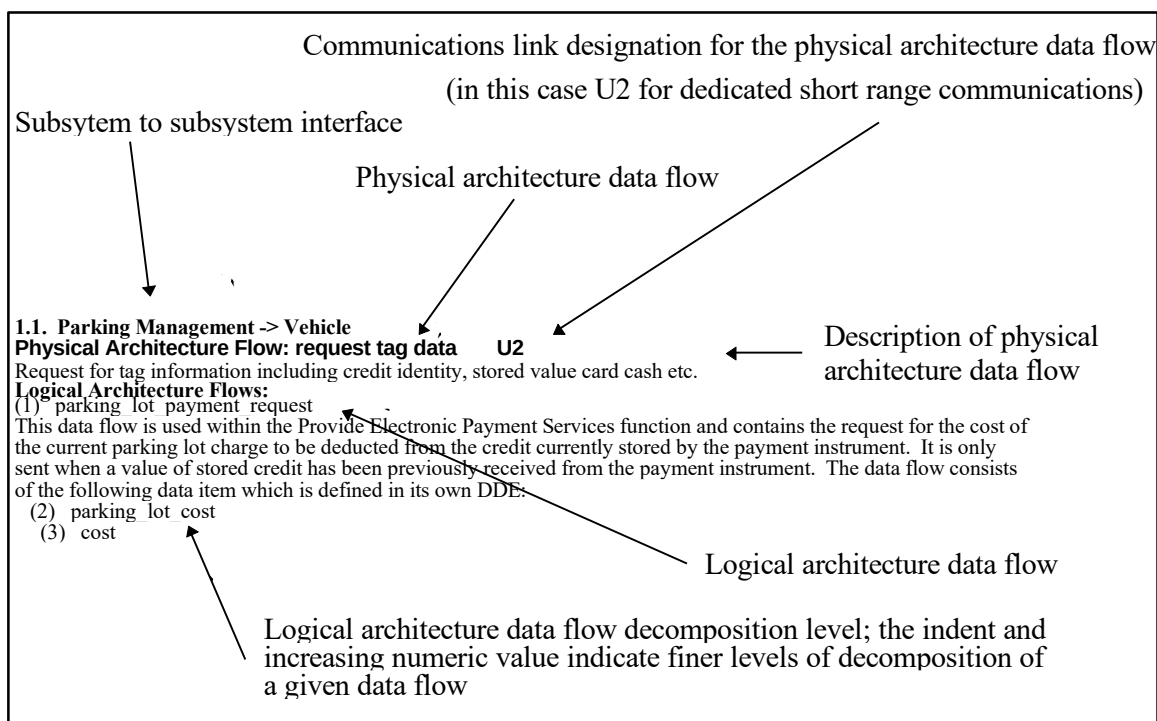


Figure 1 - Example of the parts of an interface decomposition

As a final clarification, it is useful to remind readers of the distinction between the layers in the 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: Information Service Provider Wireless Interfaces

In the spirit of creating a seamless nationwide transportation information service, the wireless links between ISPs and their mobile clients is critical for the creation of wide spread usage and acceptance of these services. Achieving standards that allow an ATIS user to move across jurisdictions while continuing to receive services will aid the development of the larger markets necessary to attract investment in developing services.

The ISP wireless links are the wide area wireless links from ISPs to Vehicles (or Personal Information Access devices) and for 2-way channels from Vehicles (or Personal Information Access devices) to ISPs. These messages contribute to the Travel and Traffic Management user services:

1. Pre-Trip Travel Information
2. Driver Advisory
3. Route Guidance
4. Traveler Information Services

Figure 2 - shows the key interfaces described in this standards package.

The following table lists the Architecture Flows used in this interface, identifies the source and destination subsystems of the flows and indicates which user services the flow plays a role in implementing:

Architecture Flow	Source Entity	Destination Entity	Pre-Trip Travel Information	Driver Advisory	Route Guidance	Traveler Information Services
trip request	PIAS	ISP			x	
trip confirmation	PIAS	ISP			x	
traveler information request	PIAS	ISP	x			
yellow pages request	PIAS	ISP				x
broadcast information	ISP	PIAS			y	
trip plan	ISP	PIAS			x	

traveler information	ISP	PIAS	x			x
trip confirmation	VS	ISP			x	
trip request	VS	ISP			x	
traveler information request	VS	ISP	x	x		
yellow pages request	VS	ISP				x
vehicle probe data	VS	ISP		x		
broadcast information	ISP	VS		x	y	
trip plan	ISP	VS			x	
traveler information	ISP	VS	x	x		x

This package will need to be coordinated with the Personal Mayday in SRD Package 5: Personal, Transit, and HAZMAT Maydays, if a common set of devices will support both ATIS and Mayday.

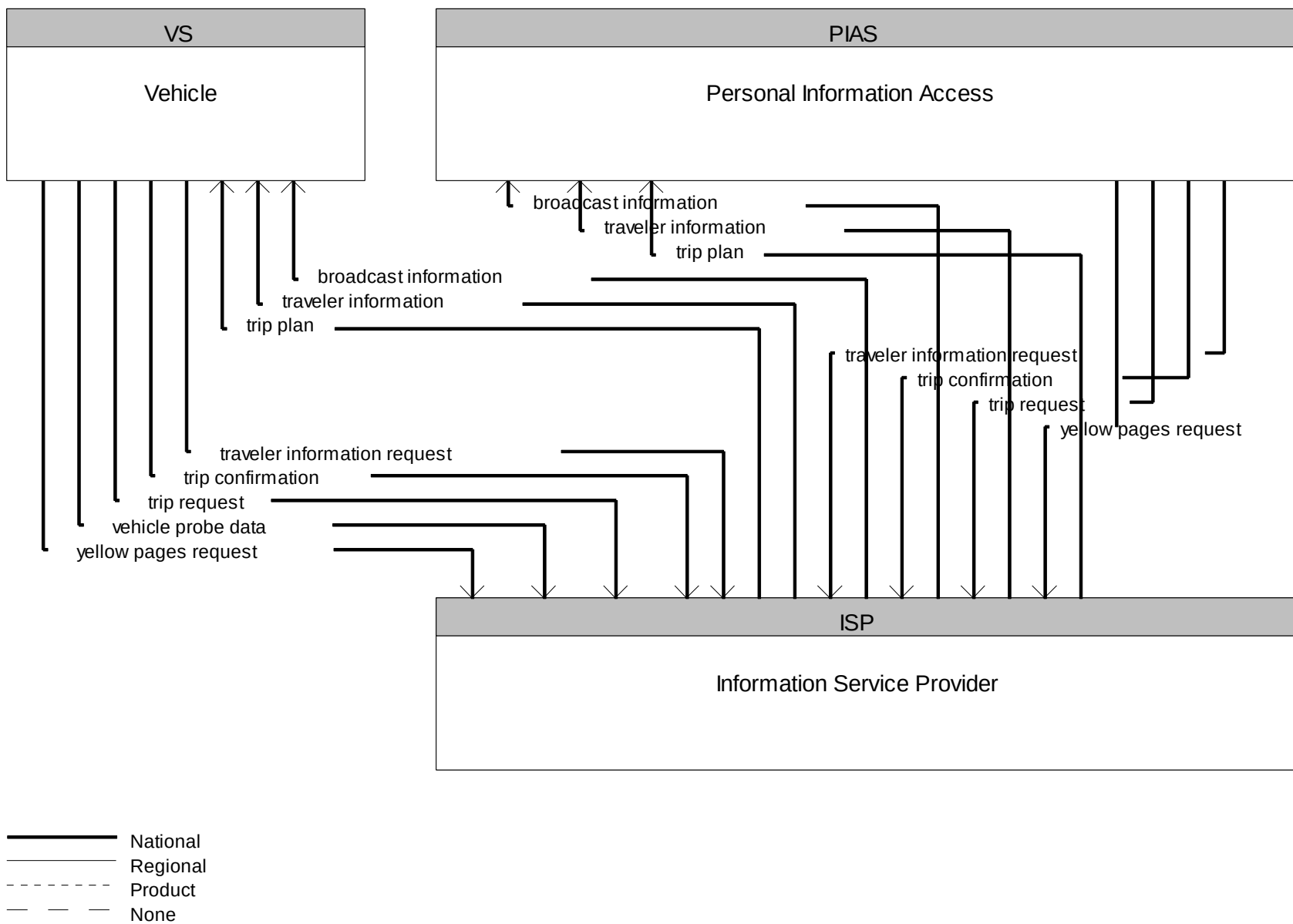


Figure 2 - . Information Service Provider Wireless Interfaces Architecture Flows

3. Transaction Sets for the Information Service Provider Wireless Interfaces

In this section we define the transaction sets needed to accomplish different ITS tasks. An operational concept diagram as well as a message sequence chart format along the lines of those defined under ISO standardization is used for clarity of presentation. The following subsections each discuss the interactions between the Information Service Provider subsystem and subsystems and terminators that the ISP communicates with over wireless interfaces.

The transaction set figures used in this chapter identify the messages that go between the ISP and the Vehicle or Personal Information Access subsystems to perform the general class of user service identified in the title of the associated subsection. Where messages follow each other top to bottom, they represent a transaction sequence or protocol. Where messages are separated by a horizontal dotted line, the separated messages are distinct, and not related in any particular sequence. A number in a circle identifies an associated numbered section in the text which describes the particular message or message sequence function.

3.1. Pre-Trip Travel Information

Figure 3 - and Figure 4 - show the subsystems and high-level message sequences for the Pre-Trip Travel Information services and the associated wireless communication transactions set respectively.

1. The traveler or driver, either from a Kiosk or home/office computer interface (Remote Traveler Support subsystem), the Vehicle subsystem, or from a portable computer (Personal Information Access subsystem) issues a Trip Request architecture flow which is sent to the ISP (Information Service Provider subsystem).

Note that the architecture does not specify the implementation of subsystems, but rather the functional requirements. For example, the Remote Traveler Support subsystem could be implemented as a “kiosk”, or as a “human operator” that interfaces with travelers over a phone line. In either case, the human interface based interaction with the traveler results in a “Trip Request” message being issued from the Remote Traveler Support subsystem to the Information Service Provider subsystem.

In the ISP, the “Infrastructure Provided Route Selection” equipment package identifies which type of service is required and obtains information from the appropriate subsystems, if necessary, in the next two steps:

2. If demand responsive transit (paratransit) is an option then a transit trip request is sent to the Transit Center and

if vehicle travel is an option then link travel times and other link conditions (e.g. incident locations and status, construction) are requested from the appropriate Traffic Management subsystem(s) and

if Parking is required then a “parking reservation” is sent to one or more Parking Management subsystems and

if other travel service provider modes are an option (e.g., rail, plane, ship, ferry, taxi, shuttle) then a request is sent to the appropriate “Intermodal Transportation Service Provider” external system interface.

(Note: the Transit Subsystem has its own route selection process for routing demand responsive transit vehicles for demand responsive transit passenger pick-up and delivery.)

3. The response messages for portions of the trip that were just requested (in step 2 above) are sent from their respective subsystems (or terminators) and received at the ISP.

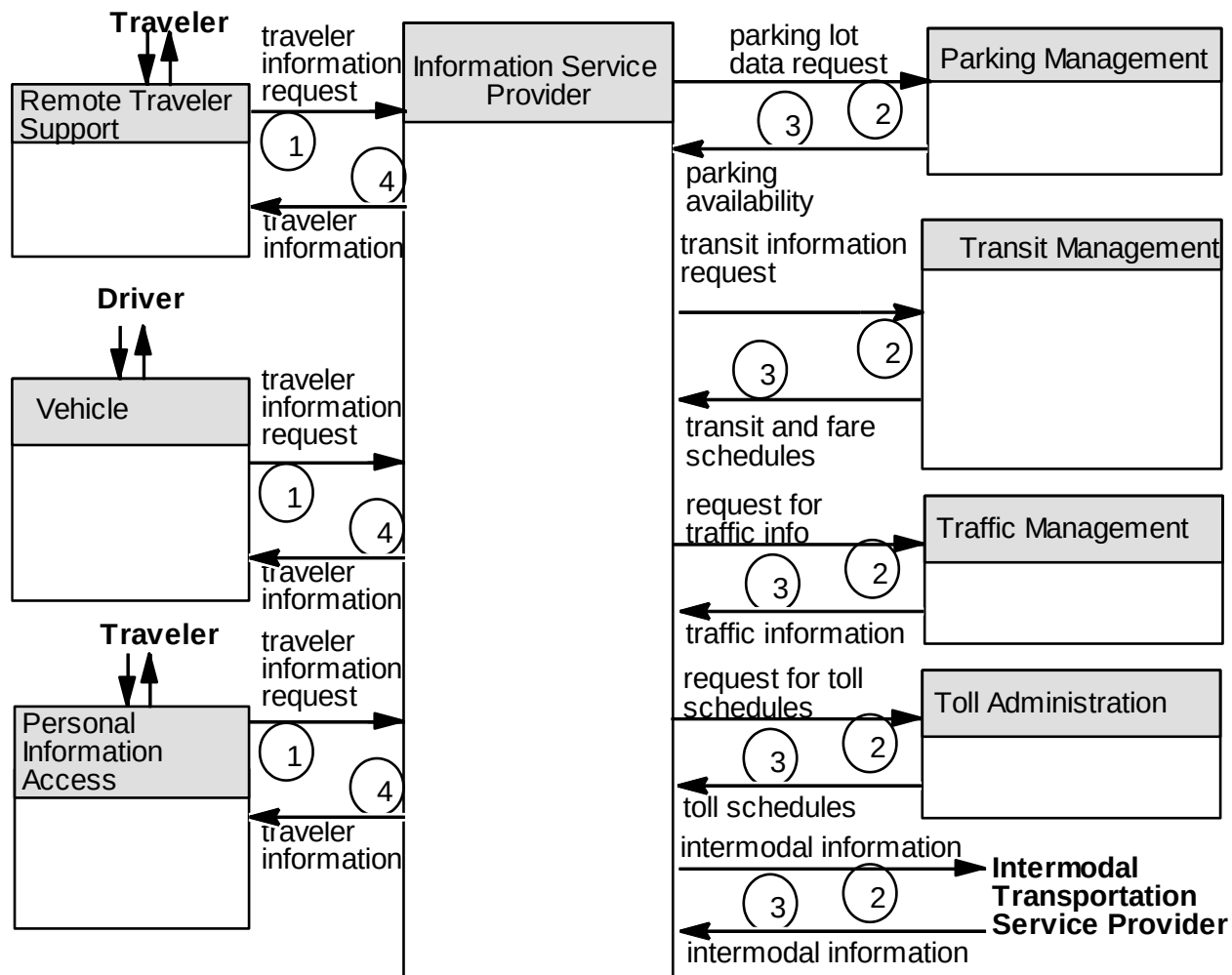


Figure 3 - Physical Architecture for Pre-Trip Travel Information

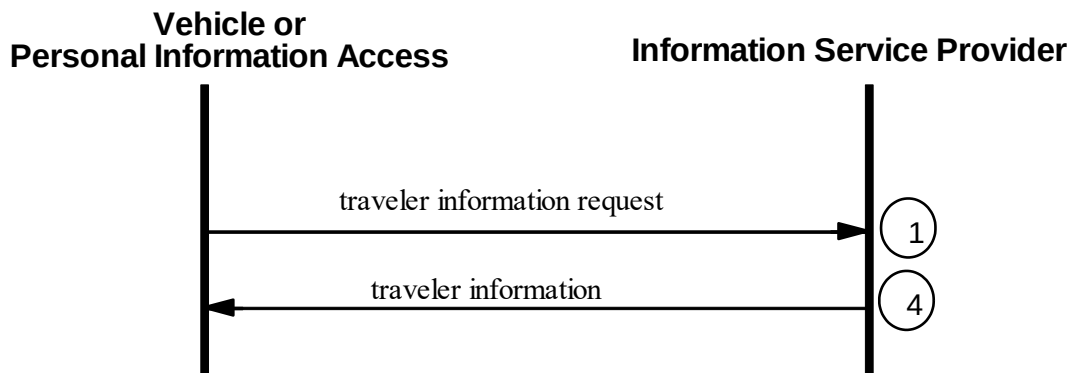


Figure 4 - Pre-Trip Travel Information Transaction Set

If a route is requested (either vehicular or bicycle, or pedestrian) then the traveler/driver request goes to the Infrastructure Provided Route Selection equipment package for determination of the route. If transit is a part of the trip then the Route Selection equipment package responds based upon its database of transit schedules which is updated (perhaps independently of any specific trip request) on a basis determined by the ISP. If Rideshare is requested, then the Infrastructure Provided Dynamic Ridesharing equipment package within the ISP meets this request.

4. The traveler information architecture flow response is sent by the ISP to the traveler/driver.

3.2. Driver Advisory

The basic driver advisory service, shown in Figure 5 - and Figure 6 - , is provided by the Information Service Provider (ISP).

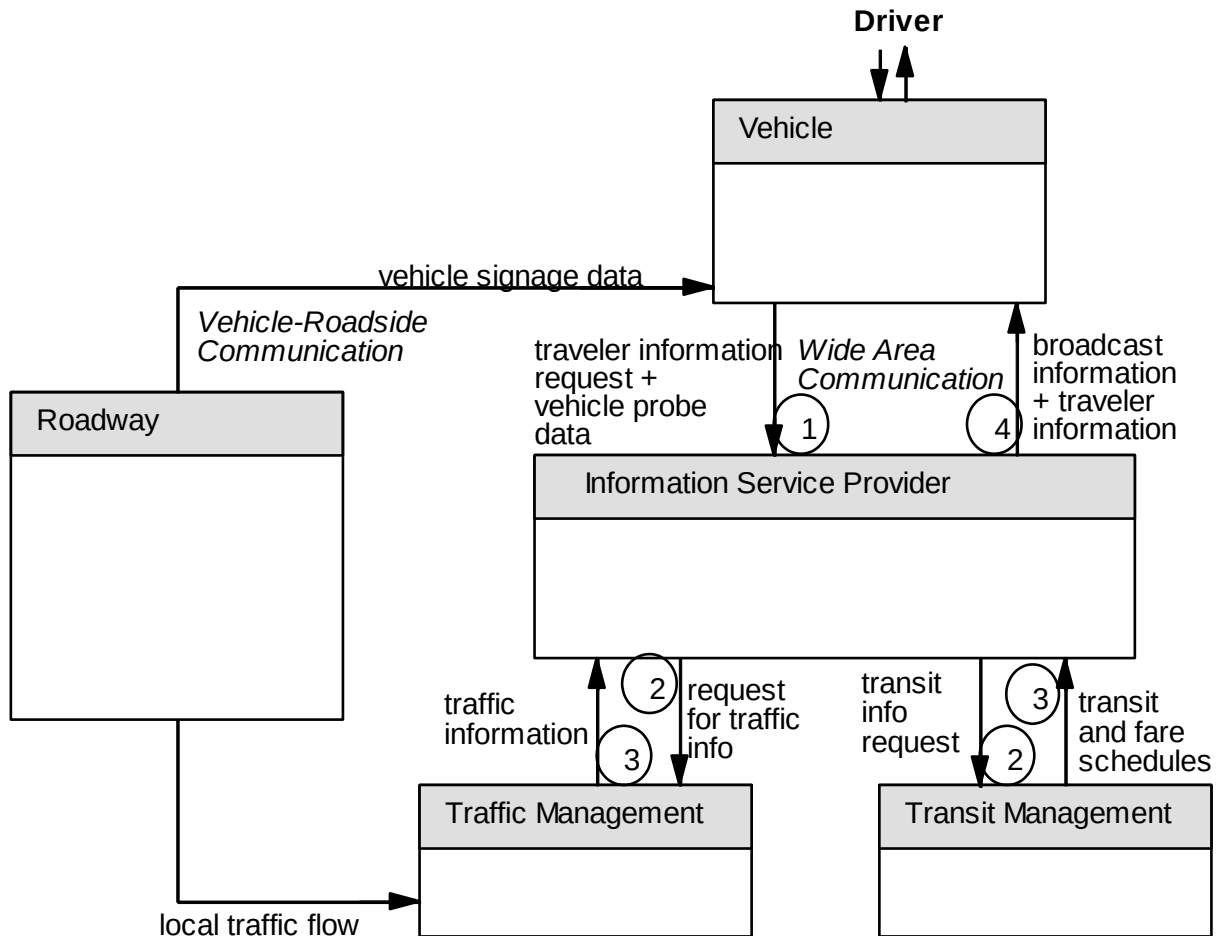


Figure 5 - Physical Architecture for Driver Advisory

1. A driver requests advisory information (via the traveler information request architecture flow) through the driver interface. He also sends the vehicle location and a time-stamp (vehicle probe data), which is the simplest basis for “probe” data, since the ISP can make an estimate of traffic flow conditions based on the time and location differences between these messages from each vehicle.

2. The ISP requests advisory data from the TMS subsystem (through the architecture flow “current road data”). At the same time, Transit information is requested from the Transit Management Center (TRM) via the “transit status” architecture flow. Note that the ISP may choose to request information from the TRM and TMS at regular intervals, not related to traveler requests. If the ISP is paying for the TMS and TRM information, then the ISP will be motivated to carefully manage these information requests.

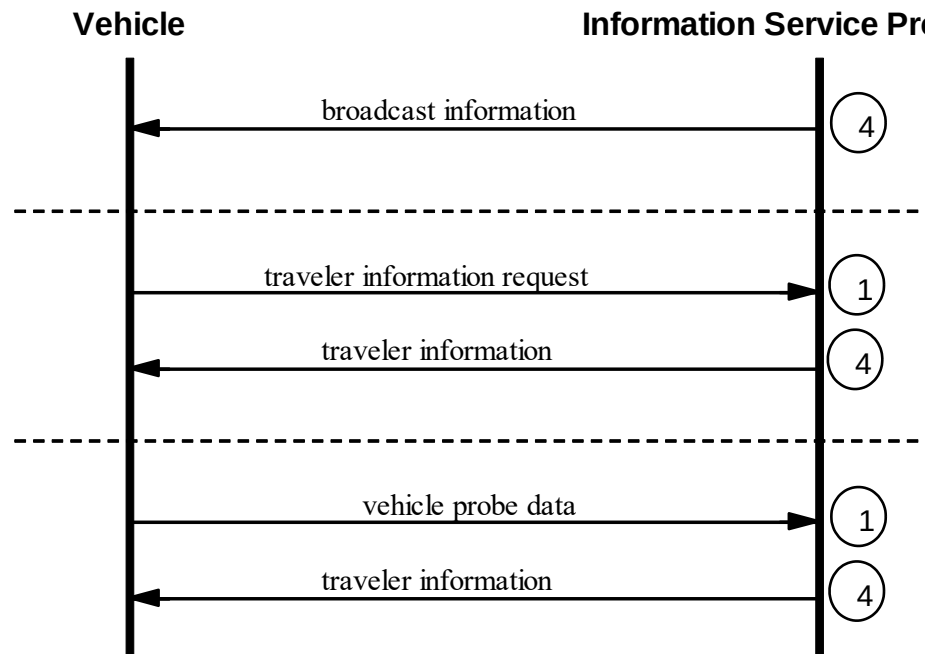


Figure 6 - Driver Advisory Transaction Set

The Roadway subsystem periodically updates the Traffic Management subsystem with surveillance data about roadway conditions. The TMS uses this information to maintain a real-time model of roadway conditions, so that the TMS can perform its own Traffic Management functions, and also rapidly respond to ISP requests.

3. In response to the ISP requests, the TRM and TMS send transit and traffic/ road status back to the ISP.
4. Advisory information included in the architecture flow “traveler information” can be provided to the driver based on the driver request, or can be provided automatically (event driven) once a connection with the ISP has been initiated. In this way, the driver can be notified shortly after an incident that effects their travel plan.

Alternative In-Vehicle Signage Using Wireless Wide Area Communication

An alternative approach to providing In-Vehicle Signage, shown in Figure 7 - and Figure 8 - , from that discussed in the ITS-America Program Plan and shown in Figure 5 - , is also included in the National ITS architecture. This user service may be an outgrowth of the Route Selection provided by the ISP. A navigable database maintained by the ISP can contain information about the location and content of signage on the links. By adding this signage information to route messages as link attributes, it can be transmitted to the vehicle using the Wireless Wide Area Communications. When combined with an in vehicle location system, the route guidance capability in the vehicle can provide the driver with upcoming signage

information. The information could be provided either by auditory, or visual means through the same driver interface used by the route guidance function.



Figure 7 - Alternative Physical Architecture for In-Vehicle Signage

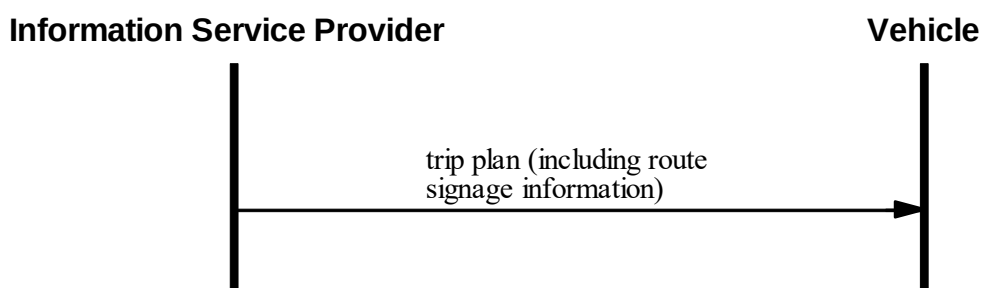


Figure 8 - ISP Wireless Message Sequence Diagram for In-Vehicle Signage

Using this mechanism, signage becomes a service provided by the ISP, not constrained to be an extension of the existing infrastructure signage. An active link from roadway signs to vehicles is certainly possible, and can coexist with this alternative, but brings with it added liability on the public sector. Once the public sector provides this service they become responsible for maintaining the capability, and can suffer legal exposure if the infrastructure component fails to work. (The assumption here, which can be debated, is that the private sector may be better prepared to manage the inherent liability of the signage user service. This issue is discussed in more detail in the legal analysis section of the Implementation Plan document.) ISPs will likely exercise a choice as to what kind of signs they choose to include in routes, possibly taking driver preferences into account.

3.3. Route Guidance

The Route Guidance User Service involves two distinct processing operations: route selection and route guidance. The route selection operation involves selecting the route to take based upon the Driver, Traveler (or Commercial Vehicle Dispatcher) request. The route guidance operation involves presenting the selected route to the driver or traveler in a step by step fashion. All implementations of the Route Guidance user service involve a route guidance process in the vehicle subsystem or Personal Information Access subsystem (e.g., a PDA or Personal Digital Assistant). The location of the route selection process distinguishes different Route Guidance operating modes of the architecture.

The method of providing Route Selection in the fully developed architecture, to either a driver in a vehicle, a traveler with a PDA (Personal Information Access subsystem) or at a Remote Traveler Support subsystem, or a Commercial Vehicle Manager at a Fleet Management Center, is by the Information Service Provider. The architecture supports the autonomous mode of guidance (route selection processing in the Vehicle or Personal Information Access subsystems) and also supports the mode of route selection in the Vehicle or

Personal Information Access subsystems where the Information Service Provider provides link and queue times to the mobile route selection processes.

Another key function in providing the Route Guidance user service in the fully developed architecture is the use of a predictive model from which to estimate future transportation link and queue delay times. This process can reside in either the ISP or in the TMS (Traffic Management Subsystem). Figure 9 - and Figure 10 - show the high-end state Route Guidance user service where the predictive model resides in the TMS. The prediction of link delays (the time to transit a link) and ramp or intersection queue delays (the expected waiting time at a highway on-ramp, off-ramp or an intersection based on a desired turning movement) can be of varying levels of sophistication. In a sophisticated deployments, the link and queue times may be based on the expected statistical occupancy of links, and models based on historical data of the relationship between occupancy and expected (average) link times and queue delays. The expected statistical occupancy of links may be determined by historical time-of-day data, as well as the prior choices of travelers to travel specific routes (routes that have been requested and selected by travelers using an Information Service Provider subsystem). In Figure 9 - , these choices are communicated (without any identification of specific vehicles or travelers), by the ISP to the TMS so that the predictive model may be incrementally updated in real-time. In the same way, the expected occupancy of transit vehicles may be updated in real-time through a similar message from the ISP to the Transit Management subsystem.

1. Driver, Traveler or Commercial Vehicle Manager interacts with the corresponding subsystem to issue a Trip Request message to the ISP.
2. The ISP issues, if necessary, appropriate traffic and/or transit data requests. These requests (and waiting for the corresponding response) may not be necessary if the ISP has recently requested (and stored) similar information.
3. The ISP receives current and predicted traffic data (link travel times and ramp or intersection queue delays) and/or transit data (available schedules and schedule variances) relevant to the route request.

Based on the data received in step 3. above, the ISP may make additional requests (step 2. above) to find a better route. These steps are very dependent on the specific implementation of route selection in the ISP. It is expected that there will be considerable innovation in the development of these processes, and the performance of these processes (the quality of the resultant routes and the minimization of the transit/traffic data requests) will determine the cost-performance operating points of competing ISPs.

4. The ISP processes a route and sends it to the requesting subsystem in the Trip Plan message. (For mobile equipment that computes autonomous routes, this flow may not have a route, but just relevant link travel times or ramp or intersection queue delays that are variances from the expected values. Unless the selected route is reported to the ISP and subsequently to the TMS, there is no possibility in this case to achieve system (near) optimal use of the transportation network.) Note that this route may be of considerable size, depending on the complexity of the route. The ISP and receiving subsystem may use a data compression/decompression process at both ends to minimize the communications cost of this potentially large message. The route sent to the traveler can include a route ID associated with the computed route, so that the traveler equipment can efficiently refer to the selected route in the next step, route confirmation.
5. The driver, traveler or Commercial Vehicle Manager decides to accept or reject the provided route (making use of a "route preview" process), and may change the route request (going back to step 1 above) or accept the route, issuing the Trip Confirmation message from the mobile subsystem.

Commercial Vehicle Manager

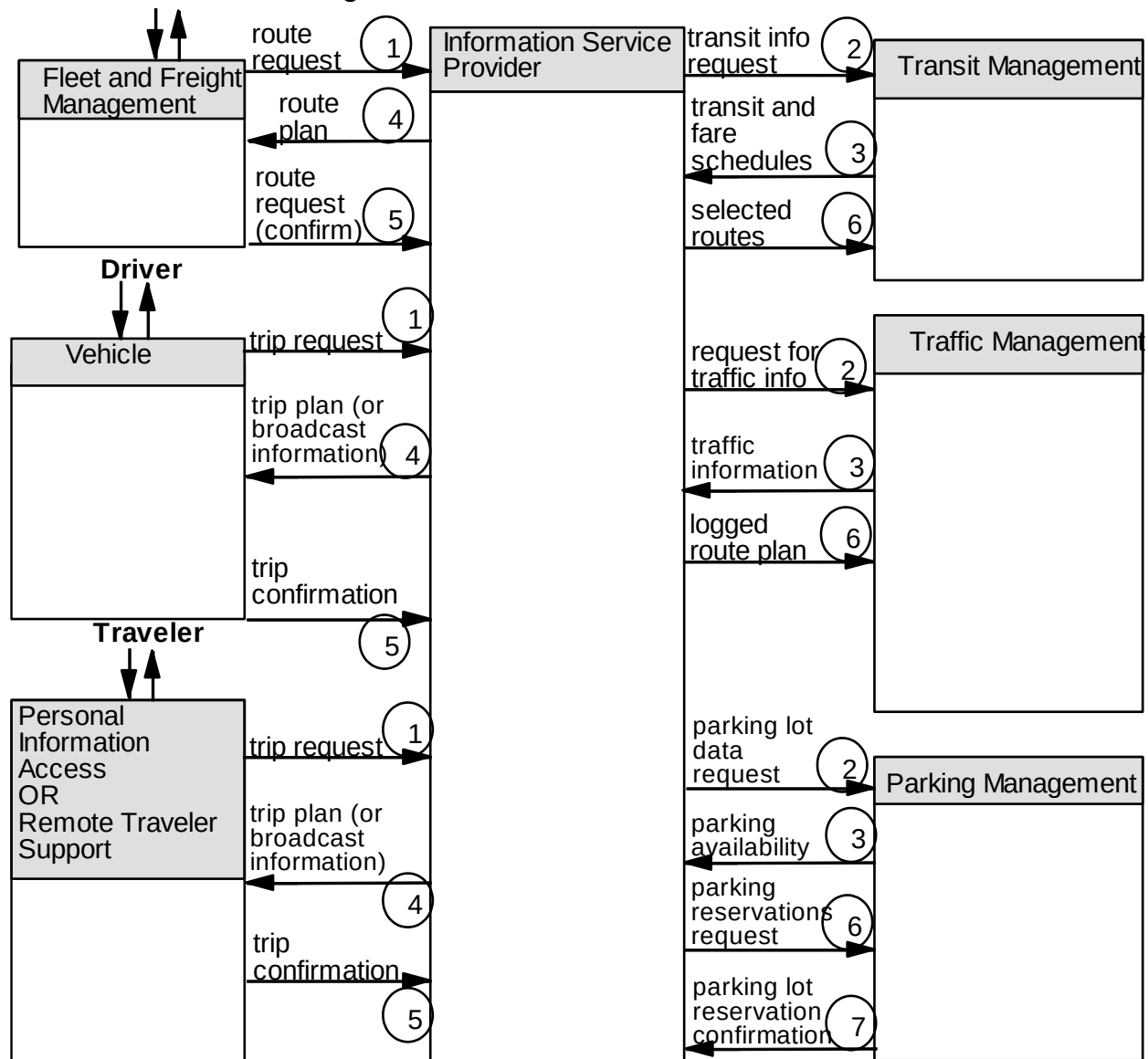


Figure 9 - Physical Architecture for Route Guidance

Confirming the acceptance of a route may be the basis for real-time, event-driven travel advisories to the driver or traveler, as outlined in Section 3.2. Because of this, the driver or traveler may be strongly motivated to inform the ISP of the intention to accept a selected route.

It is the responsibility of the traveler/driver to make the final decision on the selection of a route, whether the route is selected (“computed”) autonomously or at an ISP. In some cases, it may be necessary or beneficial to communicate the traveler/driver’s selection back to the ISP e.g., to confirm demand responsive transit links in the route or other reservations or to update a congestion model used by the infrastructure to compute future routes. (Note: it is in the travelers interest to have the Traffic Management congestion model updated to expect their future approximate link occupancies if the updated model is used to send suggestions to subsequent travelers to use other links, thereby leaving the links the traveler has chosen to travel in a less congested state. Furthermore, the traveler’s expected occupancy may be used by the Traffic Management subsystem to better plan the signal timings for the traveler’s benefit.)

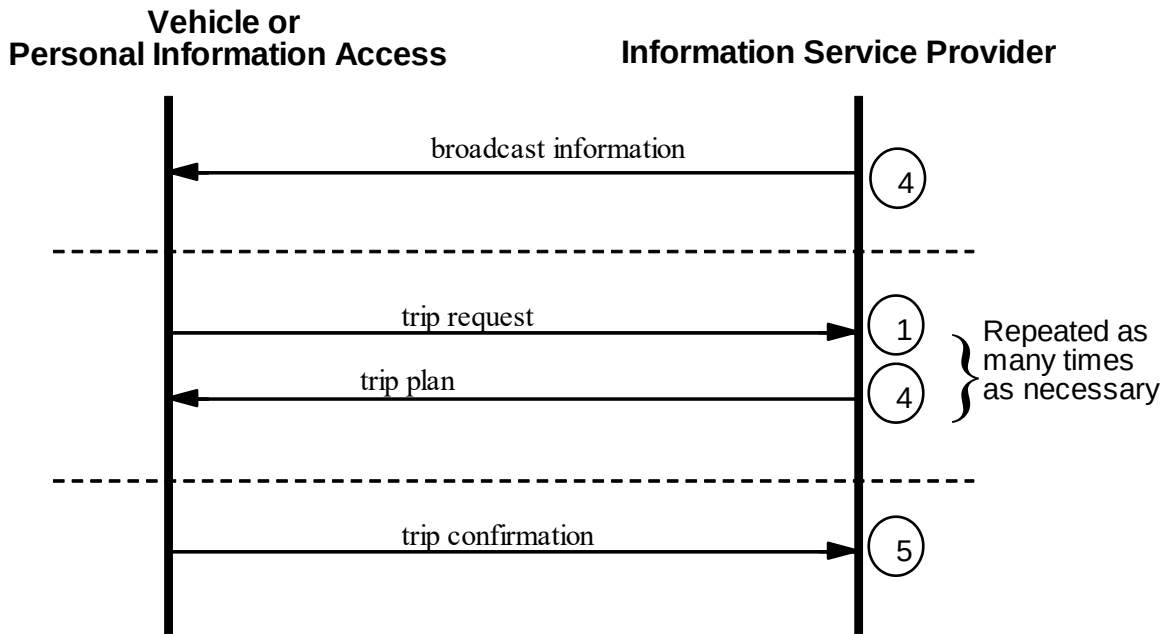


Figure 10 - Route Guidance Transaction Set

6. The ISP sends the selected route to the Traffic Management Center and/or Transit Management Center (with vehicle classification and occupancy but without traveler or driver/vehicle identification) so that the appropriate expected statistical occupancy models can be updated, reflecting the incremental congestion and transit time impact that the planned route will have on the transportation network (or transit vehicle occupancy).

Note that although personal identification of vehicles is not included in the message from the ISP to the TMS (because it is not needed), the *type* of vehicle may be included because different type vehicles will have different impacts on the road network occupancy (i.e. a large truck will occupy more space than a passenger vehicle and will have different acceleration, deceleration, and environmental profiles). Also, vehicle occupancy is communicated in support of traffic control optimization based on movement of people (as opposed to vehicles). Another exception is for commercial vehicles transporting hazardous materials (HAZMAT). In these cases, the selected route may also include the hazardous materials manifest, each item identified by the material safety data sheet number (MSDS, a standard for identifying hazardous materials) and the material quantity. The purpose of this information is for public safety purposes: emergency pre-planning and accelerating incident classification and (appropriate) response.

Dynamic Route Selection and Probe Data

A variation of the basic Route Guidance mechanism supported by the architecture involves the mobile subsystem frequently requesting a new route from the ISP at pre-specified waypoints along a route. These additional trip requests can be used to recompute the route for the driver or traveler, and if the new route is better than the old route (due to some unanticipated change in link, ramp or intersection characteristics, e.g., a nonrecurring incident) by some user specified criteria, then the new route is sent to the mobile subsystem as in flow “4” of Figure 9 - .

The waypoints for the additional trip requests are pre-specified by the ISP in the original route message, and the waypoint route requests need only take the form of a location and a timestamp (the return address of the mobile subsystem is assumed to be included as a part of the message protocol below the application layer).

Finally, the waypoint specified route locations for updated route request messages serve the ISP as “probe data”, which may allow ISPs to construct their own models of the transportation network to be used for route selection. This capability of ISPs to build their own models of the transportation network may be significant in the time period before ISPs and TMSs integrate the ATIS and ATMS functions, or in regions where the TMS chooses not to participate or does not exist, and will allow competing ISPs to differentiate their services. The probe information is determined by computing the timestamp difference between a vehicle’s route request message at the current waypoint and the previous waypoint.

3.4. Traveler Services Information

Traveler Services Information includes getting traffic information, transit information, and yellow pages information (e.g., tourist attractions, lodging, and motorist services). This information can be accessed by travelers at kiosks, in transit vehicles, home or office computers, travelers with Personal Digital Assistants (PDAs), and by drivers.

The yellow pages service includes a two-way reservation capability, including electronic payment for reservations.

The ISP supports data collection from Information Brokers (for generic yellow pages information) and Event Promoters (for information that will have a predictable impact on the transportation network) shown in Figure 11 - and Figure 12 - . This data collection can be in response to a specific Information Request or may be collected whenever the Event Promoters or Yellow Pages Service Providers issue their specific messages. Note that it will be in the interest of the Yellow Pages Service Providers to issue the travel service info message frequently to assure its accuracy, since the providers of the information (the product or service vendors) are probably paying the information brokers to get the broadest possible distribution of their listings.

Note that the architecture does not specify implementation, so that the Remote Traveler Support subsystem of Figure 11 - could be implemented with a “kiosk” type electronic interface, or with a human operator implementing the interface. In this way, a traveler could interface with the subsystem through electronic input / output devices, or through the operator, including speaking with the operator over a telephone line.

1. Travel service information from Yellow Pages Service Providers are collected whenever they are made available and then stored in the ISP.
2. Drivers or travelers from the three remote access subsystems shown in Figure 11 - prepare and issue a traveler request message to the ISP. The request can be only for information, or can request a reservation with optional payment service in support of the reservation.
3. If necessary, the ISP issues a payment request message to the Financial Institution (or Financial Clearinghouse) to transact payment. The payment could be for the information, or (more likely) for reservations for travel services.
4. If a payment request was issued by the ISP, then the financial institution issues an acknowledgement (that payment was transacted or denied).
5. If a travel service reservation was requested, then the ISP issues a message with the reservation and payment confirmation information to the Yellow Pages Service Provider.

6. The ISP returns the traveler information message to the requesting subsystem. This message will contain confirmation for the various traveler services requested, if any.

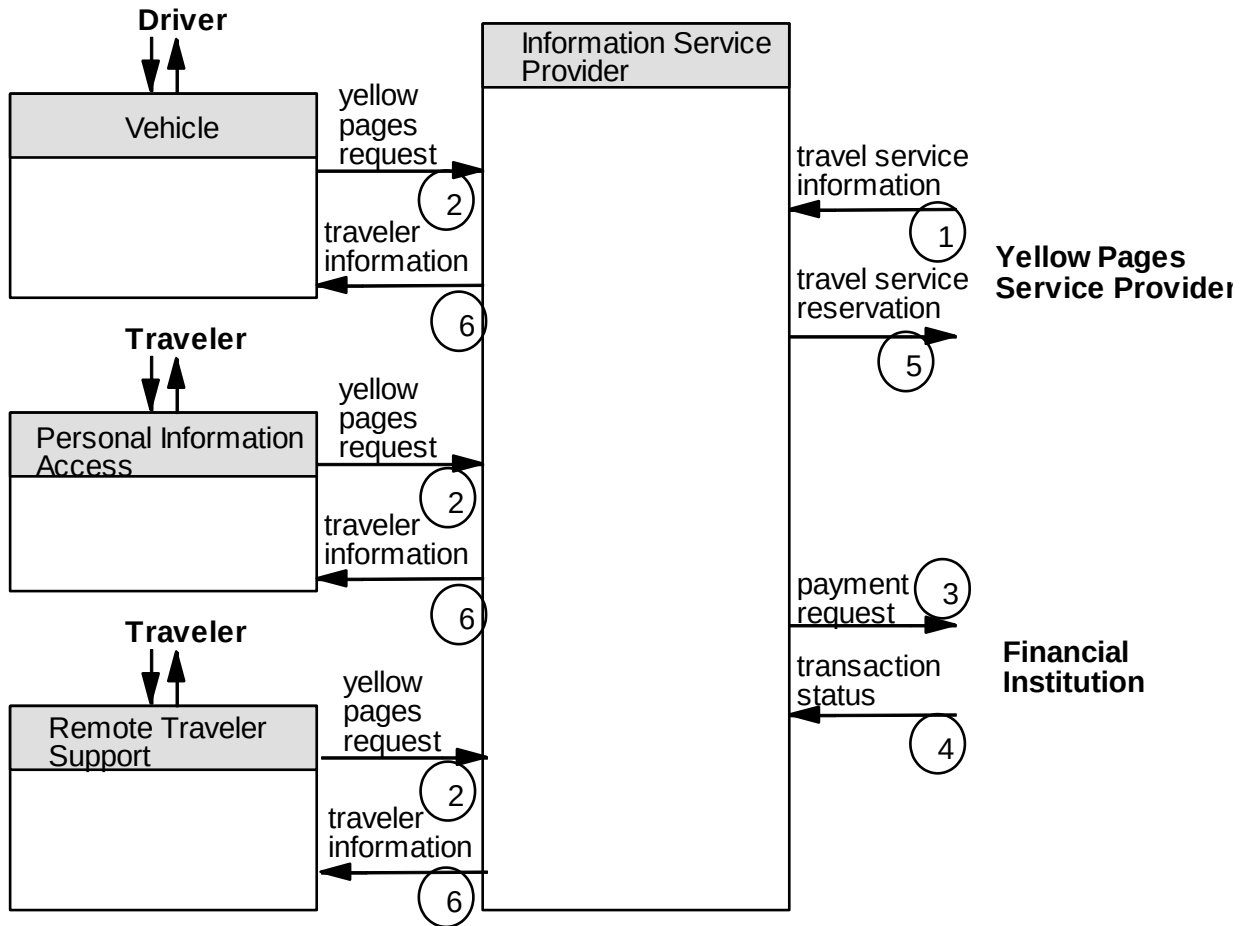


Figure 11 - Physical Architecture for Traveler Information Services

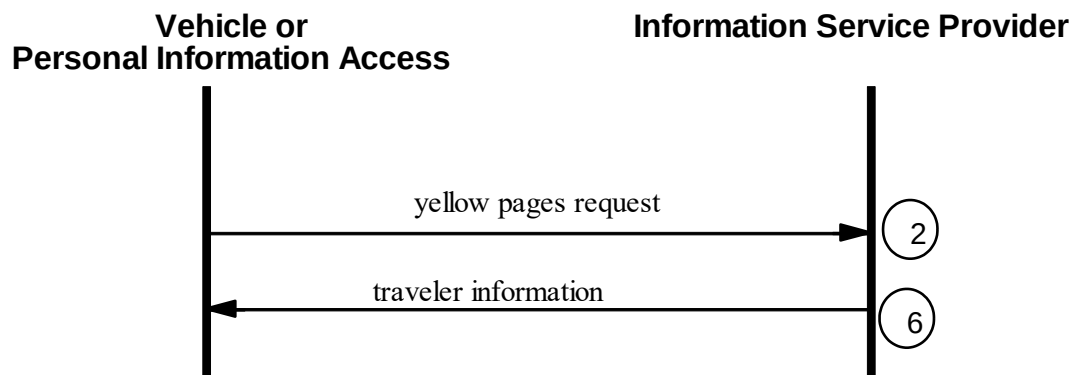


Figure 12 - Traveler Information Services Transaction Set

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 logical architecture data flows, which in turn are decomposed until we reach primitive data elements. (The hierarchy is carried down 5 levels. In some instances this does not extend to the primitive elements. In these cases the remaining decomposition can be found by referring to the data dictionary.) The logical architecture data flows are numbered and indented to indicate which are top level flows (1) and which are constituent data flows (numbered 2 and lower). The description of the top level logical architecture flows is given. The full data dictionary entry for the top level flows and for all the constituent flows is given in Section 7. That section contains the data dictionary entries, listed in alphabetical order, for all of the logical data flows contained in this package. (Hence it represents a focussed subset of the entire National Architecture Data Dictionary).

4.1. Personal Information Access -> Information Service Provider

Physical Architecture Flow: traveler information request W,U1t

Request for any type of traveler information

Logical Architecture Flows:

(1) *traffic_data_portables_request*

This data flow contains the request for the provision of traffic data for output at a traveler's personal portable device. It consists of the following data items each of which is defined in its own DDE:

(2)*traffic_data_request*

(2)*traveler_identity*

(1) *transit_deviations_portables_request*

This data flow is a request for data on current transit service deviations for output to a traveler's personal portable device. The request is modified so that only the data for a transit route specified by the traveler from the portable device is requested. The data flow consists of the following data items each of which is defined in its own DDE:

(2)*transit_route_number*

(2)*transit_vehicle_deviation_request*

(2)*traveler_identity*

(1) *traveler_map_update_payment_request*

This data flow 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. It consists of the following data items each of which is defined in its own DDE:

(2)*credit_identity*

(2)*navigable_map_traveler_update_cost*

(3)*cost*

(2)*traveler_identity*

(1) *traveler_personal_current_condition_request*

This data flow contains a request for details of the current conditions, e.g. weather, events, incidents, etc. The request includes the identity of the personal portable device from which the request was input by the traveler so that the response can be correctly returned. The data flow consists of the following item which is defined in its own DDE:

(1) *traveler_personal_display_update_payment_request*

This data flow 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 portable device. The payment will be made by debiting the credit identity with the cost through the financial institution terminator. It consists of the following data items each of which is defined in its own DDE:

(2)*credit_identity*

(2)*display_map_traveler_update_cost*

(2)*traveler_identity*

Physical Architecture Flow: trip confirmation W,U1t

Acknowledgement of acceptance of route

Logical Architecture Flows:

(1) *traveler_personal_payment_information*

This data flow is used within the Provide Driver and Traveler Services function. It contains details of the components of a trip which a traveler has obtained from the input of data to a personal portable device and for which advanced payment is needed following a trip confirmation. The traveler's identity and credit identity or stored credit from the payment instrument are therefore also included to enable payment to be made. The data flow consists of the following items each of which is defined in its own DDE:

(2)*credit_identity*

(2)*parking_space_details*

(3)*date*

(3)*duration*

(3)*time*

(2)*ride_segments*

(3)*list_size*

(3)*transit_route_segment_number*

(2)*stored_credit*

(2)*toll_route_segments*

(3)*list_size*

(3)*toll_segment_identity*

(4)*unit_number*

(2)*traveler_identity*

(1) *traveler_personal_trip_confirmation*

This data flow is used within the Provide Driver and Traveler Services function to confirm the trip details provided as the result of a traveler's previous trip request input from a personal portable device. It contains the following data item which is defined in its own DDE:

(2)*paratransit_service_confirmation*

(3) *paratransit_service_identity*

(3)*transit_confirmation_flag*

(3)*traveler_identity*

- (2)traveler_identity
- (2)traveler_rideshare_confirmation
- (3)credit_identity
- (3)reservation_status
- (4)confirmation_flag
- (3)rideshare_selection_number
- (3)traveler_identity
- (1) traveler_route_accepted

This data flow contains the acceptance by the traveler of the previously provided route for on-line infrastructure based guidance. Acceptance must be provided before guidance can begin. The data flow consists of the following data item which is defined in its own DDE: *

- (2)route_identity

Physical Architecture Flow: trip request W,U1t

Request for special routing

Logical Architecture Flows:

- (1) traveler_personal_trip_request

This data flow contains data about a traveler's trip request which has been input from a personal portable device. It consists of the following data items each of which is defined in its own DDE:

- (2)traveler_identity
- (2)traveler_rideshare_request
- (3)traveler_identity
- (3)traveler_rideshare_constraints
- (4)constraint_on_acceptable_travel_time
- (4)constraint_on_ahs_lanes
- (4)constraint_on_eta_change
- (4)constraint_on_interstate
- (4)constraint_on_special_needs
- (4)constraint_on_urban
- (4)constraint_on_vehicle_type
- (3)traveler_rideshare_data
- (4)departure_time
- (5)time
- (4)desired_arrival_time
- (5)time
- (4)destination
- (4)origin
- (3)traveler_rideshare_preferences
- (4)preferred_alternate_routes
- (4)preferred_ridesharing_options
- (4)preferred_route_segments
- (4)preferred_routes
- (2)trip_request
- (3)constraints
- (4)constraint_on_number_of_mode_changes
- (4)constraint_on_acceptable_travel_time
- (4)constraint_on_ahs_lanes

- (4)constraint_on_eta_change
- (4)constraint_on_interstate
- (4)constraint_on_load_classification
- (4)constraint_on_number_of_transfers
- (4)constraint_on_special_needs
- (4)constraint_on_urban
- (4)constraint_on_vehicle_type
- (3)departure_time
 - (4)time
- (3)desired_arrival_time
 - (4)time
- (3)destination
 - (4)route_point
- (3)origin
- (3)preferences
 - (4)modes
 - (4)preferred_alternate_routes
 - (4)preferred_ridesharing_options
 - (4)preferred_route_segments
 - (4)preferred_routes
 - (4)preferred_transit_options
 - (4)preferred_weather_conditions

(1) traveler_route_request

This data flow is used within the Provide Driver and Traveler Services function and contains data from which the route requested by a traveler can be determined, or that the previously provided data has been accepted. It consists of the following data items each of which is defined in its own DDE:

- (2)constraint_on__number_of_mode_changes
- (2)constraint_on_acceptable_travel_time
- (2)constraint_on_eta_change
- (2)constraint_on_number_of_transfers
- (2)constraint_on_special_needs
- (2)desired_arrival_time
 - (3)time
- (2)destination
- (2)modes
- (2)origin
- (2)preferred_alternate_routes
- (2)preferred_ridesharing_options
- (2)preferred_route_segments
- (2)preferred_routes
- (2)preferred_transit_options
- (2)traveler_identity
- (2)traveler_location
 - (3)location_identity
- (2)traveler_route_accepted
 - (3)route_identity

Physical Architecture Flow: yellow pages request W,U1t

Request for reservation through yellow pages type service

(1) *traveler_personal_transaction_request*

This data flow contains data input by the traveler at a personal portable device to make reservations for various other (yellow pages) services. It contains the following data items, each of which is defined in its own DDE:

(2)*yellow_pages_dining_reservation*

(2)*yellow_pages_lodging_reservation*

(2)*yellow_pages_ticket_purchase*

(1) *traveler_personal_yellow_pages_information_request*

This data flow contains a request for data on other (yellow pages) services to be provided to a traveler using a personal portable device. The traveler identity is used as the means of ensuring that the data produced in response to the request is returned to the correct traveler. As no filtering components are included, all the data currently available will be provided. The data flow consists of the following data item which is defined in its own DDE:

(2)*traveler_identity*

4.2. Information Service Provider -> Personal Information Access

Physical Architecture Flow: broadcast information W,U1b

common link travel times, advisories, transit schedule exceptions, other traveler information

(1) *traffic_data_for_portables*

This data flow is sent from the Manage Traffic function to the Provide Driver and Traveler Services function. It is used to provide data on the traffic flowing in the road network, plus that which is predicted to flow in the network for output to a traveler's personal portable device. The data flow has been sized to take account of the need to only supply a subset of the full traffic data to the portable device. This subset will depend on the route segment list included in the request, which for sizing purposes has been assumed to have a maximum value of 25. Thus, the size expression below is based on sampling a percentage of the data equivalent to an N route segment square area (i.e. N/total number of segments). The flow consists of the following items each of which is defined in its own DDE:

(2)*tmc_identity*

(2)*traffic_data_for_media*

(3)*current_data_for_media*

(4)*current_incident_data*

(5)*current_incident_details*

(5)*list_size*

(4)*current_other_routes_use*

(5)*route_segment_guided_travelers*

(5)*route_segment_identity*

(5)*route_segment_journey_time*

(5)*route_segment_total_number*

(4)*parking_lot_storage_data*

(5)*list_size*

(5)*parking_lot_current_occupancy*

(5)*parking_lot_identity*

(5)*parking_lot_state*

(4)*traffic_flow_state*

(5)*current_ramp_state*

(5)*current_road_network_use*

(5)*current_roadway_network_data*

(5)*hov_lane_data*

(5)*link_data_from_tags*

(4)*wide_area_pollution_data*

(5)*list_size*

(5)*pollution_state_area_collection*

(5)*pollution_state_roadside_collection*

(3)*long_term_data_for_media*

(4)*current_incident_data*

(5)*current_incident_details*

(5)*list_size*

(4)*current_other_routes_use*

(5)*route_segment_guided_travelers*

(5)*route_segment_identity*

(5)*route_segment_journey_time*

(5)*route_segment_total_number*

- (4) *parking_lot_storage_data*
 - (5) *list_size*
 - (5) *parking_lot_current_occupancy*
 - (5) *parking_lot_identity*
 - (5) *parking_lot_state*
- (4) *traffic_flow_state*
 - (5) *current_ramp_state*
 - (5) *current_road_network_use*
 - (5) *current_roadway_network_data*
 - (5) *hov_lane_data*
 - (5) *link_data_from_tags*
- (4) *wide_area_pollution_data*
 - (5) *list_size*
 - (5) *pollution_state_area_collection*
 - (5) *pollution_state_roadside_collection*
- (3) *predictive_model_data_for_media*
 - (4) *predicted_highway_network_data*
 - (5) *link_delay*
 - (5) *link_journey_time*
 - (5) *link_list_for_highways*
 - (4) *predicted_hov_lane_data*
 - (5) *hov_lane_vehicle_count*
 - (5) *hov_lane_violation_count*
 - (5) *list_size*
 - (4) *predicted_other_routes_use*
 - (5) *route_segment_guided_travelers*
 - (5) *route_segment_identity*
 - (5) *route_segment_journey_time*
 - (5) *route_segment_total_number*
 - (4) *predicted_parking_lot_data*
 - (5) *list_size*
 - (5) *parking_lot_identity*
 - (5) *parking_lot_occupancy*
 - (5) *parking_lot_state*
 - (4) *predicted_road_network_data*
 - (5) *link_delay*
 - (5) *link_journey_time*
 - (5) *link_list_for_highways*
 - (4) *predicted_road_network_use*
 - (5) *route_segment_guided_vehicles*
 - (5) *route_segment_identity*
 - (5) *route_segment_journey_time*
 - (5) *route_segment_total_number*
- (2) *traveler_identity*
- (1) *transit_deviations_for_portables*

This data flow is sent by the Provide Driver and Traveler Services function to the Manage Transit function and contains current transit service deviations for a particular route. This data will be output to a traveler's personal portable device. It consists of the following data items each of which is defined in its own DDE:

- (2) *list_size*

- (2)transit_route_segment_number*
- (2)transit_vehicle_achieved_time*
- (3)time*
- (2)transit_vehicle_identity*
- (2)traveler_identity*

Physical Architecture Flow: traveler information W,U1t

Traveler routing, yellow pages etc.

Logical Architecture Flows:

(1) *traffic_data_for_portables*

This data flow is sent from the Manage Traffic function to the Provide Driver and Traveler Services function. It is used to provide data on the traffic flowing in the road network, plus that which is predicted to flow in the network for output to a traveler's personal portable device. The data flow has been sized to take account of the need to only supply a subset of the full traffic data to the portable device. This subset will depend on the route segment list included in the request, which for sizing purposes has been assumed to have a maximum value of 25. Thus, the size expression below is based on sampling a percentage of the data equivalent to an N route segment square area (i.e. N/total number of segments). The flow consists of the following items each of which is defined in its own DDE:

- (2)tmc_identity*
- (2)traffic_data_for_media*
 - (3)current_data_for_media*
 - (4)current_incident_data*
 - (5)current_incident_details*
 - (5)list_size*
 - (4)current_other_routes_use*
 - (5)route_segment_guided_travelers*
 - (5)route_segment_identity*
 - (5)route_segment_journey_time*
 - (5)route_segment_total_number*
 - (4)parking_lot_storage_data*
 - (5)list_size*
 - (5)parking_lot_current_occupancy*
 - (5)parking_lot_identity*
 - (5)parking_lot_state*
 - (4)traffic_flow_state*
 - (5)current_ramp_state*
 - (5)current_road_network_use*
 - (5)current_roadway_network_data*
 - (5)hov_lane_data*
 - (5)link_data_from_tags*
 - (4)wide_area_pollution_data*
 - (5)list_size*
 - (5)pollution_state_area_collection*
 - (5)pollution_state_roadside_collection*
- (3)long_term_data_for_media*
 - (4)current_incident_data*
 - (5)current_incident_details*

- (5)list_size
- (4)current_other_routes_use
 - (5)route_segment_guided_travelers
 - (5)route_segment_identity
 - (5)route_segment_journey_time
 - (5)route_segment_total_number
- (4)parking_lot_storage_data
 - (5)list_size
 - (5)parking_lot_current_occupancy
 - (5)parking_lot_identity
 - (5)parking_lot_state
- (4)traffic_flow_state
 - (5)current_ramp_state
 - (5)current_road_network_use
 - (5)current_roadway_network_data
 - (5)hov_lane_data
 - (5)link_data_from_tags
- (4)wide_area_pollution_data
 - (5)list_size
 - (5)pollution_state_area_collection
 - (5)pollution_state_roadside_collection
- (3)predictive_model_data_for_media
 - (4)predicted_highway_network_data
 - (5)link_delay
 - (5)link_journey_time
 - (5)link_list_for_highways
 - (4)predicted_hov_lane_data
 - (5)hov_lane_vehicle_count
 - (5)hov_lane_violation_count
 - (5)list_size
 - (4)predicted_other_routes_use
 - (5)route_segment_guided_travelers
 - (5)route_segment_identity
 - (5)route_segment_journey_time
 - (5)route_segment_total_number
 - (4)predicted_parking_lot_data
 - (5)list_size
 - (5)parking_lot_identity
 - (5)parking_lot_occupancy
 - (5)parking_lot_state
 - (4)predicted_road_network_data
 - (5)link_delay
 - (5)link_journey_time
 - (5)link_list_for_highways
 - (4)predicted_road_network_use
 - (5)route_segment_guided_vehicles
 - (5)route_segment_identity
 - (5)route_segment_journey_time
 - (5)route_segment_total_number
- (2)traveler_identity

(1)transit_deviations_for_portables

This data flow is sent by the Provide Driver and Traveler Services function to the Manage Transit function and contains current transit service deviations for a particular route. This data will be output to a traveler's personal portable device. It consists of the following data items each of which is defined in its own DDE:

- (2)list_size***
- (2)transit_route_segment_number***
- (2)transit_vehicle_achieved_time***
- (3)time***
- (2)transit_vehicle_identity***
- (2)traveler_identity***

(1) traveler_map_update_payment_response

This data flow is sent from the Provide Electronic Payment Services function to the Provide Driver and Traveler Services function and 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. It consists of the following data items each of which is defined in its own DDE:

- (2)confirmation_flag***
- (2)credit_identity***
- (2)traveler_identity***

(1) traveler_personal_display_update_payment_response

This data flow is sent from the Provide Electronic Payment Services function to the Provide Driver and Traveler Services function and 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 portable device. It consists of the following data items each of which is defined in its own DDE:

- (2)confirmation_flag***
- (2)credit_identity***
- (2)traveler_identity***

(1) traveler_personal_payment_confirmation

This data flow is used within the Provide Driver and Traveler Services function to indicate 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. The request for payment will have been initiated by input from the traveler to a personal portable device. The data flow consists of the following data items each of which is defined in its own DDE:

- (2)advanced_fares_confirm***
 - (3)confirmation_flag***
- (2)advanced_parking_lot_charges_confirm***
 - (3)confirmation_flag***
 - (3)credit_identity***
 - (3)parking_lot_cost***
 - (4)cost***
 - (3)stored_credit***
- (2)advanced_tolls_confirm***
 - (3)confirmation_flag***
 - (3)credit_identity***
 - (3)stored_credit***
 - (3)toll_cost***

- (2)credit_identity*
- (2)stored_credit*
- (2)traveler_identity*
- (2)traveler_total_trip_cost*

(1)traveler_personal_transaction_confirmation

This data flow is used within the Provide Driver and Traveler Services function to confirm any reservations made by the traveler from a personal portable device. These reservations will be based on information obtained by the traveler from previous data input and output through the device. The data flow consists of the following data items each of which is defined in its own DDE:

- (2)credit_identity*
- (2)transaction_number*
- (2)traveler_identity*
- (2)yellow_pages_cost*
- (3)cost*
- (2)yellow_pages_dining_reservation_confirmation*
- (3)confirmation_flag*
- (3)yellow_pages_service_reservation_number*
- (2)yellow_pages_lodging_reservation_confirmation*
- (3)confirmation_flag*
- (3)yellow_pages_service_reservation_number*
- (2)yellow_pages_ticket_purchase_confirmation*
- (3)confirmation_flag*
- (3)yellow_pages_service_reservation_number*

(1) traveler_personal_yellow_pages_data

This data flow is used within the Provide Driver and Traveler Services function and contains details of other (yellow pages) services which is to be sent to the traveler interface facility for output using a kiosk. The size of the data flow has been set to take account of the need to provide only a small percentage of the total yellow pages data that is available. The data flow consists of the following data items each of which is defined in its own DDE:

- (2)traveler_identity*
- (2)yellow_pages_general_information*
- (3)yellow_pages_history*
- (4)list_size*
- (4)yellow_pages_service_contact*
- (4)yellow_pages_service_description*
- (4)yellow_pages_service_location*
- (5)location_identity*
- (4)yellow_pages_service_time*
- (5)time*
- (4)yellow_pages_service_type*
- (3)yellow_pages_local_customs*
- (4)list_size*
- (4)yellow_pages_service_description*
- (4)yellow_pages_service_location*
- (5)location_identity*
- (4)yellow_pages_service_type*
- (3)yellow_pages_people*
- (4)list_size*

- (4)yellow_pages_service_contact
- (4)yellow_pages_service_description
- (4)yellow_pages_service_location
- (5)location_identity
- (4)yellow_pages_service_type
- (2)yellow_pages_specific_information
 - (3)yellow_pages_food
 - (4)list_size
 - (4)yellow_pages_service_contact
 - (4)yellow_pages_service_description
 - (4)yellow_pages_service_location
 - (5)location_identity
 - (4)yellow_pages_service_type
 - (3)yellow_pages_gas_stations
 - (4)list_size
 - (4)yellow_pages_service_contact
 - (4)yellow_pages_service_description
 - (4)yellow_pages_service_location
 - (5)location_identity
 - (4)yellow_pages_service_type
 - (3)yellow_pages_hospitals
 - (4)list_size
 - (4)yellow_pages_service_contact
 - (4)yellow_pages_service_description
 - (4)yellow_pages_service_location
 - (5)location_identity
 - (4)yellow_pages_service_type
 - (3)yellow_pages_lodging
 - (4)list_size
 - (4)yellow_pages_service_contact
 - (4)yellow_pages_service_description
 - (4)yellow_pages_service_location
 - (5)location_identity
 - (4)yellow_pages_service_type
 - (3)yellow_pages_parking
 - (4)list_size
 - (4)yellow_pages_service_contact
 - (4)yellow_pages_service_description
 - (4)yellow_pages_service_location
 - (5)location_identity
 - (4)yellow_pages_service_type
 - (3)yellow_pages_private_vehicle_parts_shops
 - (4)list_size
 - (4)yellow_pages_service_contact
 - (4)yellow_pages_service_description
 - (4)yellow_pages_service_location
 - (5)location_identity
 - (4)yellow_pages_service_type
 - (3)yellow_pages_private_vehicle_repair_shops
 - (4)list_size

- (4)yellow_pages_service_contact
- (4)yellow_pages_service_description
- (4)yellow_pages_service_location
- (5)location_identity
- (4)yellow_pages_service_type
- (3)yellow_pages_rest_areas
 - (4)list_size
 - (4)yellow_pages_service_contact
 - (4)yellow_pages_service_description
 - (4)yellow_pages_service_location
 - (5)location_identity
 - (4)yellow_pages_service_type
- (3)yellow_pages_special_events
 - (4)list_size
 - (4)yellow_pages_service_contact
 - (4)yellow_pages_service_description
 - (4)yellow_pages_service_location
 - (5)location_identity
 - (4)yellow_pages_service_type
- (3)yellow_pages_tourist_activities
 - (4)list_size
 - (4)yellow_pages_service_contact
 - (4)yellow_pages_service_description
 - (4)yellow_pages_service_location
 - (5)location_identity
 - (4)yellow_pages_service_time
 - (5)time
 - (4)yellow_pages_service_type
- (3)yellow_pages_tourist_services
 - (4)list_size
 - (4)yellow_pages_service_contact
 - (4)yellow_pages_service_description
 - (4)yellow_pages_service_location
 - (5)location_identity
 - (4)yellow_pages_service_type
- (2)yellow_pages_transaction_information
- (3)yellow_pages_dining_information
 - (4)list_size
 - (4)yellow_pages_service_detail
 - (5)yellow_pages_service_availability
 - (5)yellow_pages_service_contact
 - (5)yellow_pages_service_cost
 - (5)yellow_pages_service_date
 - (5)yellow_pages_service_description
 - (5)yellow_pages_service_location
 - (5)yellow_pages_service_time
 - (5)yellow_pages_service_type
- (3)yellow_pages_lodging_reservations
 - (4)list_size
 - (4)yellow_pages_service_detail

- (5)yellow_pages_service_availability
- (5)yellow_pages_service_contact
- (5)yellow_pages_service_cost
- (5)yellow_pages_service_date
- (5)yellow_pages_service_description
- (5)yellow_pages_service_location
- (5)yellow_pages_service_time
- (5)yellow_pages_service_type
- (3)yellow_pages_ticket_information
- (4)list_size
- (4)yellow_pages_service_detail
 - (5)yellow_pages_service_availability
 - (5)yellow_pages_service_contact
 - (5)yellow_pages_service_cost
 - (5)yellow_pages_service_date
 - (5)yellow_pages_service_description
 - (5)yellow_pages_service_location
 - (5)yellow_pages_service_time
 - (5)yellow_pages_service_type

Physical Architecture Flow: trip plan W,U1t

A sequence of links and special instructions indicating efficient ways of navigating the links. Normally coordinated with traffic conditions, other incidents, preemption and prioritization plans.

(1) traveler_guidance_route

This data flow is used within the Provide Driver and Traveler Services function and contains the data for a traveler's route which has been produced following a route request from the traveler. It consists of the following data items each of which is defined in its own DDE:

- (2)route_identity
- (2)traveler_identity
- (2)traveler_route
 - (3)route_segment_description
 - (3)route_segment_end_point
 - (4)location_identity
 - (3)route_segment_estimated_travel_time
 - (3)route_segment_mode
 - (3)route_segment_report_position_points
 - (4)list_size
 - (4)route_segment_way_point
 - (5)location_identity
 - (3)route_segment_start_point
 - (4)location_identity

(1) traveler_personal_trip_information

This data flow is used within the Provide Driver and Traveler Services function and contains information about a proposed trip that the traveler has requested earlier from the personal portable device. It consists of the following data items each of which is defined in its own DDE:

- (2)current_conditions
 - (3)fws_current_weather

- (3)fws_predicted_weather
- (3)incident_duration
 - (4)duration
- (3)incident_location
 - (4)location_identity
- (3)incident_start_time
 - (4)time
- (3)incident_type
- (2)paratransit_personal_schedule
 - (3)paratransit_service_cost
 - (4)cost
 - (3)paratransit_service_details
 - (4)paratransit_availability_time
 - (4)paratransit_destination
 - (4)paratransit_pickup_location
 - (5)location_identity
 - (4)paratransit_pickup_time
 - (4)paratransit_service_identity
 - (3)traveler_identity
- (2)rideshare_response
 - (3)rideshare_details
 - (3)rideshare_selection_number
 - (3)traveler_identity
- (2)route
 - (3)route_cost
 - (3)route_list
 - (4)route_segment_number
 - (3)route_segment
 - (4)route_segment_data
 - (5)route_segment_description
 - (5)route_segment_end_point
 - (5)route_segment_estimated_arrival_time
 - (5)route_segment_estimated_condition
 - (5)route_segment_estimated_travel_time
 - (5)route_segment_predicted_weather
 - (5)route_segment_report_position_points
 - (5)route_segment_start_point
 - (4)route_segment_identity
 - (5)location_identity
 - (5)route_segment_type
 - (5)unit_number
 - (4)route_segment_mode
 - (3)route_start_time
 - (4)date
 - (4)time
 - (3)route_statistics
- (2)traveler_identity
- (2)traveler_total_trip_cost

4.3. Vehicle -> Information Service Provider

Physical Architecture Flow: traveler information request U1t

Request for any type of traveler information

Logical Architecture Flows:

(1) *advanced_fares_and_charges_request*

This data flow is used within the Provide Electronic Payment Services function to transfer requests for advanced payments from the driver interface for subsequent processing. The size of the data flow has been set at less than the sum of the two constituent flows to allow for the fact that they will both not be present for every data transfer. It consists of the following data items each of which is defined in its own DDE:

- (2)*advanced_fare_details***
 - (3)*credit_identity***
 - (3)*stored_credit***
 - (3)*transit_journey_date***
 - (4)*date***
 - (4)*time***
 - (3)*transit_route_destination***
 - (3)*transit_route_origin***
- (2)*advanced_parking_lot_charges***
 - (3)*credit_identity***
 - (4)*location_identity***
 - (4)*unit_number***
 - (3)*parking_space_details***
 - (4)*date***
 - (4)*duration***
 - (4)*time***
 - (3)*stored_credit***
 - (3)*vehicle_identity***

(1) *advanced_tolls_and_fares_request*

This data flow is used within the Provide Electronic Payment Services function to transfer requests for advanced payments from the driver parking lot charge payment interface for subsequent processing. The size of the data flow has been set at less than the sum of the two constituent flows to allow for the fact that they will both not be present for every data transfer. It consists of the following data items each of which is defined in its own DDE:

- (2)*advanced_fare_details***
 - (3)*credit_identity***
 - (3)*stored_credit***
 - (3)*transit_journey_date***
 - (4)*date***
 - (4)*time***
 - (3)*transit_route_destination***
 - (3)*transit_route_origin***
- (2)*advanced_tolls***
 - (3)*credit_identity***
 - (3)*stored_credit***
 - (3)*toll_route_segments***
 - (4)*list_size***

- (4)toll_segment_identity*
- (5)unit_number*
- (3)vehicle_identity*

(1)advisory_data_request

This data flow is used within the Provide Driver and Traveler Services function 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, whilst the vehicle location will be provided automatically. The data flow consists of the following data items each of which is defined in its own DDE:

- (2)advisory_data_scope*
- (2)transit_route_number*
- (2)transit_vehicle_identity*
- (2)vehicle_location_for_advisories*
- (3)location_identity*

(1) driver_map_update_payment_request

This data flow 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. It consists of the following data items each of which is defined in its own DDE:

- (2)credit_identity*
- (2)navigable_map_vehicle_update_cost*
- (3)cost*
- (2)vehicle_identity*

Physical Architecture Flow: trip confirmation U1t

Acknowledgement of acceptance of route

Logical Architecture Flows:

(1) vehicle_guidance_route_accepted

This data flow is used within the Provide Driver and Traveler Services function and contains the acceptance by the driver of the previously provided route for on-line guidance. Acceptance must be provided before guidance can begin. The data flow consists of the following data item which is defined in its own DDE:

- (2)route_identity*

Physical Architecture Flow: trip request U1t

Request for special routing

Logical Architecture Flows:

(1) vehicle_route_request

This data is flow used within the Provide Driver and Traveler Services function and contains a request for on-line guidance of the vehicle. This will have been generated by the driver and will include the necessary source and destination data from which a route can be computed. It consists of the following data items each of which is defined in its own DDE:

- (2)constraint_on_acceptable_travel_time*
- (2)constraint_on_ahs_lanes*
- (2)constraint_on_eta_change*
- (2)constraint_on_interstate*
- (2)constraint_on_load_classification*

- (2)constraint_on_special_needs*
- (2)constraint_on_urban*
- (2)constraint_on_vehicle_type*
- (2)departure_time*
 - (3)time*
- (2)desired_arrival_time*
 - (3)time*
- (2)destination*
- (2)origin*
 - (3)route_point*
- (2)preferred_alternate_routes*
- (2)preferred_route_segments*
- (2)preferred_routes*
- (2)vehicle_identity*
- (2)vehicle_location_for_dynamic_guidance*
 - (3)location_identity*

Physical Architecture Flow: vehicle probe data U1t

Single vehicle probe data indicating link time and location.

(1) vehicle_guidance_probe_data

This data flow is used within the Provide Driver and Traveler Services function and contains the time at which a vehicle was at a route segment end point. This data will be used to calculate the actual vehicle journey time for the route segment which may supplement or replace data gathered from other sources. This data will be used for in-vehicle guidance purposes. The data flow consists of the following data items each of which is defined in its own DDE:

- (2)route_segment_identity*
 - (3)location_identity*
 - (3)route_segment_type*
 - (3)unit_number*
- (2)vehicle_identity*

Physical Architecture Flow: yellow pages request U1t

Request for reservation through yellow pages type service

(1) yellow_pages_advisory_requests

This data flow is used within the Provide Driver and Traveler Services function to request that data about yellow pages services be output to a driver or a transit user in a vehicle or that a yellow pages services reservation be made. The scope and transit route number data will be provided by the driver or transit user, whilst the vehicle location will be provided automatically. The data flow consists of the following data items each of which is defined in its own DDE:

- (2)advisory_data_scope*
- (2)transit_route_number*
- (2)transit_vehicle_identity*
- (2)vehicle_location_for_advisories*
 - (3)location_identity*
- (2)yellow_pages_dining_reservation*
- (2)yellow_pages_lodging_reservation*

(2)yellow_pages_ticket_purchase

4.4. Information Service Provider -> Vehicle

Physical Architecture Flow: broadcast information U1b

Common link travel times, advisories, transit schedule exceptions, other traveler information

(1) broadcast_data

This data flow is used within the Provide Driver and Traveler Services function to provide traffic and travel advisory data via a wide area broadcast message to drivers and travelers in vehicles. It consists of the following data items each of which is defined in its own DDE:

- (2)predicted_incidents_for_broadcast*
 - (3)incident_description*
 - (3)incident_location*
 - (4)location_identity*
 - (3)incident_severity*
 - (3)incident_traffic_impact*
 - (3)incident_type*
 - (3)list_size*
- (2)prediction_data_for_broadcast*
 - (3)list_size*
 - (3)route_segment_identity*
 - (4)location_identity*
 - (4)route_segment_type*
 - (4)unit_number*
 - (3)route_segment_occupancy_predictions*
 - (3)route_segment_queue_delay_predictions*
 - (3)route_segment_volume_delay_predictions*
- (2)traffic_data_for_broadcast*
 - (3)hov_lane_vehicle_count*
 - (3)link_identity*
 - (4)link_type*
 - (4)location_identity*
 - (4)unit_number*
 - (3)list_size*
 - (3)parking_lot_identity*
 - (4)location_identity*
 - (4)unit_number*
 - (3)parking_lot_state*
 - (3)pollution_state_area_collection*
 - (4)current_carbon_monoxide_pollution*
 - (4)current_hydrocarbon_pollution*
 - (4)current_nitrous_oxide_pollution*
 - (4)current_ozone_pollution*
 - (4)current_particulate_pollution*
 - (4)current_pollution_location*
 - (5)location_identity*
 - (4)current_sulphur_dioxide_pollution*
 - (3)pollution_state_roadside_collection*
 - (4)current_carbon_monoxide_pollution*
 - (4)current_hydrocarbon_pollution*

- (4)*current_nitrous_oxide_pollution*
- (4)*current_ozone_pollution*
- (4)*current_particulate_pollution*
- (4)*current_roadside_pollution_location*
- (5)*location_identity*
- (4)*current_sulfur_dioxide_pollution*
- (3)*route_segment_identity*
- (4)*location_identity*
- (4)*route_segment_type*
- (4)*unit_number*
- (3)*route_segment_journey_time*
- (3)*tmc_identity*
- (2)*transit_running_data_for_broadcast*
- (3)*list_size*
- (3)*transit_route_number*
- (3)*transit_route_segment_number*
- (3)*transit_stop_scheduled_time*
- (4)*time*
- (3)*transit_vehicle_achieved_time*
- (4)*time*
- (3)*transit_vehicle_identity*
- (3)*transit_vehicle_time*
- (2)*transit_services_for_broadcast*
- (1) *link_and_queue_data*

This data is used within the Provide Driver and Traveler Services function and contains the average link journey times and queue times for each link, computed from traffic data and (if available) vehicle probe data.

- (2)*link_identity*
- (3)*link_type*
- (3)*location_identity*
- (3)*unit_number*
- (2)*link_journey_time*
- (2)*link_queue_time*
- (2)*list_size*

Physical Architecture Flow: traveler information U1t

Traveler routing, yellow pages etc.

Logical Architecture Flows:

- (1) *advanced_fares_and_charges_response*

This data flow is used within the Provide Electronic Payment Services function and contains the result of the requested advanced transit fare and/or parking lot charge payment transaction from a driver. It consists of the following data item which is defined in its own DDE:

- (2)*confirmation_flag*
- (2)*credit_identity*
- (2)*parking_lot_cost*
- (3)*cost*
- (2)*stored_credit*
- (2)*transit_fare*

(1) advanced_tolls_and_fares_response

This data flow is used within the Provide Electronic Payment Services function and contains the result of the requested advanced toll and/or transit fare payment transaction from a driver. It consists of the following data item which is defined in its own DDE:

- (2)confirmation_flag*
- (2)credit_identity*
- (2)stored_credit*
- (2)toll_cost*
- (2)transit_fare*

(1) advisory_data

This data flow is used within the Provide Driver and Traveler Services function to provide traffic and travel advisory data to drivers and travelers in vehicles. It consists of the following data items each of which is defined in its own DDE:

- (2)predicted_incidents_for_advisories*
 - (3)incident_description*
 - (3)incident_location*
 - (4)location_identity*
 - (3)incident_severity*
 - (3)incident_traffic_impact*
 - (3)incident_type*
 - (3)list_size*
- (2)prediction_data_for_advisories*
 - (3)list_size*
 - (3)route_segment_identity*
 - (4)location_identity*
 - (4)route_segment_type*
 - (4)unit_number*
 - (3)route_segment_occupancy_predictions*
 - (3)route_segment_queue_delay_predictions*
 - (3)route_segment_volume_delay_predictions*
- (2)traffic_data_for_advisories*
 - (3)hov_lane_vehicle_count*
 - (3)link_identity*
 - (4)link_type*
 - (4)location_identity*
 - (4)unit_number*
 - (3)list_size*
 - (3)parking_lot_identity*
 - (4)location_identity*
 - (4)unit_number*
 - (3)parking_lot_state*
 - (3)pollution_state_area_collection*
 - (4)current_carbon_monoxide_pollution*
 - (4)current_hydrocarbon_pollution*
 - (4)current_nitrous_oxide_pollution*
 - (4)current_ozone_pollution*
 - (4)current_particulate_pollution*
 - (4)current_pollution_location*

- (5)*location_identity*
- (4)*current_sulphur_dioxide_pollution*
- (3)*pollution_state_roadside_collection*
- (4)*current_carbon_monoxide_pollution*
- (4)*current_hydrocarbon_pollution*
- (4)*current_nitrous_oxide_pollution*
- (4)*current_ozone_pollution*
- (4)*current_particulate_pollution*
- (4)*current_roadside_pollution_location*
- (5)*location_identity*
- (4)*current_sulfur_dioxide_pollution*
- (3)*route_segment_identity*
- (4)*location_identity*
- (4)*route_segment_type*
- (4)*unit_number*
- (3)*route_segment_journey_time*
- (3)*tmc_identity*
- (2)*transit_running_data_for_advisories*
- (3)*list_size*
- (3)*transit_route_number*
- (3)*transit_route_segment_number*
- (3)*transit_stop_scheduled_time*
- (4)*time*
- (3)*transit_vehicle_achieved_time*
- (4)*time*
- (3)*transit_vehicle_identity*
- (3)*transit_vehicle_time*
- (2)*transit_services_for_advisories*

(1) *driver_map_update_payment_response*

This data flow is sent from the Provide Electronic Payment Services function to the Provide Driver and Traveler Services function and 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. It consists of the following data items each of which is defined in its own DDE:

- (2)*confirmation_flag*
- (2)*credit_identity*
- (2)*vehicle_identity*

(1) *link_and_queue_data*

This data is used within the Provide Driver and Traveler Services function and contains the average link journey times and queue times for each link, computed from traffic data and (if available) vehicle probe data.

- (2)*link_identity*
- (3)*link_type*
- (3)*location_identity*
- (3)*unit_number*
- (2)*link_journey_time*
- (2)*link_queue_time*
- (2)*list_size*

(1) *yellow_pages_advisory_data*

This data flow is used within the Provide Driver and Traveler Services function to provide yellow pages data to drivers and transit users in vehicles and/or confirmation of a previously requested reservation. It consists of the following data items each of which is defined in its own DDE:

- (2)*yellow_pages_cost***
 - (3)*cost***
- (2)*yellow_pages_data_for_advisories***
 - (3)*list_size***
 - (3)*yellow_pages_service_detail***
 - (4)*yellow_pages_service_availability***
 - (4)*yellow_pages_service_contact***
 - (4)*yellow_pages_service_cost***
 - (5)*cost***
 - (4)*yellow_pages_service_date***
 - (5)*date***
 - (4)*yellow_pages_service_description***
 - (4)*yellow_pages_service_location***
 - (5)*location_identity***
 - (4)*yellow_pages_service_time***
 - (5)*time***
 - (4)*yellow_pages_service_type***
 - (2)*yellow_pages_dining_reservation_confirmation***
 - (3)*confirmation_flag***
 - (3)*yellow_pages_service_reservation_number***
 - (2)*yellow_pages_lodging_reservation_confirmation***
 - (3)*confirmation_flag***
 - (3)*yellow_pages_service_reservation_number***
 - (2)*yellow_pages_ticket_purchase_confirmation***
 - (3)*confirmation_flag***
 - (3)*yellow_pages_service_reservation_number***

Physical Architecture Flow: trip plan U1t

A sequence of links and special instructions indicating efficient ways of navigating the links. Normally coordinated with traffic conditions, other incidents, preemption and prioritization plans.

(1) *vehicle_guidance_route*

This data flow is used within the Provide Driver and Traveler Services function and is a special form of "route" for vehicle guidance only. It contains a subset of the data items included in the "route" data flow to meet the requirements of in-vehicle infrastructure based guidance as opposed to the more general requirements for a route need as part of a trip planning activity. The data flow consists of the following data items each of which is defined in its own DDE:

- (2)*route_identity***
- (2)*route_segment_description***
- (2)*route_segment_end_point***
 - (3)*location_identity***
- (2)*route_segment_estimated_travel_time***
- (2)*route_segment_report_position_points***
 - (3)*list_size***

(3)route_segment_way_point
(4)location_identity
(2)route_segment_start_point
(3)location_identity
(2)vehicle_identity

5. Communications Considerations

This chapter describes relevant requirements and information regarding the portion of the Communications Layer 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.

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.

Communication services consist of two broad categories, *interactive* and *distribution*. Interactive services allow the user to exchange data with other users or providers in real or near real time, asking for service or information and receiving it in the time it takes to communicate or look up the information. Distribution services allow the user to send the same message to multiple other users.

Interactive services may be either *conversational* or *messaging*. Conversational implies the use of a two-way connection established before information exchange begins and terminated when the exchange is completed. Messaging, on the other hand, works more like electronic mail being exchanged between users. The messages are exchanged without establishing a dedicated path between the two sites. Each message is addressed and placed on the network for transmission, intermixed with messages from other users. The communications community labels this mode of communication a “datagram” service.

Distribution services may be either *broadcast* or *multicast* and may be used over wireline and/or wireless communication links. Broadcast messages are those sent to all users while multicast messages are sent only to a subset of users. Multicast differs from broadcast in its use of a designated address for all users and user groups. Examples of broadcast information might include current weather or road conditions, whereas multicast information might be information sent to all drivers working for a specific company. A changing group membership could be the set of users traveling between two locations or with a certain destination, for which unique information must be transmitted. The services that can be supported using circuit or packet connection mode include voice, video, image and data. (see Appendix A-1 of the communication document for a complete description.)

An additional class of communications services is location services. These fall in two categories: (1) the services that do not use the communication network (i.e., GPS, and stand alone terrestrial systems); (2) location services that use the network for providing the service (e.g., cellular based systems). In the latter case, the location services fall under the interactive services. The service will be rendered by a service provider in response to a request for information or help.

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

5.2. Wireline Communication Elements (w)

There are no wireline interfaces in this standards requirements package

5.3. Wireless Communication Elements (u1 and u2)

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

A key feature of most wireless communication elements is that they are or can be internetworked to a wireline communication system of some sort. In this way, mobile units can exchange ITS messages with Center or Roadside subsystems. 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.

Wireless communication systems can be one-way (broadcast) or two-way. For broadcast systems, an example is FM-subcarrier systems. Two-way systems that are private can be SMR (Special Mobile Radio) or E-SMR (Enhanced SMR). SMR and E-SMR require licenses from the FCC for operation, and are typically dedicated to a specific service or agency.

Dedicated and Shared Communications

We think it likely that in the 20-year timeframe, Wide Area Network (WAN) data communications will have become largely a commodity with many competing suppliers of wireline and 2-way wireless services. As a commodity, the ITS Subsystems will use whatever WAN communication service is available that meets the operators needs at the lowest price.

Today, since the commoditization of WAN 2-way data communications is still in its early stages, many ITS early deployments and Field Operational Tests (FOTs) properly use dedicated WAN systems or one-way FM-subcarrier and pager systems. The architecture supports both private and shared deployments as appropriate.

Architecture Robustness to Spatially Different Deployments

This section discusses how different deployments (Urban, Interurban and Rural) of the architecture will interoperate giving specific focus on the strategy for mobile subsystems.

Figure 13 - shows how a large number of Communication Service Providers (CSPs) both internetwork themselves together and connect to their clients, thus provide any-to-any messaging for their clients to and from any other clients on the set of internetworked CSPs. This is, at a very high level, how the Internet functions today, and how the NII will function in the future.

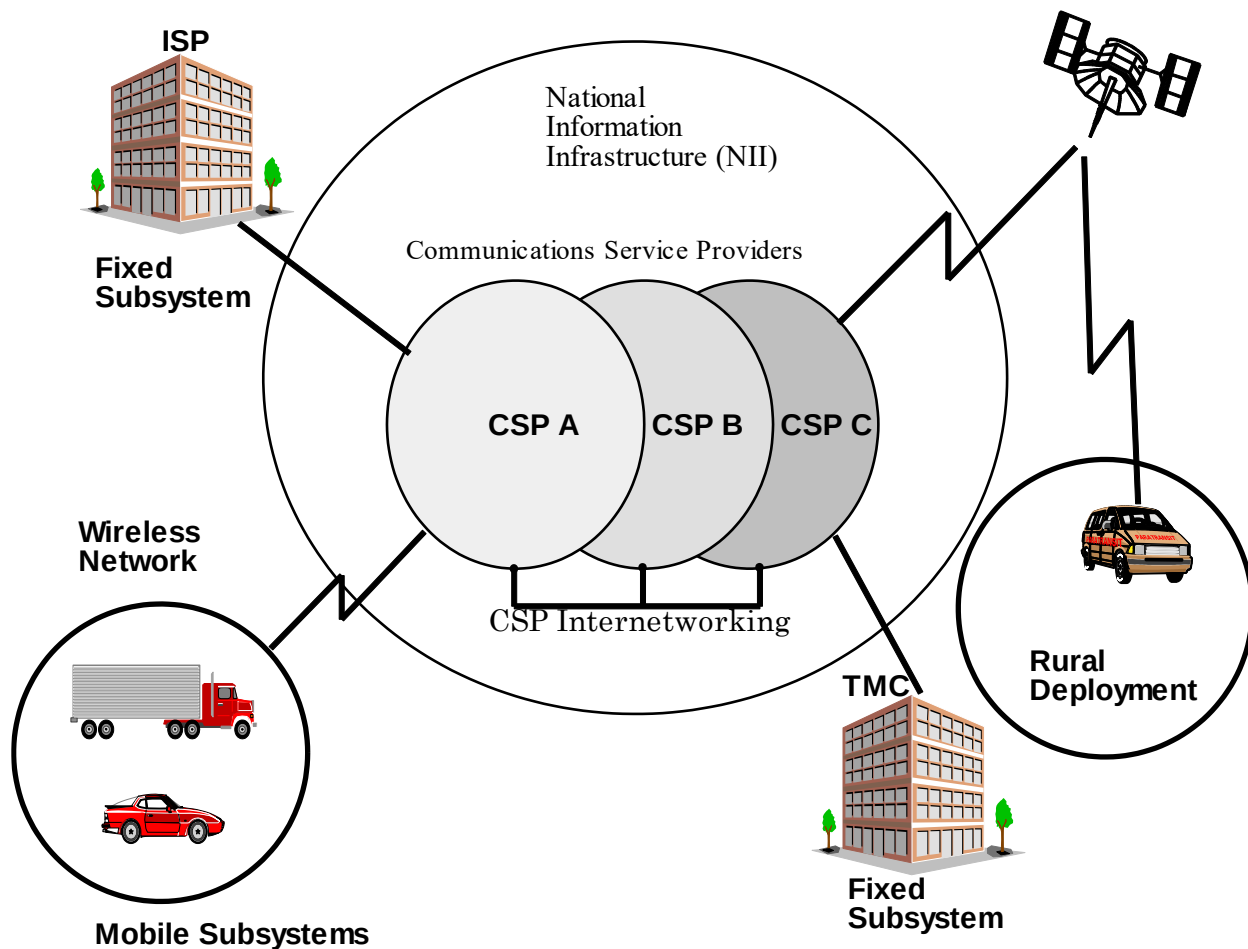


Figure 13 - ITS Communications Network Topology

The key feature of this system is that the clients can connect to their chosen CSP with any technology, wireline or wireless, and send messages to any other client of any other CSP, independent of the technology that they have chosen to connect with.

Mobile clients will be able to "roam", that is move geographically anywhere that their service provider offers service, and be able at any time to send or receive data messages. This capability already exists for the Advanced Mobile Phone System (AMPS), and will be extended for the emerging data services based on the same cell-based communication technologies. Mobile data service providers can be expected to make arrangements with providers out of their area to reciprocally give their clients roaming privileges outside of their "home" areas, thus extending mobile connectivity across the country.

Institutionally, the clients have a choice of CSPs to choose from. Competition for clients will result in aggressive pricing and technology deployments by the CSPs, leading the commoditization of wireline and wireless communications referred to earlier.

Figure 14 - shows that ISPs use wireline and wireless communications to provide services to their clients (including Transit Vehicles and Emergency Vehicles for Publicly operated ISPs). Figure 15 - combines the previous discussion regarding Communication Service Providers, internetworked to effect the NII, and the connection to an ISP, to show how a client can choose an ISP and be in communications with the selected ISP no matter where they are in the country. At the same time, the ISP is using the NII to access TMCs across the country to service the requests of the client.

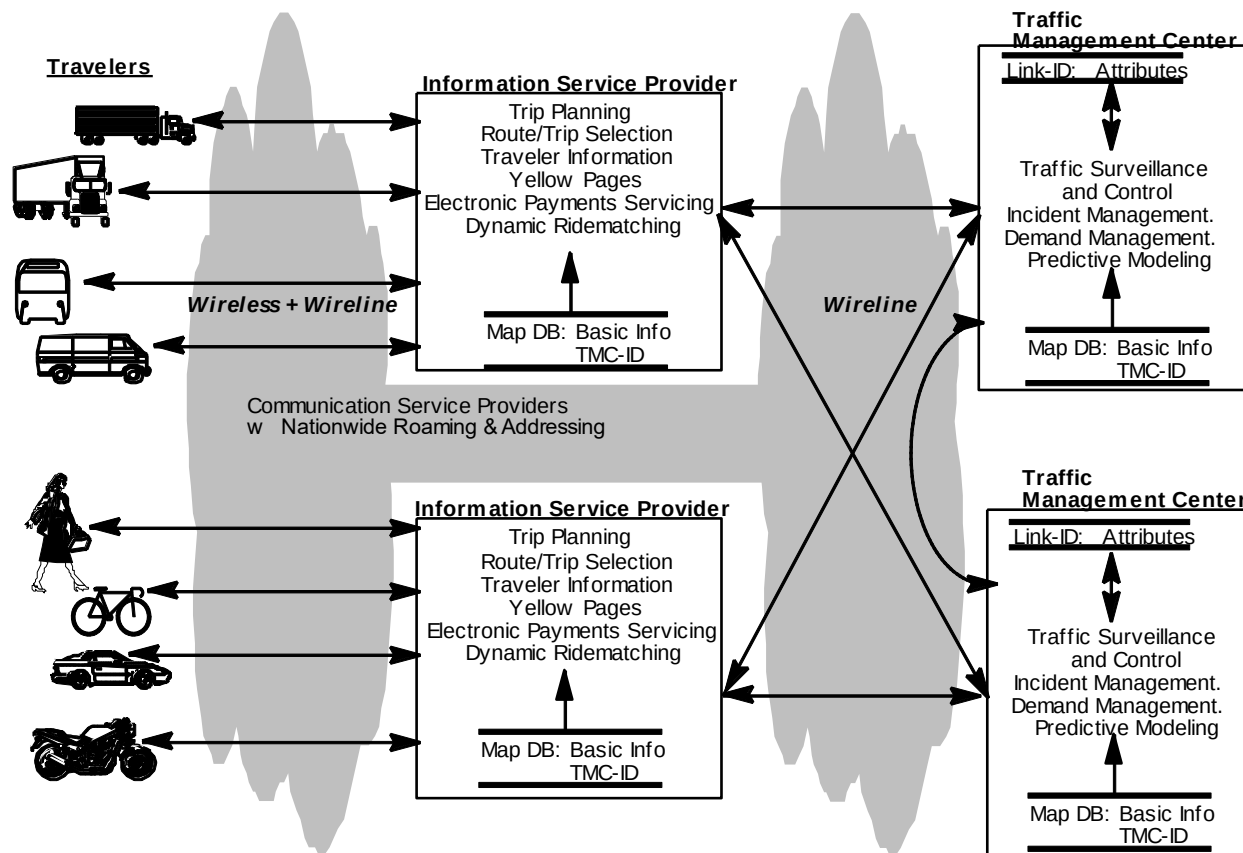


Figure 14 - Open National Compatibility

Fi

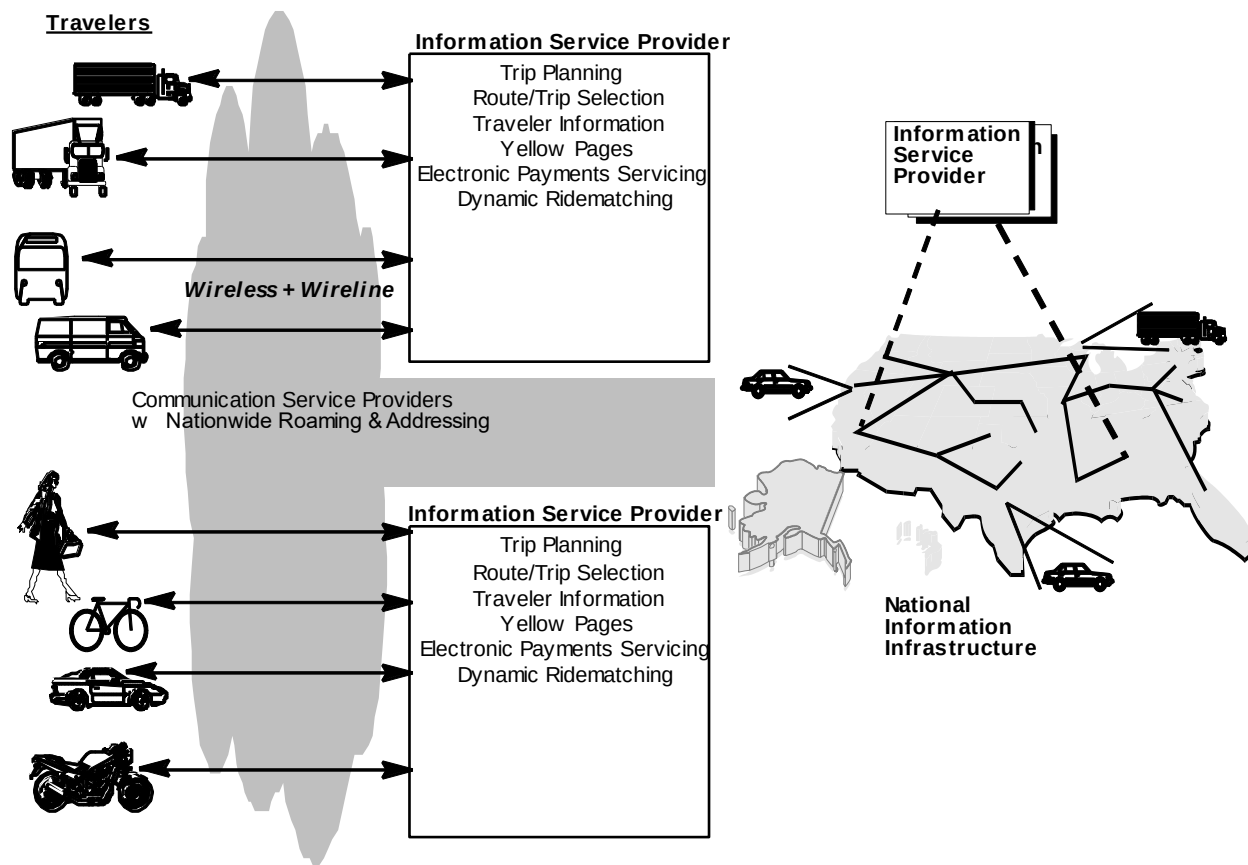


Figure 15 - Traveler to ISP National Interoperability

6. Constraints

This chapter identifies Physical Architecture intersubsystem message performance requirements below the application layer.

6.1. Assessment Categories

The following categories have been used in rating the constraints that exist on the physical 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 in emergencies. The data channels require 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 travelling 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 can not be specified directly when discussing only the interface between two subsystems.

2. Data Sensitivity

a. Security (S)

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

b. Privacy(P)

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

6.2. Architecture Flow Constraints

Source	Destination	Architecture Flow	Interconnects	Communication Service	Special Constraints
Information Service Provider	Personal Information Access	broadcast information	W,U1b	messaging data,Broadcast data, Multicast	
Information Service Provider	Personal Information Access	traveler information	W,U1t	Broadcast data,Multicast data	P

Information Service Provider	Personal Information Access	trip plan	W,U1t	Conversational data, Messaging data	P
Information Service Provider	Vehicle	broadcast information	U1b	messaging data,Broadcast data, Multicast	
Information Service Provider	Vehicle	traveler information	U1t	messaging data,Broadcast data, Multicast	P
Information Service Provider	Vehicle	trip plan	U1t	Conversational data, Messaging data	P
Personal Information Access	Information Service Provider	traveler information request	W,U1t	messaging data	P
Personal Information Access	Information Service Provider	trip confirmation	W,U1t	Conversational Data, Messaging data	P
Personal Information Access	Information Service Provider	trip request	W,U1t	Conversational Data, Messaging data	P
Personal Information Access	Information Service Provider	yellow pages request	W,U1t	Conversational Data, Messaging data	P
Vehicle	Information Service Provider	traveler information request	U1t	Conversational data, messaging data	P
Vehicle	Information Service Provider	trip confirmation	U1t	Conversational data, messaging data	P
Vehicle	Information Service Provider	trip request	U1t	Conversational data, messaging data	P
Vehicle	Information Service Provider	vehicle probe data	U1t	messaging data, location data	P
Vehicle	Information Service Provider	yellow pages request	U1t	Conversational data, messaging data	P

7. Data Dictionary Elements

This section contains the data dictionary abstracts and sizes for all the logical architecture data flows listed in this standards requirements package. This is an abbreviated version of the information available in the Logical Architecture Document, but should be sufficient for understanding the purpose of a given data element. For a deeper understanding, it is necessary to consult the Logical Architecture Document to find the specifications of the processes that the data flows connect.

The Additional sizing assumptions provide an estimate of the expected size of the data flow. There are three cases which occur in the data dictionary.

1. The dataflow is a primitive element and a size in bytes is given. In the common case where the data flow is composed of other DDEs, the size of the composite dataflow is calculated by adding up the sizes of the constituent DDEs.
2. The dataflow is a composite flow (made up of other flows) and the expected size is simply the sum of the sizes of the other flows. In this case the additional sizing assumption is "None"
3. The dataflow is a composite flow and the expected size is an expression relating to the component dataflows and some additional parameters. The full list of parameters is given in the Logical Architecture Document Table 1.

The DDE's are given in alphabetical order.

advanced_fare_details

* This data flow is used within the Provide Electronic Payment Services function and contains details of the transit ride for which a driver wishes to make an advanced payment. It consists of the following data items each of which is defined in its own DDE: *

credit_identity
+ stored_credit
+ transit_journey_date
+ transit_route_destination
+ transit_route_origin.

Additional sizing assumptions:

None

advanced_fares_and_charges_request

* This data flow is used within the Provide Electronic Payment Services function to transfer requests for advanced payments from the driver interface for subsequent processing. The size of the data flow has been set at less than the sum of the two constituent flows to allow for the fact that they will both not be present for every data transfer. It consists of the following data items each of which is defined in its

own DDE: *

advanced_fare_details
+ advanced_parking_lot_charges.

Additional sizing assumptions::

SIZE = 0.6{advanced_fare_details} + 0.6{advanced_parking_lot_charges};

advanced_fares_and_charges_response

* This data flow is used within the Provide Electronic Payment Services function and contains the result of the requested advanced transit fare and/or parking lot charge payment transaction from a driver. It consists of the following data item which is defined in its own DDE: *

confirmation_flag
+ credit_identity
+ parking_lot_cost
+ stored_credit
+ transit_fare.

Additional sizing assumptions:

None

advanced_fares_confirm

* This data flow is used within the Provide Electronic Payment Services function to show that payment for advanced transit fares has been confirmed or not. It consists of the following data item which is defined in its own DDE: *

confirmation_flag.

Additional sizing assumptions:

None

advanced_parking_lot_charges

* This data flow is used within the Provide Electronic Payment Services function and contains data to enable an advanced parking lot charge to be calculated and billed. It consists of the following data items each of which is defined in its own DDE: *

credit_identity
+ parking_lot_identity

- + parking_space_details
- + stored_credit
- + vehicle_identity.

Additional sizing assumptions:

None

advanced_parking_lot_charges_confirm

* This data flow is used within the Provide Electronic Payment Services function to show that payment for an advanced parking lot charge has been confirmed or not. It consists of the following data items each of which is defined in its own DDE: *

- confirmation_flag
- + credit_identity
- + parking_lot_cost
- + stored_credit.

Additional sizing assumptions:

None

advanced_tolls

* This data flow is used within the Provide Electronic Payment Services function and contains data to enable an advanced toll to be calculated and billed. It consists of the following data items

each of

- credit_identity
- + stored_credit
- + toll_route_segments
- + vehicle_identity.

Additional sizing assumptions:

None

advanced_tolls_and_fares_request

* This data flow is used within the Provide Electronic Payment Services function to transfer requests for advanced payments from the driver parking lot charge payment interface for subsequent processing. The size of the data flow has been set at less than the sum of the two constituent flows to allow for the fact that they will both not be present for every data transfer. It consists of the following data items each of which is defined in its own DDE: *

advanced_fare_details

+ advanced_tolls.

Additional sizing assumptions:

SIZE = 0.6{advanced_fare_details} + 0.6{advanced_tolls};

advanced_tolls_and_fares_response

* This data flow is used within the Provide Electronic Payment Services function and contains the result of the requested advanced toll and/or transit fare payment transaction from a driver. It consists of the following data item which is defined in its own DDE: *

confirmation_flag
+ credit_identity
+ stored_credit
+ toll_cost
+ transit_fare.

Additional sizing assumptions:

None

advanced_tolls_confirm

* This data flow is used within the Provide Electronic Payment Services function to show that payment for an advanced toll has been confirmed or not. It consists of the following data items each of which is defined in its own DDE: *

confirmation_flag
+ credit_identity
+ stored_credit
+ toll_cost.

Additional sizing assumptions:

None

advisory_data

* This data flow is used within the Provide Driver and Traveler Services function to provide traffic and travel advisory data to drivers and travelers in vehicles. It consists of the following data items each of which is defined in its own DDE: *

traffic_data_for_advisories
+ predicted_incidents_for_advisories
+ prediction_data_for_advisories

+ transit_services_for_advisories
+ transit_running_data_for_advisories.

Additional sizing assumptions:

None

advisory_data_request

* This data flow is used within the Provide Driver and Traveler Services function 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, whilst the vehicle location will be provided automatically. The data flow consists of the following data items each of which is defined in its own DDE: *

advisory_data_scope
+ vehicle_location_for_advisories
+ transit_route_number
+ transit_vehicle_identity.

Additional sizing assumptions:

None

advisory_data_scope

* This data flow is used within the Provide Driver and Traveler Services function to show the scope of the advisory data requested by the driver or transit user from a vehicle. The scope will define the type of data, e.g. traffic, transit, yellow pages, etc. It will use but not be limited to the following values:

0 - none
1 - current traffic data
2 - long term traffic data
100 - predictive model data
101 - predicted incidents
102 - prediction data
150 - transit schedules
151 - transit routes
152 - current transit running data
210 - yellow pages hotel data
211 - yellow pages restaurant data
212 - yellow pages theater data
213 - yellow pages services data

Additional code numbers will be needed to further subdivide the some of the data, e.g. current traffic data includes both traffic flows and pollution information. However the codes will be contained in the range 0 through 255, requiring a data flow size of

one (1) byte. *.

Additional sizing assumptions:

SIZE=1;

broadcast_data

* This data flow is used within the Provide Driver and Traveler Services function to provide traffic and travel advisory data via a wide area broadcast message to drivers and travelers in vehicles. It consists of the following data items each of which is defined in its own DDE: *

traffic_data_for_broadcast
+ predicted_incidents_for_broadcast
+ prediction_data_for_broadcast
+ transit_services_for_broadcast
+ transit_running_data_for_broadcast.

Additional sizing assumptions:

None

confirmation_flag

* This data flow is used within various ITS functions. It is a flag which is set to one (1) to indicate the success of a request or transaction, and zero (0) to indicate failure. *.

Additional sizing assumptions:

SIZE=1;

constraint_on_acceptable_travel_time

* This data flow is used within the Provide Driver and Traveler Services function and contains the maximum total travel time which the traveler or driver will allow for the selected route. This is an integer value of the time in minutes and is sized at two (2) bytes to enable a route to be selected that takes several days. *.

Additional sizing assumptions:

SIZE=2;

constraint_on_ahs_lanes

* This data flow is used within the Provide Driver and Traveler Services function and contains a flag which if set to one (1) means that where possible use route segments that are automatic highway system (ahs) lanes. The default is set to false, i.e. do not use ahs lanes. *.

Additional sizing assumptions:

SIZE=1;

constraint_on_eta_change

* This data flow is used within the Provide Driver and Traveler Services function. It contains the value by which the estimated time of arrival (eta) at the destination must change for a new route to be automatically sent to the vehicle, or used for autonomous guidance with long journey and queue times being obtained from a central source. *.

Additional sizing assumptions:

SIZE=2;

constraint_on_interstate

* This data flow is used within the Provide Driver and Traveler Services function and contains a flag which if set to one (1) means where possible use interstate freeways except for when access is required to particular places, e.g. origin, destination, way points along a route. The default is set to true. *.

Additional sizing assumptions:

SIZE=1;

constraint_on_load_classification

* This data flow is used within the Provide Driver and Traveler Services function and contains a three character code that specifies the load type. This is principally aimed at hazardous material (HAZMAT) type loads that may require special routing restrictions. The load type is specified using a three character code, the most hazardous type being used if more than one is being carried on a single vehicle. *.

Additional sizing assumptions:

SIZE=3;

constraint_on_number_of_mode_changes

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

contains the maximum number of changes between different modes of transport which the traveler or driver wishes to see used in the planned trip (1 byte) *.

Additional sizing assumptions:

SIZE=1;

constraint_on_number_of_transfers

* This data flow is used within the Provide Driver and Traveler Services function and contains the maximum number of mode changes that a traveler or driver will allow when a multimodal route is being specified. *.

Additional sizing assumptions:

SIZE=1;

constraint_on_special_needs

* This data flow is used within the Provide Driver and Traveler Services function and contains a three character code that covers physical and/or mental disabilities which may affect the choice of mode, route, etc., e.g. blind and will be accompanied, blind with a guide dog, deaf, dumb, uses crutches, wheelchair bound, etc. *.

Additional sizing assumptions:

SIZE=3;

constraint_on_urban

* This data flow is used within the Provide Driver and Traveler Services function and contains a flag which if set to one (1) means avoid all urban roads except for when they are needed for access. The default is set to true. *.

Additional sizing assumptions:

SIZE=1;

constraint_on_vehicle_type

* This data flow is used within the Provide Driver and Traveler Services function and contains a three character code that specifies that the route must be suitable for a particular type or types of vehicle. If left blank then routes suitable for all types of vehicle will be chosen so that for example, routes prohibiting commercial vehicles will be avoided. When vehicle types are specified, then the route will be suitable for that type and will if possible use segments from which other types are prohibited. The type is specified using a three (3) character code and the data flow has been sized

to enable up to six different types to be specified. *.

Additional sizing assumptions:

SIZE=18;

constraints

* This data flow is used within the Provide Driver and Traveler Services function and is also sent to that function by the Provide Vehicle Monitoring and Control function as part of the data to enable a route involving automatic highway system (ahs) lanes to be selected. It contains the constraints being placed on the choice of route and which will override any preferences that are also specified. Unless a default value is specifically defined, a value giving the least severe requirement will be used. Some parameters will have to be supplied by the traveler or driver (or provided by a process as a default value) before the route selection process can proceed. The data flow consists of the following items each of which is defined in its own DDE: *

constraint_on_acceptable_travel_time
+ constraint_on_number_of_mode_changes
+ constraint_on_number_of_transfers
+ constraint_on_eta_change
+ constraint_on_special_needs
+ constraint_on_load_classification
+ constraint_on_ahs_lanes
+ constraint_on_interstate
+ constraint_on_urban
+ constraint_on_vehicle_type.

Additional sizing assumptions:

None

cost

* This data flow is used by several functions within ITS and contains the cost of a service. This may something provided by a yellow pages service provider, the cost of a display map or navigable map database update, the cost of a transit fare, a paratransit service etc. The cost is shown in cents (US) and is sized as a two (2) byte number. *.

Additional sizing assumptions:

SIZE=2;

credit_identity

* This data flow is principally used within the Provide Electronic Payment Services function, although it also appears in the Manage Commercial Vehicles, Manage Transit and Provide Driver and Traveler Services functions. It contains the identity number of a credit card (13 digits) 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. The value is obtained from the relevant credit identity data flow provided from the payment instrument terminator and consists of the credit identity (using the standard 16 character credit card identity field) plus the expiration data (4 characters). *.

Additional sizing assumptions:

SIZE=20;

current_carbon_monoxide_pollution

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

Additional sizing assumptions:

SIZE=2;

current_conditions

* This data flow is used within the Provide Driver and Traveler Services function and contains data from the store of tourist information. It consists of the following data items each of which is defined in its own DDE: *

incident_location
+ incident_start_time
+ incident_duration
+ incident_type
+ fws-current_weather
+ fws-predicted_weather.

Additional sizing assumptions:

None

current_data_for_media

* This data flow is used within the Manage Traffic function. It contains a subset of the current data stored by the function which will be used as the basis for traffic data

that is sent to other functions. The data flow consists of the following data items each of which is defined in its own DDE: *

current_incident_data
+ current_other_routes_use
+ parking_lot_storage_data
+ traffic_flow_state
+ vehicle_smart_probe_stored_data
+ wide_area_pollution_data.

Additional sizing assumptions:

None

current_highway_network_data

* This data flow is used within the Manage Traffic function and contains data about traffic conditions on links in the highway network served by the function. This data is used for determining traffic management strategies and is also sent for storage in both the long term and current data stores. It consists of the following data items each of which is defined in its own DDE: *

link_list_for_highways
+ list_size{link_journey_time
+ link_delay}.

Additional sizing assumptions:

SIZE=link_list_for_highways+HIGHWAY_LINKS{link_journey_time+link_delay};

current_hydrocarbon_pollution

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

Additional sizing assumptions:

SIZE=2;

current_incident_data

* This data flow is used within the Manage Traffic function to transfer data about current incidents from the Incident Management facility to the Provide Traffic Surveillance facility for storage. It contains the following data items each of which

is defined in its own DDE: *

list_size
+ list_size{current_incident_details}.

Additional sizing assumptions:

SIZE=list_size+MAX_CUR_INCIDENTS{current_incident_details};

current_incident_details

* This data flow is used within the Manage Traffic function and contains the details of a current incident. It consists of the following data items each of which is defined in its own DDE: *

incident_description
+ incident_duration
+ incident_location
+ incident_number
+ incident_severity
+ incident_start_time
+ incident_traffic_impact
+ incident_type.

Additional sizing assumptions:

None

current_nitrous_oxide_pollution

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

Additional sizing assumptions:

SIZE=2;

current_other_routes_use

* This data flow is used within the Provide Driver and Traveler Services function and contains data about the non-vehicle portion(s) of routes that have been requested by travelers. These route portions will involve the use of modes such as cycling, walking, etc. The data will be stored in ascending route segment number order (i.e. from 1 to the maximum number of route segments),r and consists of the following data items each

of which is defined in its own DDE: *

```
route_segment_total_number
+ route_segment_total_number{route_segment_identity
    + time_period{route_segment_guided_travelers}
    + route_segment_journey_time}.
```

Additional sizing assumptions:

```
SIZE=route_segment_total_number+
OTHER_SEGS{TIME_PERIOD{route_segment_guided_travelers}
    +route_segment_journey_time+route_segment_identity};
```

current_ozone_pollution

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

Additional sizing assumptions:

```
SIZE=2;
```

current_particulate_pollution

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

Additional sizing assumptions:

```
SIZE=2;
```

current_pollution_location

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

location_identity.

Additional sizing assumptions:

None

current_road_network_data

* This data flow is used within the Manage Traffic function and contains data about traffic conditions on links in the road network served by the function. This data is used for determining traffic management strategies and is also sent for storage in both the long term and current data stores. It consists of the following data items each of which is defined in its own DDE: *

link_list_for_roads
+ list_size{link_journey_time
+ link_delay}.

Additional sizing assumptions:

SIZE=link_list+ROAD_LINKS{link_journey_time+link_delay};

current_road_network_use

* This data flow is sent from the Provide Driver and Traveler Services function to the Manage Traffic function. It contains information about how many vehicles are being guided down each route segment and the average journey time for each route segment provided by guided vehicles. The data will be stored in ascending route segment number order (i.e. from 1 to the maximum number of route segments), and consists of the following data items each of which is defined in its own DDE: *

route_segment_total_number
+ route_segment_total_number{route_segment_identity
+ route_segment_use_prediction
+ route_segment_journey_time}.

Additional sizing assumptions:

SIZE=route_segment_total_number+ROADWAY_SEGS{route_segment_use_prediction
+route_segment_journey_time+route_segment_identity};

current_roadside_pollution_location

* This data flow is used within the Manage Traffic function and contains the location at which an associated set of current roadside atmospheric pollution values have been obtained from sensors. It consists of the following data item which is defined in its own DDE: *

location_identity.

Additional sizing assumptions:

None

current_roadway_network_data

* This data flow is used within the Manage Traffic function and contains data about traffic conditions on links in the road (surface street) and highway network served by the function. The data is used for determining traffic management strategy and is also sent for in both the long term and current data stores. It consists of the following data items each of which is defined in its own DDE: *

current_highway_network_data
+ current_road_network_data.

Additional sizing assumptions:

None

current_sulfur_dioxide_pollution

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

Additional sizing assumptions:

SIZE=2;

date

* This data flow is used within many ITS function and contains the calendar date data normally used to indicate currency or effectivity of other data flows. The codification of the data is MMDDYY or equivalent and the size estimate is based on 4 bit month, 5 bit day, 7 bit year code.*.

Additional sizing assumptions::

SIZE = 2;

departure_time

* This data flow is used within the Provide Driver and Traveler Services function and defines the time at which a driver or traveler's planned or requested trip is to start. It consists of the following data item which is defined in its own DDE: *

time.

Additional sizing assumptions:

None

desired_arrival_time

* This data flow is used within the Provide Driver and Traveler Services function and specifies the target time for arrival at the end of a driver or traveler's planned or requested trip. It consists of the following data item which is defined in its own DDE: *

time.

Additional sizing assumptions:

None

destination

* This data flow is used within the Provide Driver and Traveler Services function. It defines the destination point for a trip request or a route to be used by a traveler or a vehicle. In some instances it will be used as the origin for the use of a particular mode within a trip, e.g. the part of the route for the trip that is to be provided by walking, or ridesharing, or an intermodal service provider. It consists of the following data item which is defined in its own DDE: *

route_point.

Additional sizing assumptions:

None

display_map_traveler_update_cost

* This data flow is sent from the Provide Driver and Traveler Services function to the Provide Electronic Payment Services function and contains the cost (cents) of an update to the digitized map data used as the background to displays of traffic and travel information on a traveler's personal portable device. The data flow is sized at two

bytes to give a maximum cost of 32767 cents for each update. *.

Additional sizing assumptions:

SIZE=2;

driver_map_update_payment_request

* This data flow is sent from the Provide Driver and Traveler Services function to the Provide Electronic Payment Services function and 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. It consists of the following data items each of which is defined in its own DDE: *

vehicle_identity
+ credit_identity
+ navigable_map_vehicle_update_cost.

Additional sizing assumptions:

None

driver_map_update_payment_response

* This data flow is sent from the Provide Electronic Payment Services function to the Provide Driver and Traveler Services function and 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. It consists of the following data items each of which is defined in its own DDE: *

confirmation_flag
+ credit_identity
+ vehicle_identity.

Additional sizing assumptions:

None

duration

* This data flow is used within many ITS function. It contains the expected duration of a particular activity. Although 17 bits would be required to provide 1 second granularity, a 16 bit data element supports time accurate to within a few seconds and will be sufficient for all ITS applications.*.

Additional sizing assumptions::

SIZE = 2;

fws_current_weather

* This data flow is sent to the Manage Traffic function and the Provide Driver and Traveler Services functions. It contains details of the current weather conditions, e.g. temperature, pressure, wind speed, wind direction, humidity, precipitation, visibility, light conditions, etc. *.

Additional sizing assumptions:

SIZE=64;

fws_predicted_weather

* This data flow is sent to the Manage Traffic and Provide Driver and Traveler Services functions. It contains details of the predicted weather conditions, e.g. temperature, pressure, wind speed, wind direction, humidity, precipitation, visibility, light conditions, etc. *.

Additional sizing assumptions:

SIZE=64;

hov_lane_data

* This data flow is used within the Manage Traffic function and contains the data obtained from processing the inputs from traffic sensors located on High Occupancy Vehicle (HOV) lanes around the road network. It consists of the following data items each of which is defined in its own DDE: *

list_size
+ list_size{hov_lane_vehicle_count
+ hov_lane_violation_count}.

Additional sizing assumptions:

SIZE=list_size+HOV_LANES{hov_lane_vehicle_count+hov_lane_violation_count};

hov_lane_vehicle_count

* This data flow is used within the Manage Traffic function and contains the a count of the number of vehicle legitimately using High Occupancy Vehicle (HOV) lanes in the road and highway network served by the function. The count shows the actual number of

vehicles in a lane, which is not the same as the vehicle flow rate, although this can be calculated as an average from successive values of this data flow. The data flow is updated every second and is fixed at one (1) byte for a maximum value of 255. *.

Additional sizing assumptions:

SIZE=1;

hov_lane_violation_count

* This data flow is used within the Manage Traffic function and contains the a count of the number of vehicle illegally using High Occupancy Vehicle (HOV) lanes in the road and highway network. The count shows the actual number of illegal vehicles in a lane, which is not the same as the illegal vehicle flow rate, although this can be calculated as an average from successive values of this data flow. The data flow is updated every second and is fixed at one (1) byte for a maximum value of 255. *.

Additional sizing assumptions:

SIZE=1;

incident_description

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

Additional sizing assumptions:

SIZE=3;

incident_duration

* This data flow is used within the Manage Traffic function and gives the expected duration of an incident from its start time until the time at which it is expected that it will have no further effect on traffic conditions. The data flow consists of the following data item which is defined in its own DDE: *

duration.

Additional sizing assumptions:

None

incident_location

* This data flow is used within the Manage Traffic function and contains the location

at which an incident will take place (for predicted incidents) or is taking place (for current incidents). The location will be defined in terms of map coordinates to enable it to be referenced spatially within the geographic area served by the local TMC. The data flow consists of the following data item which is defined in its own DDE: *

location_identity.

Additional sizing assumptions:

None

incident_number

* This data item is used by processes in the Manage Emergency Services and Manage Traffic functions and identifies each incident that has been or is active. The data flow is seized at two (2) bytes to enable up to 32767 incidents to be accommodated before old data is overwritten. Note that each function will have its own copy of this data so that an incident in one function does not have the same number in the other function, i.e. the numbering of incidents is independent in each function. *.

Additional sizing assumptions:

SIZE=2;

incident_severity

* This data flow is used within the Manage Traffic and Manage Emergency Services functions and defines the severity of an incident held as a three character code. *.

Additional sizing assumptions:

SIZE=3;

incident_start_time

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

time.

Additional sizing assumptions:

None

incident_traffic_impact

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

Additional sizing assumptions:

SIZE=80;

incident_type

* This data flow is used within both the Manage Traffic and Manage Emergency Services functions and defines an incident type using a three character code. This will use a standard set of character codes to uniquely define the type of incident. *.

Additional sizing assumptions:

SIZE=3;

link_and_queue_data

* This data is used within the Provide Driver and Traveler Services function and contains the average link journey times and queue times for each link, computed from traffic data and (if available) vehicle probe data. *

list_size

+ list_size{link_identity
+ link_journey_time
+ link_queue_time}.

Additional sizing assumptions:

SIZE=list_size+LINKS{link_identity+link_journey_time+link_queue_time};

link_data_from_tags

* This data flow is used within the Manage Traffic function. It contains the link journey and queue times calculated by processing the times at which tag data was collected from vehicles on the road (surface street) and highway network served by the function. The data flow consists of the following data items each of which is defined in its own DDE: *

list_size
+ list_size{link_queue_time
+ link_journey_time}.

Additional sizing assumptions:

SIZE=list_size+1 {HIGHWAY_LINKS+ROAD_LINKS} {link_queue_time+link_journey_time};

link_delay

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

Additional sizing assumptions:

SIZE=2;

link_identity

* This data flow is used within the Manage Traffic, Provide Driver and Traveler Services and Plan System Deployment functions. It contains the unique identity of each link, data for which is stored by a particular TMC or ISP. A link is a short segment typically less than one mile, e.g. a segment of freeway between off-ramps or a street segment between two intersections. The utilization of this data in a variety of other data flows necessitates fairly comprehensive coverage to include all route segments along which such services as route guidance are offered. For some link attributes such as link times, a link pair may be required since travel times will differ per link pair (e.g. link time for a vehicle turning left may be different from the link time for a vehicle proceeding through an intersection). The data flow consists of the following data items each of which is defined in its own DDE: *

unit_number
+ link_type
+ location_identity.

Additional sizing assumptions:

None

link_journey_time

* This data flow is used within the Manage Traffic function and contains the current journey time for vehicles on a particular link. This will have been determined using

sensor data that measures traffic on the road and highway network served by the function or produced by the predictive model process. *.

Additional sizing assumptions:

SIZE=2;

link_list_for_highways

* This data flow is used within the Manage Traffic function and contains a list of links for which data is being provided. These links will comprise all of those on the highway network served by the function. The data flow consists of the following data items each of which is defined by its own DDE: *

list_size
+ 1{link_identity}list_size.

Additional sizing assumptions:

SIZE=list_size+HIGHWAY_LINKS{link_identity};

link_list_for_roads

* This data flow is used within the Manage Traffic function and contains a list of links for which data is being provided. These links will comprise all of those on the road (surface street) network served by the function. The data flow consists of the following data items each of which is defined by its own DDE: *

list_size
+ 1{link_identity}list_size.

Additional sizing assumptions:

SIZE=list_size+ROAD_LINKS{link_identity};

link_queue_time

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

Additional sizing assumptions:

SIZE=2;

link_type

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

Additional sizing assumptions:

SIZE=4;

list_size

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

Additional sizing assumptions:

SIZE=1;

location_identity

* This data flow is used within many of the ITS functions and is an identifier for the position of a subsystem or component such as a variable message sign (vms), parking lot, ramp, etc., or for the start, end and way points along a route segment. The position may then be used to orient the equipment or route segment within a spatial database. The data flow is sized at thirteen (13) bytes to enable it to include the georeferenced point ISP-location reference standard LRMP format, as described in the White Paper on location referencing dated 11/8/95. *.

Additional sizing assumptions:

SIZE=13;

long_term_data_for_media

* This data flow is used within the Manage Traffic function. It contains a subset of the long data stored by the function which will be used as the basis for traffic data that is sent to other functions. This subset shows the traffic conditions for the last six hours plus the smoothed or average flow over a weekday, giving a total of 31 entries or sets of data. The data flow consists of the following data items each of which is defined in its own DDE: *

1 {current_incident_data

- + current_other_routes_use
- + parking_lot_storage_data
- + traffic_flow_state
- + vehicle_smart_probe_stored_data
- + wide_area_pollution_data}31.

Additional sizing assumptions:

SIZE=31 {current_incident_data+current_other_routes_use+parking_lot_storage_data
+traffic_flow_state+wide_area_pollution_data};

modes

* This data flow is used within many functions and forms part of the data used for route requests and trip plans. It defines the mode(s) of transport to be used on a requested route or proposed trip. The following different modes are supported using the associated three character code and up to six (6) may be used in any trip request:

- CAR - own private car
- BUS - part of public transit services
- RLY - part of public transit services
- AIR - scheduled air service
- SHP - sea borne transport other than ferry, see below
- FRY - passenger or vehicle ferry
- CYL - pedal or motor powered bicycle
- WLK - walking
- VPL - van pool
- CPL - car pool
- EBS - express bus service
- SPS - specialized service, e.g. a private bus service from airport to hotel
- EMV - emergency vehicle *.

Additional sizing assumptions:

SIZE=18;

navigable_map_traveler_update_cost

* This data flow is sent from the Provide Driver and Traveler Services function to the Provide Electronic Payment Services function and contains the cost (cents) of an update to the navigable map database used for on-line traveler guidance. The data flow consists of the following data item which is defined in its own DDE: *

cost.

Additional sizing assumptions:

None

navigable_map_vehicle_update_cost

* This data flow is sent from the Provide Driver and Traveler Services function to the Provide Electronic Payment Services function and contains the cost (cents) of an update to the digitized map data used for on-line vehicle guidance. It consists of the following data item which is defined in its own DDE: *

cost.

Additional sizing assumptions:

SIZE=2;

origin

* This data flow is used within the Provide Driver and Traveler Services function. It defines the origin point for a trip request or a route to be used by a traveler or a vehicle. In some instances it will be used as the origin for the use of a particular mode within a trip, e.g. the part of the route for the trip that is to be provided by walking, or ridesharing, or an intermodal service provider. It consists of the following data item which is defined in its own DDE: *

route_point.

Additional sizing assumptions:

None

paratransit_arrival_time

* This data flow is used within the Manage Transit function and contains the time at which the requested paratransit service will get the traveler to the requested destination. The location of the destination is provided in a separate data flow. The data flow consists of the following data item which is defined in its own DDE: *

time.

Additional sizing assumptions:

None

paratransit_availability_time

* This data flow is used within the Manage Transit function and contains time window of availability of the requested paratransit service. If the traveler does not confirm

the use of the within this time frame, the details will no longer be valid, and the traveler will have to re-request the service. This is to allow for the fluctuating nature of demand for paratransit services and to enable the best possible service to be provided at any time. *.

Additional sizing assumptions:

SIZE=4;

paratransit_destination

* This data flow is used within the Manage Transit function and contains destination of the requested paratransit service, which may not be the traveler's final destination, since the remainder of the trip may be completed by other means, e.g. regular public transit. *.

Additional sizing assumptions:

SIZE=3;

paratransit_personal_schedule

* This data flow is sent from the Manage Transit function to the Provide Driver and Traveler Services function. It consists of the following data items each of which is defined in its own DDE: *

paratransit_service_details
+ paratransit_service_cost
+ traveler_identity.

Additional sizing assumptions:

None

paratransit_pickup_location

* This data flow is used within the Manage Transit function and contains the location at which the requested paratransit service will pick up the traveler. The time at which the traveler will be picked up is contained in a separate data flow. The data flow consists of the following data item which is defined in its own DDE: *

location_identity.

Additional sizing assumptions:

None

paratransit_pickup_time

* This data flow is used within the Manage Transit function and contains the time at which the requested paratransit service will pick up the traveler. The location of the pick-up point is provided in a separate data flow. *.

Additional sizing assumptions:

SIZE=4;

paratransit_service_confirmation

* This data flow is sent by the Provide Driver and Traveler Services function to the Manage Transit function to confirm that the traveler wants to use the previously identifies paratransit service. It contains the following data items each of which is defined in its own DDE: *

paratransit_service_identity
+ transit_confirmation_flag
+ traveler_identity.

Additional sizing assumptions:

None

paratransit_service_cost

* This data flow is used within the Manage Transit function and contains the cost of the requested paratransit service. It consists of the following data item which is defined in its own DDE: *

cost.

Additional sizing assumptions:

None

paratransit_service_details

* This data flow is used within the Manage Transit function to provide details of the response to a requested paratransit service. It consists of the following data items each of which is defined in its own DDE: *

paratransit_arrival_time
+ paratransit_availability_time
+ paratransit_destination

- + paratransit_pickup_time
- + paratransit_pickup_location
- + paratransit_service_identity.

Additional sizing assumptions:

None

paratransit_service_identity

* This data flow is used within the Manage Transit function to provide a unique identity number for a requested paratransit service. It is sized at three (3) bytes to enable this number to be unique over a long time period. *.

Additional sizing assumptions:

SIZE=3;

parking_lot_calculated_occupancy

* This data flow is used within the Manage Traffic function and contains the current occupancy of a parking lot, i.e. the number of vehicles present, calculated from traffic sensors located at its entrance(s) and exit(s). It is sized at two (2) bytes to enable a parking lot with up to 32767 spaces to be served by the Manage Traffic function. *.

Additional sizing assumptions:

SIZE=2;

parking_lot_cost

* This data flow is used within the Provide Electronic Payment Services function. It defines the cost of particular vehicle using a space in a parking lot for a particular time period. The data flow consists of the following data item which is defined in its own DDE: *

cost.

Additional sizing assumptions:

None

parking_lot_current_occupancy

* This data flow is used within the Manage Traffic function and contains the parking lot identity and current occupancy. It consists of the following data items each of

which is defined in its own DDE: *

parking_lot_identity
+ parking_lot_calculated_occupancy.

Additional sizing assumptions:

None

parking_lot_identity

* This data flow is used within the Provide Electronic Payment Services and Manage Traffic function. It contains the identity of an individual parking lot so that its charges can be defined and a control strategy applied to its use. The data flow consists of the following data items each of which is defined in its own DDE: *

unit_number
+ location_identity.

Additional sizing assumptions:

None

parking_lot_occupancy

* This data flow is used within the Manage Traffic function and contains the current occupancy of a parking lot, i.e. the number of vehicles present. *.

Additional sizing assumptions:

SIZE=2;

parking_lot_state

* This data flow is used within the Manage Traffic function and contains the current state of a parking lot, e.g. "spaces", "almost full", "full", "closed", etc. It will have been determined from data provided by either the parking lot operator, the parking service provider, or a comparison of the actual occupancy of the parking lot determined from vehicle detectors sited at the lot entrance(s) and exit(s) with threshold values for each status condition. The state is stored as a two character code, which could typically be as follows:

SP - spaces
AF - almost full
F - full
C - closed. *.

Additional sizing assumptions::

SIZE=2;

parking_lot_storage_data

* This data flow is used within the Manage Traffic function and contains occupancy and state data for all the parking lots in the geographic area served by the function. It consists of the following data items each of which is defined in its own DDE: *

list_size

+ list_size{parking_lot_current_occupancy
+ parking_lot_identity
+ parking_lot_state}.

Additional sizing assumptions:

SIZE=list_size+PARKING_LOTS{parking_lot_current_occupancy+parking_lot_identity
+parking_lot_state};

parking_space_details

* This data flow is used within the Provide Electronic Payment Services function and contains details of the parking lot space requirements for a particular user. It consists of the following data items each of which is defined in its own DDE: *

date

+ duration
+ time.

Additional sizing assumptions:

None

pollution_state_area_collection

* This data flow is used within the Manage Traffic function and contains the current states of the various types of pollution within the atmosphere in the geographic area served by the function. It consists of the following data items each of which is defined in its own DDE: *

current_ozone_pollution

+ current_nitrous_oxide_pollution
+ current_sulfur_dioxide_pollution
+ current_hydrocarbon_pollution
+ current_carbon_monoxide_pollution

+ current_particulate_pollution
+ current_pollution_location.

Additional sizing assumptions:

None

pollution_state_roadside_collection

* This data flow is used within the Manage Traffic function and contains the digitized values of pollution levels obtained from roadside sensors in the geographic area served by the function. It consists of the following data items each of which is defined in its own DDE: *

current_ozone_pollution
+ current_nitrous_oxide_pollution
+ current_sulfur_dioxide_pollution
+ current_hydrocarbon_pollution
+ current_carbon_monoxide_pollution
+ current_particulate_pollution
+ current_roadside_pollution_location.

Additional sizing assumptions:

None

predicted_highway_network_data

* This data flow is used within the Manage Traffic function and contains data about predicted traffic conditions on links in the highway network served by the function. This data is produced by the predictive model process. It consists of the following data items each of which is defined in its own DDE: *

link_list_for_highways
+ list_size{link_journey_time
+ link_delay}.

Additional sizing assumptions:

SIZE=link_list_for_highways+HIGHWAY_LINKS{link_journey_time+link_delay};

predicted_hov_lane_data

* This data flow is used within the Manage Traffic function and contains prediction of the numbers of both legal and illegal vehicles using High Occupancy Vehicle (HOV) lanes in the road and highway network served by the function. It consists of the following data items each of which is defined in its own DDE: *

```
list_size
+ list_size{hov_lane_vehicle_count
            + hov_lane_violation_count}.
```

Additional sizing assumptions:

```
SIZE=list_size+HOV_LANES{hov_lane_vehicle_count+hov_lane_violation_count};
```

predicted_incidents_for_advisories

* This data flow is used within the Provide Driver and Traveler Services function and 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 that which is in the area local to the vehicle's current location and in the road and highway network served by the Manage Traffic function. The data flow consists of the following data items each of which is defined in its own DDE *

```
list_size
+ list_size{incident_location
            + incident_type
            + incident_severity
            + incident_description
            + incident_traffic_impact}.
```

Additional sizing assumptions:

```
SIZE=list_size+LOCAL_DATA{incident_location+incident_type+incident_severity
                           +incident_description+incident_traffic_impact};
```

predicted_incidents_for_broadcast

* This data flow is used within the Provide Driver and Traveler Services function and contains data about predicted incidents for use in wide area broadcast messages that are automatically output to drivers and travelers in vehicles. The data will be restricted to that which is unusual using parameters set up by the ISP operator and will only relate to the road and highway network served by the Manage Traffic function. The data flow consists of the following items each of which is defined in its own DDE *

```
list_size
+ list_size{incident_location
            + incident_type
            + incident_severity
            + incident_description
            + incident_traffic_impact}.
```

Additional sizing assumptions:

```
SIZE=list_size+BROADCAST_ITEMS{incident_location+incident_type+incident_severity
+incident_description+incident_traffic_impact};
```

predicted_other_routes_use

* This data flow is used within the Manage Traffic function. It is produced by the predictive model process and contains information about how many travelers it is predicted will be guided down each non-vehicle and non-transit route segment and the average journey time for each route segment. The data will be stored in ascending route segment number order (i.e. from 1 to the maximum number of route segments), and consists of the following data items each of which is defined in its own DDE: *

```
route_segment_total_number
+ route_segment_total_number{route_segment_identity
+ time_period{route_segment_guided_travelers}
+ route_segment_journey_time}.
```

Additional sizing assumptions:

```
SIZE=route_segment_total_number+OTHER_SEGS{TIME_PERIOD{route_segment_guided_travelers}
+route_segment_journey_time+route_segment_identity};
```

predicted_parking_lot_data

* This data flow is used within the Manage Traffic function and contains predicted parking lot states produced by the predictive model process. It will apply to all the parking lots in the geographic area served by the function, and consists of the following data items each of which is defined in its own DDE: *

```
list_size
+ list_size{parking_lot_identity
+ parking_lot_state
+ parking_lot_occupancy}.
```

Additional sizing assumptions:

```
SIZE=list_size+PARKING_LOTS{parking_lot_identity+parking_lot_state+parking_lot_occupancy
};
```

predicted_road_network_data

* This data flow is used within the Manage Traffic function and contains data about predicted traffic conditions on links in the road network served by the function. This data is produced by the predictive model process. It consists of the following data items each of which is defined in its own DDE: *

```
link_list_for_roads
+ list_size{link_journey_time
    + link_delay}.
```

Additional sizing assumptions:

```
SIZE=link_list_for_highways+ROAD_LINKS{link_journey_time+link_delay};
```

predicted_road_network_use

* This data flow is used within the Manage Traffic function. It is produced by the predictive model process and contains information about how many vehicles it is predicted will be guided down each route segment and the average journey time for each route segment. The data will only apply to those route segments that are related to links in the road and highway network served by the Manage Traffic function. It will be stored in ascending route segment number order (i.e. from 1 to the maximum number of route segments), and consists of the following data items each of which is defined in its own DDE: *

```
route_segment_total_number
+ route_segment_total_number{route_segment_identity
    + time_period{route_segment_guided_vehicles}
    + route_segment_journey_time}.
```

Additional sizing assumptions:

```
SIZE=route_segment_total_number
    +ROADWAY_SEGS{TIME_PERIOD{route_segment_guided_vehicles}
    +route_segment_journey_time+route_segment_identity};
```

prediction_data_for_advisories

* This data flow is used within the Provide Driver and Traveler Services function. It 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. The data flow consists of the following items each of which is defined in its own DDE: *

```
list_size
+ list_size{route_segment_identity
    + route_segment_volume_delay_predictions
    + route_segment_queue_delay_predictions
    + route_segment_occupancy_predictions}.
```

Additional sizing assumptions:

SIZE=list_size+LOCAL_DATA{route_segment_identity+route_segment_volume_delay_prediction
s
+route_segment_queue_delay_predictions+route_segment_occupancy_predictions};

prediction_data_for_broadcast

* This data flow is used within the Provide Driver and Traveler Services function. It is used to provide wide area broadcast 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. The data will be restricted to that which is unusual using parameters set up by the ISP operator. The data flow consists of the following items each of which is defined in its own DDE: *

list_size
+ list_size{route_segment_identity
+ route_segment_volume_delay_predictions
+ route_segment_queue_delay_predictions
+ route_segment_occupancy_predictions}.

Additional sizing assumptions:

SIZE=list_size+BROADCAST_ITEMS{route_segment_identity
+route_segment_occupancy_predictions
+route_segment_queue_delay_predictions+route_segment_volume_delay_predictions};

predictive_model_data_for_media

* This data flow is used within the Manage Traffic function. It contains a subset of the predictive model data stored by the function which will be used as the basis for traffic data that is sent to other functions. The data flow consists of the following data items each of which is defined in its own DDE: *

predicted_highway_network_data
+ predicted_hov_lane_data
+ predicted_other_routes_use
+ predicted_parking_lot_data
+ predicted_road_network_data
+ predicted_road_network_use.

Additional sizing assumptions:

None

preferences

* This data flow is used within the Provide Driver and Traveler Services function and is also sent to that function by the Provide Vehicle Monitoring and Control function as part of the data needed to request a route involving automatic highway system (ahs)

lanes. It contains the preferences being placed on the choice of a route being requested by a driver or traveler and consists of the following data items each of which is defined in its own DDE: *

modes
+ preferred_routes
+ preferred_alternate_routes
+ preferred_route_segments
+ preferred_weather_conditions
+ preferred_ridesharing_options
+ preferred_transit_options.

Additional sizing assumptions:

None

preferred_alternate_routes

* This data flow is used within the Provide Driver and Traveler Services function and contains the number of alternate routes that are to be provided to the driver or traveler making the route request. These alternate routes will be in addition to the primary route, which will be the one that most nearly meets the specified preferences and constraints. This data flow is sized at one (1) byte to give 255 as the maximum number of alternate routes. *.

Additional sizing assumptions:

SIZE=1;

preferred_ridesharing_options

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

Additional sizing assumptions:

SIZE=12;

preferred_route_segments

* This data flow is used within the Provide Driver and Traveler Services function and contains a list of preferred route segments. This is actually a list of preferred types of route segment, e.g. those containing automatic highway system (ahs) lanes. If no preference is identified, the route selection process will assume that it is free to choose any type of segment, although this will not include those with ahs lanes unless this is specifically identified. This data flow has been sized at twelve (12) bytes to enable a reasonable type selection to be made. *.

Additional sizing assumptions:

SIZE=12;

preferred_routes

* This data flow is used within the Provide Driver and Traveler Services function and contains a list of preferred route choices, e.g. a route must go via a particular place or avoid another place. The list will comprise a list of place names and has been sized at 40 bytes to enable a reasonable choice to be made. *.

Additional sizing assumptions:

SIZE=40;

preferred_transit_options

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

Additional sizing assumptions:

SIZE=12;

preferred_weather_conditions

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

Additional sizing assumptions:

SIZE=12;

ramp_controls

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

Additional sizing assumptions:

SIZE=2;

ramp_list

* This data flow is used within the Manage Traffic function and contains a list of the ramps to which a particular traffic control strategy is to be applied. The ramps are served by ramp metering equipment which has the ability to control vehicle access to the highway. The data flow consists of the following data items each of which is defined by its own DDE: *

list_size
+ 1 {ramp_identity} list_size.

Additional sizing assumptions::

SIZE=list_size+RAMPS {ramp_identity};

ramp_signal_state

* This data flow is used within the Manage Traffic function to indicate the required state of the ramp meter controllers at the entrance to the highway ramps controlled by the TMC. The data flow consists of the following data items each of which is defined in its own DDE: *

ramp_list
+ 1 {ramp_controls} list_size.

Additional sizing assumptions::

SIZE=ramp_list+RAMPS {ramp_controls};

reservation_status

* This data flow is used within the ITS functions to show the status of a reservation that is being or has been requested. If the flag is set to true the reservation was accepted, but if set to false, then the reservation was denied. The data flow consists of the following data item which is defined in its own DDE: *

confirmation_flag.

Additional sizing assumptions:

None

ride_segments

* This data flow is used within the Manage Transit function and defines the transit route segment(s) for which payment is being or has been provided or for which prices

have been requested or supplied. It consists of the following data items each of which is defined in its own DDE:*

list_size
+ list_size{transit_route_segment_number}.

Additional sizing assumptions:

SIZE=list_size+TRANSIT_SEGS{transit_route_segment_number};
rideshare_details

* This data flow is used within the Provide Driver and Traveler Services function and contains a list of potential ridesharing matches for output to the traveler. This data will provide information on the other participants in the proposed rideshare, pick-up and drop-off points, etc. *.

Additional sizing assumptions:

SIZE=2048;

rideshare_response

* This data flow is used within the Provide Driver and Traveler Services function to provide the response to a traveler's rideshare request. It contains the following data items each of which is defined in its own DDE: *

rideshare_details
+ rideshare_selection_number
+ traveler_identity.

Additional sizing assumptions:

SIZE = 0;

rideshare_selection_number

* This data flow is used within the Provide Driver and Traveler Services function to provide the identification number for a rideshare selection that has been made in response to a traveler's request. This number consists of up to eight (8) alphanumeric characters and is used to identify a rideshare selection in all subsequent transactions. *.

Additional sizing assumptions:

SIZE = 8;

route

* This data flow is used within the Provide Driver and Traveler Services function and contains details of a route. This will have been produced to fit the origin, destination, preferences and constraints requirements provided by a traveler through the trip request data. The route segment(s) will be in sets, one for a primary route (the nearest fit to the traveler's requirements), plus one or more alternates that may give a better modal split, or improved journey time, etc. There may be one or many route segments depending on the length of the route. The data flow consists of the following items each of which is defined in its own DDE: *

route_start_time
+ route_statistics
+ route_cost
+ route_list
+ route_segment_number{route_segment}.

Additional sizing assumptions:

SIZE=route_start_time+route_statistics+route_cost+route_list+NUM_SEGS{route_segment};

route_cost

* This data item is used within the Provide Driver and Traveler Services function and contains the cost of using a particular route. This is made up of some or all of such things as tolls, fares, port charges, plus the cost of commercial vehicle credential filing and tax payments. The cost is shown in cents. *.

Additional sizing assumptions:

SIZE=3;

route_identity

* This data flow is used within the Provide Driver and Traveler Services function and contains the identity of a route that is to be used for either on-line vehicle or traveler guidance. The data is for internal use within the function and identifies the route when the driver or traveler subsequently accepts it for use. The data flow is sized at two (2) bytes to give the ISP a wide range of numbers. *.

Additional sizing assumptions:

SIZE=2;

route_list

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

contains a list of the number of route segments in each route that is being provided to a traveler. The data flow is sized at four (4) bytes to enable a primary route plus up to three alternates to be offered. The primary route will be that which most closely fits the traveler's requirements, whilst the others will be alternates that may give such things as improved journey time, shorter distance, lower cost, different modal split, etc. The byte entries will be filled from the lowest with a zero entry denoting that there is no further alternate routes. The data flow therefore consists of the following data item which is defined in its own DDE: *

1 {route_segment_number}4.

Additional sizing assumptions:

SIZE=4 {route_segment_number};

route_point

* This data flow is used within the Provide Driver and Traveler Services function. It defines a point that may be on the route that is provided in response to a trip request, or it may be part of the trip specification produced by the traveler as the trip request. In either case it may be the origin, destination, or an intermediate point which the traveler wishes to pass through, or where the trip planning facility has decided that it is necessary to change modes. *.

Additional sizing assumptions:

SIZE=16;

route_segment

* This data flow is used within the Provide Driver and Traveler Services function and forms the basic building block for a route. It consists of the following items of data each of which is defined in its own DDE: *

route_segment_data
+ route_segment_identity
+ route_segment_mode.

Additional sizing assumptions:

None

route_segment_data

* This data flow is used within the Provide Driver and Traveler Services function and contains information about a route segment. It consists of the following items of data each of which is defined in its own DDE: *

route_segment_estimated_condition
+ route_segment_predicted_weather
+ route_segment_end_point
+ route_segment_start_point
+ route_segment_description
+ route_segment_estimated_arrival_time
+ route_segment_estimated_travel_time
+ route_segment_report_position_points.

Additional sizing assumptions:

None

route_segment_description

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

Additional sizing assumptions:

SIZE=64;

route_segment_end_point

* This data flow is used within the Provide Driver and Traveler Services function and the Manage Traffic function. It contains the location of the end of a route segment and consists of the following data item which is defined in its own DDE: *

location_identity.

Additional sizing assumptions:

None

route_segment_estimated_arrival_time

* This data flow is used within the Provide Driver and Traveler Services function and contains the estimated time at which the route segment end point will be reached. The data flow is sized at five (5) bytes to enable the use of the twenty four hour clock system, plus an indicator for whether the time applies to the current or next day. *.

Additional sizing assumptions:

SIZE=5;

route_segment_estimated_condition

* This data flow is used within the Provide Driver and Traveler Services function and contains the traffic conditions expected on the route segment at the time at which it will be used. It is sized at three (3) bytes to enable the use of a three character code to define the actual conditions. *.

Additional sizing assumptions:

SIZE=3;

route_segment_estimated_travel_time

* This data flow is used within the Provide Driver and Traveler Services function and contains the estimated time it will take a vehicle to travel the route segment taking account of the expected conditions defined in other data. It is sized at two (2) bytes to enable the time to be in excess of 255 seconds (the maximum value for one byte), but with a maximum value of 32767 seconds. *.

Additional sizing assumptions:

SIZE=2;

route_segment_guided_travelers

* This data flow is used within the Provide Driver and Traveler Services function and contains the number of travelers being guided along a route segment in one minute of real time. This data only applies to non-vehicle route segments and those not provided by transit services. The travelers may not actually be on the segment at the time the data is used, but will have it included in their current personal guidance data. The data flow is sized at two bytes to give a maximum of 32767 travelers per route segment per minute. *.

Additional sizing assumptions:

SIZE=2;

route_segment_guided_vehicles

* This data flow is used within the Provide Driver and Traveler Services function and contains the number of vehicles being guided along a route segment in one minute of real time. The vehicles may not actually be on the segment at the time the data is used, but will have it included in their current route guidance data. The data flow is sized at two bytes to give a maximum of 32767 vehicles per route segment per minute and will only apply to those route segments that are used by road vehicles other than

transit vehicles. *.

Additional sizing assumptions:

SIZE=2;

route_segment_identity

* This data flow is used within the Provide Driver and Traveler Services function and contains the identity number of a route segment. A link may not be the same physical entity as a surface street or highway link (defined elsewhere), but in some cases they could be the same. The data flow consists of the following data items each of which is defined in its own DDE: *

unit_number
+ route_segment_type
+ location_identity.

Additional sizing assumptions:

None

route_segment_journey_time

* This data flow is used within the Provide Driver and Traveler Services function and contains the average route segment journey time calculated from data being provided by guided vehicles. These vehicle are acting as probes in the road network by reporting their position to request fresh (updated) guidance at the beginning of each new route segment on their current route. The data is stored in seconds (secs) so that with a size of two bytes the maximum journey time for a route segment is 32767 seconds. *.

Additional sizing assumptions:

SIZE=2;

route_segment_mode

* This data flow is used within the Provide Driver and Traveler Services function and contains the mode that has been selected for use within the route segment. The choice of mode is made as part of the trip planning process using one of those listed in the "modes" data flow. Only one mode can be used in any single route segment. This gives a size of three (3) bytes to accommodate the three character code used to define the mode. *.

Additional sizing assumptions:

SIZE=3;

route_segment_number

* This data flow is used within the Provide Driver and Traveler Services function and contains the number of segments in a route that is being provided in response to a trip request from a traveler. The maximum number of route segments allowed in a route is two hundred and fifty five (255). *.

Additional sizing assumptions:

SIZE=1;

route_segment_occupancy_predictions

* This data flow is used within the Manage Traffic function and is also sent by that function to the Manage Transit and Provide Driver and Traveler Services function. It contains output from the predictive model process showing predictions of the occupancy for route segments on the road and highway network served by the Manage Traffic function. This occupancy is shown as a percentage (%) value with zero (0) meaning that there are no vehicles present and one hundred (100) meaning that the vehicles are not moving. The data flow is sized at one (1) byte as its value can never be greater than 100, i.e. 100%. *.

Additional sizing assumptions:

SIZE=1;

route_segment_predicted_weather

* This data flow is used within the Provide Driver and Traveler Services function and contains the weather conditions expected on the road segment at the time at which it will be used. It is sized at three (3) bytes to enable the use of a three character code to define the actual conditions. *.

Additional sizing assumptions:

SIZE=3;

route_segment_queue_delay_predictions

* This data flow is used within the Manage Traffic function and is also sent by that function to the Manage Transit and Provide Driver and Traveler Services function. It contains output from the predictive model process showing predictions of the delay(s) due to traffic queues for route segments on the road and highway network served by the Manage Traffic function. This delay is the additional time that a vehicle will take to move from the start of a route segment to its end, above that which it would need in

totally free flow conditions. The queues may be caused by very high traffic flows such that the traffic cannot all physically fit into certain part(s) of the roads and highways. The data flow is sized at two (2) bytes to take account of the long segments that may be present on highways and in rural areas. *.

Additional sizing assumptions:

SIZE=2;

route_segment_report_position_points

* This data flow is used within the Provide Driver and Traveler Services function and contains a list of any points other than those at the route segment start and end where the vehicle's position is to be reported. It consists of the following data items each of which is defined in its own DDE: *

list_size
+ list_size{route_segment_way_point}.

Additional sizing assumptions:

SIZE=list_size+MAX_SEG_WPS{route_segment_way_point};

route_segment_start_point

* This data flow is used within the Provide Driver and Traveler Services function and the Manage Traffic function. It contains the location of the start of a route segment and consists of the following data item which is defined in its own DDE: *

location_identity.

Additional sizing assumptions:

None

route_segment_total_number

* This data flow is used within the Manage Traffic and Provide Driver and Traveler Services function to define the total number of route segments in the road (surface street) and highway network served by the Manage Traffic function. This may be different from that served by the Provide Driver and Traveler Services function, and in this instance is used to define the number of route segments for which probe vehicle data is being provided to the Manage Traffic function, or the total number of route segments used by non-vehicle modes (walking, cycling, etc.) for which journey times are available. The data flow is sized at two bytes to enable the maximum number of route segments to be up to 32767. *.

Additional sizing assumptions:

SIZE=2;

route_segment_type

* This data flow is used within the Manage Traffic, Provide Driver and Traveler Services and Plan System Deployment functions. It contains the definition of the type of route segment which will depend on the types of use it will support. The data flow is sized as a three (3) character string which is used to defined the supported types in the following way:

ATV - any type of vehicle
OCV - commercial vehicles only
OTR - transit vehicles only
OCT - commercial and transit vehicles
OPC - private cars and vans only
OBC - bicycles only
PNV - all pedestrians, no vehicles
DPO - disabled pedestrians only, no vehicles
RRS - road route segment
HRS - highway route segment. *.

Additional sizing assumptions:

SIZE=3;

route_segment_use_prediction

* This data flow is used within the Provide Driver and Traveler Services function. It contains data about the number of guided vehicles that will be using a route segment over a set of time periods. Typically these time periods will cover five (5) minutes as so far as traffic management is concerned there is no advantage in providing a greater resolution. The data flow consists of the following data items each of which is defined in its own DDE: *

time_period{route_segment_guided_vehicles}.

Additional sizing assumptions:

SIZE=TIME_PERIOD{route_segment_guided_vehicles};

route_segment_volume_delay_predictions

* This data flow is used within the Manage Traffic function and is also sent by that function to the Manage Transit and Provide Driver and Traveler Services function. It contains output from the predictive model process showing predictions of the delay(s)

due to traffic volume for route segments on the road and highway network served by the Manage Traffic function. This delay is the additional time that a vehicle will take to move from the start of a route segment to its end, above that which it would need in totally free flow conditions. The data flow is sized at two (2) bytes to take account of the long segments that may be present on highways and in rural areas. *.

Additional sizing assumptions:

SIZE=2;

route_segment_way_point

* This data flow is used within the Provide Driver and Traveler Services function and contains the location of a point part way along a route segment at which a vehicle's position is to be reported. It consists of the following data item which is defined in its own DDE: *

location_identity.

Additional sizing assumptions:

None

route_start_time

* This data flow is used within the Provide Driver and Traveler Services function. It contains the date and time at which a route will start taken from the time specified in the request for the route. The data flow consists of the following data items each of which is defined in its own DDE: *

date
+ time.

Additional sizing assumptions:

None

route_statistics

* This data flow is used within the Provide Driver and Traveler Services function and contains the overall predicted statistics associated with a route which may assist the traveler in making a final route selection. The statistics will include such things as itinerary, estimated net travel time, time of arrival, total distance, anticipated delays/congestion, etc. *.

Additional sizing assumptions::

SIZE=25;

stored_credit

* This data flow is used within the Provide Electronic Payment Services function and contains the value of the credit currently stored by the payment instrument. This value is stored in cents (US) and has a maximum value of 32767. *.

Additional sizing assumptions:

SIZE=2;

time

* This data flow is used within many ITS functions. It contains the current time of day and will be associated with other data flows and (possibly) a date. Although 17 bits would be required to provide 1 second granularity, a 16 bit data element supports time accurate to within a few seconds and will be sufficient for all ITS applications. *.

Additional sizing assumptions::

SIZE = 2;

tmc_identity

* This data item is used within the Manage Traffic function and defines the logical identifier of an interfacing peer Traffic Management Center (TMC) to share traffic data and system status. Other centers may be on-line to coordinate wide area traffic operations to promote traffic mobility and coordination. Security safeguards are employed to ensure unauthorized entities cannot masquerade as a valid TMC. *.

Additional sizing assumptions::

SIZE=4;

toll_cost

* This data flow is used within the Provide Electronic Payment Services function and defines the cost of the toll for a particular vehicle through a toll plaza (cents), thus giving it the ability to use the toll segment governed by the toll plaza. *.

Additional sizing assumptions:

SIZE=2;

toll_route_segments

* This data flow is used within the Provide Electronic Payment Services function and contains the identity of toll segments for which toll payment is being provided or requested. It consists of the following data for a specific route. The size definition below is based on the assumption that toll segments occur in about the same frequency as the percentage of toll road miles to total freeway miles. The data flow consists of the following data items each of which is defined in its own DDE: *

list_size
+ list_size{toll_segment_identity}.

Additional sizing assumptions:

SIZE=list_size+1{ROUTE_SEGS{TOLL_MILES/HIGHWAY_MILES}}{toll_segment_identity};

toll_segment_identity

* This data flow is used within the Provide Electronic Payment Services function and the Provide Driver and Traveler Services function. It 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. The data flow consists of the following data items each of which is defined in its own DDE: *

unit_number.

Additional sizing assumptions:

None

traffic_data_for_advisories

* This data flow is used within the Provide Driver and Traveler Services function. It is used to provide advisory messages on both the current and predicted traffic flowing in the road and highway network served by the Manage Traffic function. Only data about those parts of the network that are relevant to the current location of the vehicle is included. This may involve several data items, e.g. data about route segments, of one value, e.g. data from the nearest roadside pollution measurement point. The data flow consists of the following items each of which is defined in its own DDE: *

tmc_identity
+ pollution_state_area_collection
+ pollution_state_roadside_collection
+ list_size
+ list_size{route_segment_identity
+ route_segment_journey_time

- + link_identity
- + hov_lane_vehicle_count
- + parking_lot_identity
- + parking_lot_state}.

Additional sizing assumptions:

SIZE=tmc_identity+pollution_state_area_collection+pollution_state_roadside_collection
 +list_size+LOCAL_DATA{route_segment_identity+route_segment_journey_time
 +link_identity+hov_lane_vehicle_count+parking_lot_identity+parking_lot_state};

traffic_data_for_broadcast

* This data flow is used within the Provide Driver and Traveler Services function. It is used to provide wide area broadcast messages on both the current and predicted traffic flowing in the road and highway network served by the Manage Traffic function. Only data that provides exceptional information, e.g. congestion, parking lot closed, etc. will be included. The data flow consists of the following items each of which is defined in its own DDE: *

- tmc_identity
- + pollution_state_area_collection
- + pollution_state_roadside_collection
- + list_size
- + list_size{route_segment_identity
 - + route_segment_journey_time
 - + link_identity
 - + hov_lane_vehicle_count
 - + parking_lot_identity
 - + parking_lot_state}.

Additional sizing assumptions:

SIZE=tmc_identity+pollution_state_area_collection+pollution_state_roadside_collection
 +list_size+BROADCAST_ITEMS{route_segment_identity+route_segment_journey_time
 +link_identity+hov_lane_vehicle_count+parking_lot_identity+parking_lot_state};

traffic_data_for_media

* This data flow is used within the Manage Traffic function. It contains the response to a request for particular data to be retrieved from the stores of current, long term and predictive model data. This data will be used as the basis for traffic information data that is provided to other ITS functions. The data flow consists of the following data items each of which is defined in its own DDE: *

- current_data_for_media
- + long_term_data_for_media
- + predictive_model_data_for_media.

Additional sizing assumptions:

None

traffic_data_for_portables

* This data flow is sent from the Manage Traffic function to the Provide Driver and Traveler Services function. It is used to provide data on the traffic flowing in the road network, plus that which is predicted to flow in the network for output to a traveler's personal portable device. The data flow has been sized to take account of the need to only supply a subset of the full traffic data to the portable device. This subset will depend on the route segment list included in the request, which for sizing purposes has been assumed to have a maximum value of 25. Thus, the size expression below is based on sampling a percentage of the data equivalent to an N route segment square area (i.e. N/total number of segments). The flow consists of the following items each of which is defined in its own DDE: *

tmc_identity
+ traffic_data_for_media
+ traveler_identity.

Additional sizing assumptions:

SIZE=tmc_identity+25{traffic_data_for_media/MAX_SEGS}+traveler_identity;

traffic_data_portables_request

* This data flow is sent by the Provide Driver and Traveler Services function to the Manage Traffic function and contains the request for the provision of traffic data for output at a traveler's personal portable device. It consists of the following data items each of which is defined in its own DDE: *

traffic_data_request
+ traveler_identity.

Additional sizing assumptions:

None

traffic_data_request

* This data flow is used by several ITS functions to request the Manage Traffic function to provide current, long term and predictive traffic data. It will be accompanied by other data flows to provide the origin and hence the return destination for the retrieved traffic data. The data flow has been sized at five (5) bytes to enable some type of alphanumeric convention to be used for road and/or highway network area or

region identification. *.

Additional sizing assumptions:

SIZE=5;

traffic_flow_state

* This data flow is used within the Manage Traffic function. It contains data showing the current traffic flow conditions on roads (surface streets), freeways and ramps served by the function. It also includes flows in high occupancy vehicle (hov) lanes from the same area. The data is a subset of that in the current and long term data stores and is used as a means of "packaging" the data for distribution to users such as ISP's. The data flow consists of the following data items each of which is defined in its own DDE: *

ramp_signal_state
+ current_roadway_network_data
+ current_road_network_use
+ hov_lane_data
+ link_data_from_tags.

Additional sizing assumptions:

None

transaction_number

* This data is used by ITS functions as the identifier for a particular financial transaction usually with the Information and Service Providers Brokers or Financial Institutions, etc. by the traveler. *.

Additional sizing assumptions:

SIZE=8;

transit_confirmation_flag

* This data flow is used within the Manage Transit function to indicate that a paratransit service is to be used (set to 1) or not set to (999). *.

Additional sizing assumptions:

SIZE=1;

transit_deviations_for_portables

* This data flow is sent by the Provide Driver and Traveler Services function to the Manage Transit function and contains current transit service deviations for a particular route. This data will be output to a traveler's personal portable device. It consists of the following data items each of which is defined in its own DDE: *

traveler_identity
+ list_size
+ list_size{transit_vehicle_identity
+ transit_vehicle_achieved_time
+ transit_route_segment_number}.

Additional sizing assumptions:

SIZE=traveler_identity+list_size+TRANSIT_SEGS{transit_vehicle_identity
+transit_vehicle_achieved_time+ transit_route_segment_number);

transit_deviations_portables_request

* This data flow is sent by the Provide Driver and Traveler Services function to the Manage Transit function and is a request for data on current transit service deviations for output to a traveler's personal portable device. The request is modified so that only the data for a transit route specified by the traveler from the portable device is requested. The data flow consists of the following data items each of which is defined in its own DDE: *

traveler_identity
+ transit_vehicle_deviation_request
+ transit_route_number.

Additional sizing assumptions:

None

transit_fare

* This data flow is used within the Manage Transit function and contains the actual cost (cents) for the transit user to travel over a route in the transit network, i.e. the cost of going from a particular origin on a transit route to a particular destination on (possibly another) transit route. *.

Additional sizing assumptions:

SIZE=2;

transit_journey_date

* This data flow is used within the Provide Electronic Payment Services and Manage transit functions. It gives the date and time at which a transit journey is to be made by a traveler as a transit user and is used for trip planning purposes only. The data flow consists of the following data items each of which is defined in its own DDE: *

date
+ time.

Additional sizing assumptions:

None

transit_route_destination

* This data flow is used within the Manage Transit and Provide Electronic Payment Services functions. It contains the destination of a transit route to be used by a traveler (advanced fares) or transit user. The destination will be defined as the name of a transit stop and provided as a string of up to twenty (20) alphanumeric characters. This should enable each destination to be uniquely identified allowing for the use of a common town or city name. *.

Additional sizing assumptions:

SIZE=20;

transit_route_number

* This data flow is used within the Manage Transit function and contains the number of a regular transit route. This is stored as a four (4) character string to enable the use of alphanumeric characters so that the route number may be the same as that seen by transit users, e.g. 141A, or N177, etc. *.

Additional sizing assumptions:

SIZE=4;

transit_route_origin

* This data flow is used within the Manage Transit and Provide Electronic Payment Services functions. It contains the origin of a transit route to be used by a traveler (advanced fares) or transit user.. The origin will be defined as the name of a transit stop and provided as a string of up to twenty (20) alphanumeric characters. This should enable each destination to be uniquely identified allowing for the use of a common town or city name. *.

Additional sizing assumptions:

SIZE=20;

transit_route_segment_number

* This data flow is used within the Manage Transit function. It contains the number of a transit route segment within the transit route on which it lies. The data flow is sized at two (2) bytes to enable the numbering system to accommodate a large number of stops, which may be required for long routes. *.

Additional sizing assumptions:

SIZE=2;

transit_running_data_for_advisories

* This data flow is used within the Provide Driver and Traveler Services function. It 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. The data flow consists of the following items each of which is defined in its own DDE: *

transit_route_number
+ transit_vehicle_identity
+ list_size
+ list_size{transit_route_segment_number
+ transit_stop_scheduled_time
+ transit_vehicle_achieved_time
+ transit_vehicle_time}.

Additional sizing assumptions:

SIZE=transit_route_number+transit_vehicle_identity+list_size
+LOCAL_DATA{transit_route_segment_number+transit_stop_scheduled_time
+transit_vehicle_achieved_time+transit_vehicle_time};

transit_running_data_for_broadcast

* This data flow is used within the Provide Driver and Traveler Services function. It contains data on the current state of transit operations for use in driver and transit user wide area broadcast messages. The messages will only contain data that is unusual, e.g. service suspension, temporary revised timings, etc.. The data flow consists of the following items each of which is defined in its own DDE: *

transit_route_number
+ transit_vehicle_identity
+ list_size
+ list_size{transit_route_segment_number

+ transit_stop_scheduled_time
+ transit_vehicle_achieved_time
+ transit_vehicle_time}.

Additional sizing assumptions:

SIZE=transit_route_number+transit_vehicle_identity+list_size
+BROADCAST_ITEMS{transit_route_segment_number+transit_stop_scheduled_time
+transit_vehicle_achieved_time+transit_vehicle_time};

transit_services_for_advisories

* This data flow is used within the Provide Driver and Traveler Services function to provide details of transit services that are relevant to a driver or transit user who is requesting advisory information from a vehicle. *.

Additional sizing assumptions:

SIZE=64;

transit_services_for_broadcast

* This data flow is used within the Provide Driver and Traveler Services function to provide details of transit services to a driver or transit user as part of a wide area broadcast message. This message will only contain data that is unusual such as a new service, new route, closure of an existing service, etc. *.

Additional sizing assumptions:

SIZE=48;

transit_stop_scheduled_time

* This data flow is used within the Manage Transit function and contains the time at which a transit vehicle is scheduled to reach each stop on a transit route. This will thus be the scheduled time of arrival at the end of a transit route segment. The identity of the transit route segment to which this data applies is carried in an accompanying data flow. The data flow consists of the following data item which is defined in its own DDE: *

time.

Additional sizing assumptions:

None

transit_vehicle_achieved_time

* This data flow is used within the Manage Transit function and contains the time at which a transit vehicle actually reached the end of a transit route segment. This point is usually a transit stop and the data is thus the arrival time of a transit vehicle at each of the transit stop(s) along the transit route. The identity of the transit route segment to which this data applies is carried in an accompanying data flow. The data flow consists of the following data item which is defined in its own DDE: *

time.

Additional sizing assumptions:

None

transit_vehicle_deviation_request

* This data flow is sent by the Provide Driver and Traveler Services function to the Manage Transit function. It contains a request for the provision of data on the current transit service deviations for output to a traveler at a kiosk. *.

Additional sizing assumptions:

SIZE=1;

transit_vehicle_identity

* This data flow is used within the Manage Transit function and contains the identity of an individual transit vehicle. This data is used by processes within the function to identify the source and/or ownership of other data. *.

Additional sizing assumptions:

SIZE=16;

transit_vehicle_time

* This data flow is used within the Manage Transit function. It 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. The end of a transit route segment is usually a transit stop and the data is thus the estimated arrival time of a transit vehicle at each of the remaining transit stop(s) along the transit route. The identity of the transit route segment to which this data applies is carried in an accompanying data flow. The time is stored as a seven (7) character string in the format 'hhmmssd'. The first six characters show the time using the 24-hour clock

system, whilst the last character is an indicator to show whether the time applies to the day on which the schedule started, or the next day.. *.

Additional sizing assumptions:

SIZE=7;

traveler_guidance_route

* This data flow is used within the Provide Driver and Traveler Services function and contains the data for a traveler's route which has been produced following a route request from the traveler. It consists of the following data items each of which is defined in its own DDE: *

route_identity
+ traveler_route
+ traveler_identity.

Additional sizing assumptions:

None

traveler_identity

* This data flow is used within the Provide Driver and Traveler Services function and 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. It may be passed to processes in functions outside the Provide Driver and Traveler Services function for the same purpose. The identity can be up to twenty four (24) alphanumeric characters so that (for example) the traveler's family name and initials can be used. *.

Additional sizing assumptions:

SIZE=24;

traveler_location

* This data flow is used within the Provide Driver and Traveler Services function and contains the traveler's location as computed from sensor data. *

location_identity.

Additional sizing assumptions:

None

traveler_map_update_payment_request

* This data flow is sent from the Provide Driver and Traveler Services function to the Provide Electronic Payment Services function and 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. It consists of the following data items each of which is defined in its own DDE: *

traveler_identity
+ credit_identity
+ navigable_map_traveler_update_cost.

Additional sizing assumptions:

None

traveler_map_update_payment_response

* This data flow is sent from the Provide Electronic Payment Services function to the Provide Driver and Traveler Services function and 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. It consists of the following data items each of which is defined in its own DDE: *

confirmation_flag
+ credit_identity
+ traveler_identity.

Additional sizing assumptions:

None

traveler_personal_current_condition_request

* This data flow is used within the Provide Driver and Traveler Services function and contains a request for details of the current conditions, e.g. weather, events, incidents, etc. The request

includes the identity of the personal portable device from which the request was input by the traveler so that the response can be correctly returned. The data flow consists of the following

item which is defined in its own DDE: *

traveler_identity.

Additional sizing assumptions:

None

traveler_personal_display_update_payment_request

* This data flow is sent from the Provide Driver and Traveler Services function to the Provide Electronic Payment Services function and 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 portable device. The payment will be made by debiting the credit identity with the cost through the financial institution terminator. It consists of the following data items each of which is defined in its own DDE: *

traveler_identity
+ credit_identity
+ display_map_traveler_update_cost.

Additional sizing assumptions:

None

traveler_personal_display_update_payment_response

* This data flow is sent from the Provide Electronic Payment Services function to the Provide Driver and Traveler Services function and 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 portable device. It consists of the following data items each of which is defined in its own DDE: *

confirmation_flag
+ credit_identity
+ traveler_identity.

Additional sizing assumptions:

None

traveler_personal_payment_confirmation

* This data flow is used within the Provide Driver and Traveler Services function to indicate 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. The request for payment will have been initiated by input from the traveler to a personal portable device. The data flow consists of the following data items each of which is defined in its own DDE: *

advanced_tolls_confirm
+ advanced_fares_confirm
+ advanced_parking_lot_charges_confirm
+ credit_identity
+ stored_credit
+ traveler_identity
+ traveler_total_trip_cost.

Additional sizing assumptions:

None

traveler_personal_payment_information

* This data flow is used within the Provide Driver and Traveler Services function. It contains details of the components of a trip which a traveler has obtained from the input of data to a personal portable device and for which advanced payment is needed following a trip confirmation. The traveler's identity and credit identity or stored credit from the payment instrument are therefore also included to enable payment to be made. The data flow consists of the following items each of which is defined in its own DDE: *

credit_identity
+ parking_space_details
+ ride_segments
+ stored_credit
+ toll_route_segments
+ traveler_identity.

Additional sizing assumptions:

None

traveler_personal_transaction_confirmation

* This data flow is used within the Provide Driver and Traveler Services function to confirm any reservations made by the traveler from a personal portable device. These reservations will be based on information obtained by the traveler from previous data input and output through the device. The data flow consists of the following data items each of which is defined in its own DDE: *

credit_identity
+ traveler_identity
+ transaction_number
+ yellow_pages_cost
+ yellow_pages_lodging_reservation_confirmation
+ yellow_pages_dining_reservation_confirmation

+ yellow_pages_ticket_purchase_confirmation.

Additional sizing assumptions:

None

traveler_personal_transaction_request

* This data flow is used within the Provide Driver and Traveler Services function and contains data input by the traveler at a personal portable device to make reservations for various other (yellow pages) services. It contains the following data items, each of which is defined in its own DDE: *

yellow_pages_dining_reservation
+ yellow_pages_lodging_reservation
+ yellow_pages_ticket_purchase.

Additional sizing assumptions:

None

traveler_personal_trip_confirmation

* This data flow is used within the Provide Driver and Traveler Services function to confirm the trip details provided as the result of a traveler's previous trip request input from a personal portable device. It contains the following data item which is defined in its own DDE: *

paratransit_service_confirmation
+ traveler_identity
+ traveler_rideshare_confirmation.

Additional sizing assumptions:

None

traveler_personal_trip_information

* This data flow is used within the Provide Driver and Traveler Services function and contains information about a proposed trip that the traveler has requested earlier from the personal portable device. It consists of the following data items each of which is defined in its own DDE: *

current_conditions
+ [paratransit_personal_schedule | route | rideshare_response]
+ traveler_identity
+ traveler_total_trip_cost.

Additional sizing assumptions:

SIZE=current_conditions+route+traveler_identity+traveler_total_trip_cost;

traveler_personal_trip_request

* This data flow is used within the Provide Driver and Traveler Services function and contains data about a traveler's trip request which has been input from a personal portable device. It consists of the following data items each of which is defined in its own DDE: *

trip_request
+ traveler_identity
+ traveler_rideshare_request.

Additional sizing assumptions:

None

traveler_personal_yellow_pages_data

* This data flow is used within the Provide Driver and Traveler Services function and contains details of other (yellow pages) services which is to be sent to the traveler interface facility for output using a kiosk. The size of the data flow has been set to take account of the need to provide only a small percentage of the total yellow pages data that is available. The data flow consists of the following data items each of which is defined in its own DDE: *

traveler_identity
+ yellow_pages_general_information
+ yellow_pages_specific_information
+ yellow_pages_transaction_information.

Additional sizing assumptions:

SIZE=traveler_identity+0.01{yellow_pages_general_information
+yellow_pages_specific_information+yellow_pages_transaction_information);

traveler_personal_yellow_pages_information_request

* This data flow is used within the Provide Driver and Traveler Services function and contains a request for data on other (yellow pages) services to be provided to a traveler using a personal portable device. The traveler identity is used as the means of ensuring that the data produced in response to the request is returned to the correct traveler. As no filtering components are included, all the data currently available will be provided. The data flow consists of the following data item which is defined in its own DDE: *

traveler_identity.

Additional sizing assumptions:

SIZE=1;

traveler_rideshare_confirmation

* This data flow is used within the Provide Driver and Traveler Services function and contains a traveler's request to confirm a rideshare based trip. It consists of the following data items each of which is defined in its own DDE: *

credit_identity
+ reservation_status
+ rideshare_selection_number
+ traveler_identity.

Additional sizing assumptions:

None

traveler_rideshare_constraints

* This data flow is used within the Provide Driver and Traveler Services function to provide details of the constraints for a rideshare being requested as part of a traveler's proposed trip. It consists of the following data items each of which is defined in its own DDE: *

constraint_on_acceptable_travel_time
+ constraint_on_eta_change
+ constraint_on_special_needs
+ constraint_on_ahs_lanes
+ constraint_on_interstate
+ constraint_on_urban
+ constraint_on_vehicle_type.

Additional sizing assumptions:

None

traveler_rideshare_data

* This data flow is used within the Provide Driver and Traveler Services function to provide details about a rideshare requested as part of a traveler's proposed trip. It consists of the following data items each of which is defined in its own DDE: *

origin

- + destination
- + departure_time
- + desired_arrival_time.

Additional sizing assumptions:

None

traveler_rideshare_preferences

* This data flow is used within the Provide Driver and Traveler Services function to provide details of the preferences for a rideshare being requested as part of a traveler's proposed trip. It consists of the following data items each of which is defined in its own DDE: *

- preferred_routes
- + preferred_alternate_routes
- + preferred_route_segments
- + preferred_ridesharing_options.

----- **Additional sizing assumptions:**

None

traveler_rideshare_request

* This data flow is used within the Provide Driver and Traveler Services function to request a rideshare as part of a traveler's proposed trip request. It consists of the following data items each of which is defined in its own DDE: *

- traveler_identity
- + traveler_rideshare_data
- + traveler_rideshare_preferences
- + traveler_rideshare_constraints.

Additional sizing assumptions:

None

traveler_route

* This data flow is used within the Provide Driver and Traveler Services function and is a special form of "route" for traveler guidance only. It contains a subset of the data items included in the "route" data flow to meet the requirements of on-line traveler guidance as opposed to the more general requirements for a route need as part of a trip planning activity. The data flow consists of the following data items each of which is defined in its own DDE: *

```
route_segment_number{route_segment_description
+ route_segment_end_point
+ route_segment_estimated_travel_time
+ route_segment_mode
+ route_segment_report_position_points
+ route_segment_start_point}.
```

Additional sizing assumptions:

```
SIZE=NUM_SEGS{route_segment_description+route_segment_end_point
+route_segment_start_point
+route_segment_mode+route_segment_estimated_travel_time
+route_segment_report_position_points};
```

traveler_route_accepted

* This data flow is used within the Provide Driver and Traveler Services function and contains the acceptance by the traveler of the previously provided route for on-line infrastructure based guidance. Acceptance must be provided before guidance can begin. The data flow consists of the following data item which is defined in its own DDE: *

route_identity.

Additional sizing assumptions:

None

traveler_route_request

* This data flow is used within the Provide Driver and Traveler Services function and contains data from which the route requested by a traveler can be determined, or that the previously provided data has been accepted. It consists of the following data items each of which is defined in its own DDE: *

```
origin
+ destination
+ desired_arrival_time
+ modes
+ preferred_routes
+ preferred_alternate_routes
+ preferred_ridesharing_options
+ preferred_route_segments
+ preferred_transit_options
+ constraint_on_acceptable_travel_time
+ constraint_on_number_of_mode_changes
```

- + constraint_on_number_of_transfers
- + constraint_on_eta_change
- + constraint_on_special_needs
- + traveler_route_accepted
- + traveler_identity
- + traveler_location.

Additional sizing assumptions:

None

traveler_total_trip_cost

* This data flow is used within the Provide Driver and Traveler Services function and contains the total cost of a traveler's trip. This will be a trip that has been previously confirmed by the traveler from either a personal portable device or a kiosk, and for which where necessary, reservations have been made. The cost is stored in cents (US) in a three (3) bytes to give a sensible value bearing in mind that it could include the cost of number of services, not least of which may be intermodal transport, such as those provided by airlines. It will be deducted from the credit currently stored on the traveler's payment instrument. *.

Additional sizing assumptions:

SIZE=3;

trip_request

* This data flow is used within the Provide Driver and Traveler Services function as a means of specifying the parameters needed for a trip or route to be provided to a driver or traveler. It consists of the following data items each of which is defined in its own DDE: *

- origin
- + destination
- + departure_time
- + desired_arrival_time
- + preferences
- + constraints.

Additional sizing assumptions:

None

unit_number

* This data flow is used within the Manage Traffic function to provide an identification

number of a particular piece of equipment, e.g. intersection signal controller, pedestrian signal controller, variable message sign (vms), ramp meter, parking lot, road/highway link, toll segment, traffic sensor, etc. The actual form of the number is defined as a five (5) byte character string, enabling a flexible alphanumeric based numbering system to be used rather than a more rigid entirely numeric based system. *.

Additional sizing assumptions:

SIZE=5;

vehicle_guidance_probe_data

* This data flow is used within the Provide Driver and Traveler Services function and contains the time at which a vehicle was at a route segment end point. This data will be used to calculate the actual vehicle journey time for the route segment which may supplement or replace data gathered from other sources. This data will be used for in-vehicle guidance purposes. The data flow consists of the following data items each of which is defined in its own DDE *

route_segment_identity
+ vehicle_identity.

Additional sizing assumptions:

None

vehicle_guidance_route

* This data flow is used within the Provide Driver and Traveler Services function and is a special form of "route" for vehicle guidance only. It contains a subset of the data items included in the "route" data flow to meet the requirements of in-vehicle infrastructure based guidance as opposed to the more general requirements for a route need as part of a trip planning activity. The data flow consists of the following data items each of which is defined in its own DDE: *

route_identity
+ route_segment_number{route_segment_description
+ route_segment_end_point
+ route_segment_estimated_travel_time
+ route_segment_report_position_points
+ route_segment_start_point}
+ vehicle_identity.

Additional sizing assumptions:

SIZE=route_identity+NUM_SEGS{route_segment_report_position_points

+route_segment_end_point
+route_segment_estimated_travel_time+route_segment_description
+route_segment_start_point}+vehicle_identity;

vehicle_guidance_route_accepted

* This data flow is used within the Provide Driver and Traveler Services function and contains the acceptance by the driver of the previously provided route for on-line guidance. Acceptance must be provided before guidance can begin. The data flow consists of the following data item which is defined in its own DDE: *

route_identity.

Additional sizing assumptions:

None

vehicle_identity

* This data flow is used within the Manage Commercial Vehicles function and contains the identity of a vehicle (16 characters). *.

Additional sizing assumptions:

SIZE=16;

vehicle_location_for_advisories

* This data flow is used within the Provide Driver and Traveler Services function and contains the vehicle's location as computed from data input to sensors controlled by the processes that determines vehicle location. This is a low precision data flow that has sufficient accuracy for filtering traveler and driver in-vehicle advisory data to make it relevant to the current geographic area where the vehicle is located. It consists of the following data item which is defined in its own DDE: *

location_identity.

Additional sizing assumptions:

None

vehicle_location_for_dynamic_guidance

* This data flow is used within the Provide Driver and Traveler Services function and contains the vehicle's location as computed from sensor data. This is a high precision data flow that enables the location of the vehicle to be pin-pointed to a high degree of accuracy and is used for in-vehicle dynamic guidance purposes. It

consists of the following data item which is defined in its own DDE: *

location_identity.

Additional sizing assumptions:

None

vehicle_route_request

* This data is flow used within the Provide Driver and Traveler Services function and contains a request for on-line guidance of the vehicle. This will have been generated by the driver and will include the necessary source and destination data from which a route can be computed. It consists of the following data items each of which is defined in its own DDE: *

constraint_on_acceptable_travel_time
+ constraint_on_eta_change
+ constraint_on_special_needs
+ constraint_on_load_classification
+ constraint_on_ahs_lanes
+ constraint_on_interstate
+ constraint_on_urban
+ constraint_on_vehicle_type
+ destination
+ departure_time
+ desired_arrival_time
+ origin
+ preferred_routes
+ preferred_alternate_routes
+ preferred_route_segments
+ vehicle_location_for_dynamic_guidance
+ vehicle_identity.

Additional sizing assumptions:

None

vehicle_smart_probe_data_for_storage

* This data flow is used within the Manage Traffic function. It contains the processed vehicle smart probe data collected from a roadside unit, which in turn have received data output by suitably equipped vehicles as they pass by. The data flow consists of the following data items each of which is defined in its own DDE: *

vehicle_smart_probe_data_source
+ vehicle_smart_probe_data_indication.

Additional sizing assumptions:

None

vehicle_smart_probe_data_indication

* This data flow is used within the Manage Traffic function. It contains the data from a vehicle smart probe, processed to provide an indication of the type of hazard that the vehicle found on the road or freeway. The indication will be shown as a three (3) byte character code, comprising but not limited to the following:

BDN - bridge down, i.e. broken, or in some way hazardous to traffic;

ESD - earth or mud slide;

FOG - fog, smoke or mist reducing visibility;

ICE - the road surface is icy;

LOR - road covered by a liquid, e.g. oil, which makes it hazardous to traffic;

OOR - obstacle on road, e.g. fallen tree, telegraph pole, etc.;

RSS - road subsidence, i.e part of the road surface has fallen away. *.

Additional sizing assumptions:

SIZE=3;

vehicle_smart_probe_data_source

* This data flow is used within the Manage Traffic function. It contains the identity and location of the roadside unit that has collected a particular vehicle smart probe data. The data flow consists of the following data items each of which is defined in its own DDE: *

vehicle_smart_probe_data_source_identity

+ vehicle_smart_probe_data_source_location.

Additional sizing assumptions:

None

vehicle_smart_probe_stored_data

* This data flow is used within the Manage Traffic function. It contains the processed vehicle smart probe data collected from roadside units. The data flow consists of the following data items each of which is defined in its own DDE: *

list_size

+ list_size{vehicle_smart_probe_data_for_storage}.

Additional sizing assumptions:

SIZE=list_size+VEH_PROBE_SITES{vehicle_smart_probe_data_for_storage};

wide_area_pollution_data

* This data flow is used within the Manage Traffic function as a means of transferring current pollution data from the Manage Emissions facility to the Provide Traffic Surveillance facility. It contains data about the current levels of pollution obtained from the store of pollution data in the area covered by the Traffic Management Center (TMC) and consists of the following data items each of which is defined in its own DDE: *

pollution_state_area_collection
+ list_size
+ list_size{pollution_state_roadside_collection}.

Additional sizing assumptions:

SIZE=pollution_state_area_collection+list_size
+POLLUTION_POINTS{pollution_state_roadside_collection};

yellow_pages_advisory_data

* This data flow is used within the Provide Driver and Traveler Services function to provide yellow pages data to drivers and transit users in vehicles and/or confirmation of a previously requested reservation. It consists of the following data items each of which is defined in its own DDE: *

yellow_pages_data_for_advisories
+ yellow_pages_cost
+ yellow_pages_dining_reservation_confirmation
+ yellow_pages_lodging_reservation_confirmation
+ yellow_pages_ticket_purchase_confirmation.

Additional sizing assumptions:

None

yellow_pages_advisory_requests

* This data flow is used within the Provide Driver and Traveler Services function to request that data about yellow pages services be output to a driver or a transit user in a vehicle or that a yellow pages services reservation be made. The scope and transit route number data will be provided by the driver or transit user, whilst the vehicle location will be provided automatically. The data flow consists of the following data

items each of which is defined in its own DDE: *

advisory_data_scope
+ vehicle_location_for_advisories
+ transit_route_number
+ transit_vehicle_identity
+ yellow_pages_dining_reservation
+ yellow_pages_lodging_reservation
+ yellow_pages_ticket_purchase.

Additional sizing assumptions:

None

yellow_pages_cost

* This data flow is used within the Provide Driver and Traveler Services and Provide Electronic Payments Services functions. It contains the cost of other (yellow pages) services such as hotels, restaurants, theaters, etc. that have been requested and/or confirmed by the traveler. The data flow consists of the following data item which is defined in its own DDE: *

cost.

Additional sizing assumptions:

None

yellow_pages_data_for_advisories

* This data flow is used within the Provide Driver and Traveler Services function to provide yellow pages (other services) advisory data to drivers and travelers in vehicles. It only includes those services of whatever type that are relevant to the vehicles current location. The data flow consists of the following data items each of which is defined in its own DDE: *

list_size
+ list_size{yellow_pages_service_detail}.

Additional sizing assumptions:

SIZE=list_size+YP_LOCAL_ITEMS{yellow_pages_service_detail};

yellow_pages_dining_information

* This data flow is used within the Provide Driver and Traveler Services function and contains details of those restaurants, diners, etc. in the area served by the function, with dates and prices of available seats. The type character code will define the type of restaurant, diner, etc. and the description will define the name of the chain (if applicable) and the address. The data flow consists of the following data items each of which is defined in its own DDE: *

list_size
+ list_size{yellow_pages_service_detail}.

Additional sizing assumptions:

SIZE=list_size+YP_GLOBAL_ITEMS{yellow_pages_service_detail};

yellow_pages_dining_reservation

* This data flow is used within the Provide Driver and Traveler Services function and contains a request for the information and service providers to make a dining reservation at a restaurant, hotel, etc. The reservation will be based on the data already provided to the traveler through a previous request. *.

Additional sizing assumptions:

SIZE=16;

yellow_pages_dining_reservation_confirmation

* This data flow is used within the Provide Driver and Traveler Services function. It contains a message to say that a dining reservation is confirmed and includes a confirmation number. The data flow consists of the following items each of which is defined in its own DDE: *

confirmation_flag
+ yellow_pages_service_reservation_number.

Additional sizing assumptions:

None

yellow_pages_food

* This data flow is used within the Provide Driver and Traveler Services function and contains details of restaurants, fast food outlets, etc. in the area served by the function. The type character code will define the type of food and the description will define the chain (if applicable) and the address. The data flow consists of the following data items each of which is defined in its own DDE: *

list_size
+ list_size{yellow_pages_service_type
+ yellow_pages_service_contact
+ yellow_pages_service_description
+ yellow_pages_service_location}.

Additional sizing assumptions:

SIZE=list_size+YP_GLOBAL_ITEMS{yellow_pages_service_type+yellow_pages_service_contact
+yellow_pages_service_description+yellow_pages_service_location};

yellow_pages_gas_stations

* This data flow is used within the Provide Driver and Traveler Services function and contains details of gas stations in the area served by the function. The type character code will define the facilities available at the gas station, e.g. toilets, shop, food, the type(s) of fuel supplied, etc. and the description will define the gas supplier chain(s) and the address. The data flow consists of the following data items each of which is defined in its own DDE: *

list_size
+ list_size{yellow_pages_service_type
+ yellow_pages_service_contact
+ yellow_pages_service_description
+ yellow_pages_service_location}.

Additional sizing assumptions:

SIZE=list_size+YP_GLOBAL_ITEMS{yellow_pages_service_type+yellow_pages_service_contact
+yellow_pages_service_description+yellow_pages_service_location};

yellow_pages_general_information

* This data flow is sent from the information and service providers terminator to the Provide Driver and Traveler Services function. It contains the following items the contents of which will be specific to the area covered by the function and which will include contact telephone numbers, etc. Each of them is defined in its own DDE: *

yellow_pages_history
+ yellow_pages_local_customs
+ yellow_pages_people.

Additional sizing assumptions:

None

yellow_pages_history

* This data flow is used within the Provide Driver and Traveler Services function and contains details of any sites of historic interest, etc. in the area served by the function. The type character code will define the type of site, e.g. Civil War battle site and the description will define the address of the site. The data flow consists of the following data items each of which is defined in its own DDE: *

list_size
+ list_size{yellow_pages_service_type
+ yellow_pages_service_contact
+ yellow_pages_service_description
+ yellow_pages_service_location
+ yellow_pages_service_time}.

Additional sizing assumptions:

SIZE=list_size+YP_GLOBAL_ITEMS{yellow_pages_service_type+yellow_pages_service_contact
+yellow_pages_service_description+yellow_pages_service_location
+yellow_pages_service_time};

yellow_pages_hospitals

* This data flow is used within the Provide Driver and Traveler Services function and contains details of location(s), available facilities and visiting hours of hospitals by type, e.g. general human, human speciality (eye, skin, maternity, etc.), veterinary, etc. in the area served by the function. The type character code will define the type of hospital and the description will define opening times and visiting hours plus the address. The data flow consists of the following data items each of which is defined in its own DDE: *

list_size
+ list_size{yellow_pages_service_type
+ yellow_pages_service_contact
+ yellow_pages_service_description
+ yellow_pages_service_location}.

Additional sizing assumptions:

SIZE=list_size+YP_GLOBAL_ITEMS{yellow_pages_service_type+yellow_pages_service_contact
+yellow_pages_service_description+yellow_pages_service_location};

yellow_pages_local_customs

* This data flow is used within the Provide Driver and Traveler Services function and contains details of local customs, etc. in the area served by the function. The description will define the customs themselves, e.g. the days on which shops close early, etc., whilst the location enables the data to apply to selected part(s) of the served area. The data flow consists of the following data items each of which is

defined in its own DDE: *

```
list_size
+ list_size{yellow_pages_service_type
            + yellow_pages_service_description
            + yellow_pages_service_location}.
```

Additional sizing assumptions:

```
SIZE=list_size+YP_GLOBAL_ITEMS{yellow_pages_service_type+yellow_pages_service_locatio
n
                                +yellow_pages_service_description};
```

yellow_pages_lodging

* This data flow is used within the Provide Driver and Traveler Services function and contains details of hotels, motels, etc. in the area served by the function. The type character code will define the type of hotel and the description will define the hotel chain (if applicable) and the address. The data flow consists of the following data items each of which is defined in its own DDE: *

```
list_size
+ list_size{yellow_pages_service_type
            + yellow_pages_service_contact
            + yellow_pages_service_description
            + yellow_pages_service_location}.
```

Additional sizing assumptions:

```
SIZE=list_size+YP_GLOBAL_ITEMS{yellow_pages_service_type+yellow_pages_service_contact
                                +yellow_pages_service_description+yellow_pages_service_location};
```

yellow_pages_lodging_reservation

* This data flow is used within the Provide Driver and Traveler Services function and contains a request for the information and service providers to make a lodging reservation at a hotel or motel etc. from the information already provided to the traveler through a previous request. *.

Additional sizing assumptions:

```
SIZE=16;
```

yellow_pages_lodging_reservation_confirmation

* This data flow is used within the Provide Driver and Traveler Services function. It contains a message to say that a lodging reservation is confirmed and includes a

confirmation number. The data flow consists of the following items each of which is defined in its own DDE: *

confirmation_flag
+ yellow_pages_service_reservation_number.

Additional sizing assumptions:

None

yellow_pages_lodging_reservations

* This data flow is used within the Provide Driver and Traveler Services function and contains details of those hotels, motels, etc. in the area served by the function, with dates and prices of available rooms. The type character code will define the type of hotel and the description will define the hotel chain (if applicable) and the address. The data flow consists of the following data items each of which is defined in its own DDE: *

list_size
+ list_size{yellow_pages_service_detail}.

Additional sizing assumptions:

SIZE=list_size+YP_GLOBAL_ITEMS{yellow_pages_service_detail};

yellow_pages_parking

* This data flow is used within the Provide Driver and Traveler Services function and contains details of parking lots, on-street parking arrangements, etc. in the area served by the function. The type character code will define the type parking, e.g. privately managed lot, municipally owned lot, free parking, on-street parking, etc. and the description will define the address. The data flow consists of the following data items each of which is defined in its own DDE: *

list_size
+ list_size{yellow_pages_service_type
+ yellow_pages_service_contact
+ yellow_pages_service_description
+ yellow_pages_service_location}.

Additional sizing assumptions:

SIZE=list_size+YP_GLOBAL_ITEMS{yellow_pages_service_type+yellow_pages_service_contact
+yellow_pages_service_description+yellow_pages_service_location};

yellow_pages_people

* This data flow is used within the Provide Driver and Traveler Services function and contains details of important local people, e.g. mayor, chief of police, etc. in the area served by the function. The type character code will define the type of person and the description will define the part(s) of the area served and the address of the person's office. The data flow consists of the following data items each of which is defined in its own DDE: *

list_size
+ list_size{yellow_pages_service_type
+ yellow_pages_service_contact
+ yellow_pages_service_description
+ yellow_pages_service_location}.

Additional sizing assumptions:

SIZE=list_size+YP_GLOBAL_ITEMS{yellow_pages_service_type+yellow_pages_service_contact
+yellow_pages_service_description+yellow_pages_service_location};

yellow_pages_private_vehicle_parts_shops

* This data flow is used within the Provide Driver and Traveler Services function and contains details of vehicle parts shops in the area served by the function. The type character code will define the type of vehicle parts available, e.g. engines, brakes, tyres, mufflers, etc. and the description will define the repair shop chain (if applicable) and the address. The data flow consists of the following data items each of which is defined in its own DDE: *

list_size
+ list_size{yellow_pages_service_type
+ yellow_pages_service_contact
+ yellow_pages_service_description
+ yellow_pages_service_location}.

Additional sizing assumptions:

SIZE=list_size+YP_GLOBAL_ITEMS{yellow_pages_service_type+yellow_pages_service_contact
+yellow_pages_service_description+yellow_pages_service_location};

yellow_pages_private_vehicle_repair_shops

* This data flow is used within the Provide Driver and Traveler Services function and contains details of repair shops in the area served by the function. The type character code will define the type of repair shop, the type(s) of repair facilities that are available, e.g. general servicing, engines, brakes, tyres, mufflers, etc. and the description will define the repair shop chain (if applicable) and the address. The data flow consists of the following data items each of which is defined in its own DDE: *

```
list_size
+ list_size{yellow_pages_service_type
    + yellow_pages_service_contact
    + yellow_pages_service_description
    + yellow_pages_service_location}.
```

Additional sizing assumptions:

```
SIZE=list_size+YP_GLOBAL_ITEMS{yellow_pages_service_type
+yellow_pages_service_contact
    +yellow_pages_service_description+yellow_pages_service_location};
```

yellow_pages_rest_areas

* This data flow is used within the Provide Driver and Traveler Services function and contains details of test areas adjacent to roads and highways in the area served by the function. The type character code will define the facilities available at the rest area, e.g. toilets, food, etc. and the description will define any private operators that provide on-site services and the address. The data flow consists of the following data items each of which is defined in its own DDE: *

```
list_size
+ list_size{yellow_pages_service_type
    + yellow_pages_service_contact
    + yellow_pages_service_description
    + yellow_pages_service_location}.
```

Additional sizing assumptions:

```
SIZE=list_size+YP_GLOBAL_ITEMS{yellow_pages_service_type+yellow_pages_service_contact
    +yellow_pages_service_description+yellow_pages_service_location};
```

yellow_pages_service_availability

* This data flow is used within the Provide Driver and Traveler Services function and contains a sixteen (16) character code that is used to define what is actually available from the yellow pages service that is being provided. This may be a number of rooms at a hotel, the number of seats at a theater or restaurant, or none of they are all sold, a range of services provided by a garage, a list of codes for attractions at a tourist site or special event, etc.*.

Additional sizing assumptions:

```
SIZE=16;
```

yellow_pages_service_contact

* This data flow is used within the Provide Driver and Traveler Services function and contains a twenty (20) character code that is used to define the telephone, fax or e-mail contact number for the yellow pages service that is being provided. The actual number will be preceded a character in parenthesis to show its type, i.e. (T) for telephone, (F) for facsimile, (E) for e-mail, etc. *.

Additional sizing assumptions:

SIZE=20;

yellow_pages_service_cost

* This data flow is used within the Provide Driver and Traveler Services function and contains the cost of an associated yellow pages service which is currently available. It consists of the following data item which is defined in its own DDE: *

cost.

Additional sizing assumptions:

None

yellow_pages_service_date

* This data flow is used within the Provide Driver and Traveler Services function and contains the date on which an associated yellow pages service will be available. It consists of the following data item which is defined in its own DDE: *

date.

Additional sizing assumptions:

None

yellow_pages_service_description

* This data flow is used within the Provide Driver and Traveler Services function and contains a thirty character string that describes the yellow pages service that is being provided. This may be the name of a hotel, theater or concert hall, the address of a sports stadium, the address of a garage, etc. *.

Additional sizing assumptions:

SIZE=30;

yellow_pages_service_detail

* This data flow is used within the Provide Driver and traveler Services function. It contains details of the providers of those services of whatever type that are relevant to a vehicle's current location. The data flow consists of the following data items each of which is defined in its own DDE*

yellow_pages_service_type
+ yellow_pages_service_contact
+ yellow_pages_service_cost
+ yellow_pages_service_date
+ yellow_pages_service_description
+ yellow_pages_service_location
+ yellow_pages_service_time
+ yellow_pages_service_availability.

Additional sizing assumptions::

None

yellow_pages_service_location

* This data flow is used within the Provide Driver and Traveler Services function and contains the geographic location at which an associated yellow pages service will be available. It consists of the following data item which is defined in its own DDE: *

location_identity.

Additional sizing assumptions:

None

yellow_pages_service_reservation_number

* This data flow is used within the Provide Driver and Traveler Services function and contains the confirmation number for a yellow pages service reservation. The data flow is sized at three (3) bytes to enable a unique number to be given to each and every reservation, bearing in mind the possibility that some time (months) may elapse before it expires. *.

Additional sizing assumptions:

SIZE=3;

yellow_pages_service_time

* This data flow is used within the Provide Driver and Traveler Services function and contains the time at which an associated yellow pages service will be available. It consists of the following data item which is defined in its own DDE: *

time.

Additional sizing assumptions:

None

yellow_pages_service_type

* This data flow is used within the Provide Driver and Traveler Services function and contains a three character code that is used to define the type of yellow pages service that is being provided. The three character code will use alphanumeric characters and comprise but not be limited to the following:

HTL - hotel
MTL - motel
TVL - travel lodge
RST - restaurant
TAW - take away
DNR - diner
THR - theater
CCT - concert
SHW - stage show
NFL - national football league game
NHL - national hockey league game *.

Additional sizing assumptions:

SIZE=3;

yellow_pages_special_events

* This data flow is used within the Provide Driver and Traveler Services function and contains details of special events such as parades, fairs, exhibitions, conventions, etc. in the area served by the function. The type character code will define the type of event and the description will define the organizer(s) and address at which the event will take place. The data flow consists of the following data items each of which is defined in its own DDE: *

list_size
+ list_size{yellow_pages_service_type
+ yellow_pages_service_contact
+ yellow_pages_service_description

+ yellow_pages_service_location}.

Additional sizing assumptions:

SIZE=list_size+YP_GLOBAL_ITEMS{yellow_pages_service_type+yellow_pages_service_contact
+yellow_pages_service_description+yellow_pages_service_location};

yellow_pages_specific_information

* This data flow is sent from the information and service providers terminator to the Provide Driver and Traveler Services function. It contains information which will be specific to the area covered by the function and which will include details of what facilities are currently available for purchase, etc. The data flow consists of the following items each of which is defined in its own DDE: *

yellow_pages_food
+ yellow_pages_gas_stations
+ yellow_pages_hospitals
+ yellow_pages_lodging
+ yellow_pages_private_vehicle_repair_shops
+ yellow_pages_private_vehicle_parts_shops
+ yellow_pages_parking
+ yellow_pages_rest_areas
+ yellow_pages_special_events
+ yellow_pages_tourist_activities
+ yellow_pages_tourist_services.

Additional sizing assumptions:

None

yellow_pages_ticket_information

* This data flow is used within the Provide Driver and Traveler Services function and contains details of those activities, services etc. for which tickets are required in the area served by the function, with dates and prices. The type character code will define the type of activity or service and the description will define the address. The data flow consists of the following data items each of which is defined in its own DDE: *

list_size
+ list_size{yellow_pages_service_detail}.

Additional sizing assumptions:

SIZE=list_size+YP_GLOBAL_ITEMS{yellow_pages_service_detail};

yellow_pages_ticket_purchase

* This data flow is used within the Provide Driver and Traveler Services function and contains a request for the information and service providers to make a ticket purchase for a special event, theater, tourist attraction, etc. from the information already provided to the traveler through a previous request. *.

Additional sizing assumptions:

SIZE=16;

yellow_pages_ticket_purchase_confirmation

* This data flow is used within the Provide Driver and Traveler Services function. It contains a message to say that a ticket purchase is confirmed and includes a confirmation number. The data flow consists of the following items each of which is defined in its own DDE: *

confirmation_flag
+ yellow_pages_service_reservation_number.

Additional sizing assumptions:

None

yellow_pages_tourist_activities

* This data flow is used within the Provide Driver and Traveler Services function and contains details of tourist specific activities in the area served by the function. The type character code will define the type of activity and the description will define the address at which the activity will take place. The data flow consists of the following data items each of which is defined in its own DDE: *

list_size
+ list_size{yellow_pages_service_type
+ yellow_pages_service_contact
+ yellow_pages_service_description
+ yellow_pages_service_location
+ yellow_pages_service_time}.

Additional sizing assumptions:

SIZE=list_size+YP_GLOBAL_ITEMS{yellow_pages_service_type+yellow_pages_service_contact
+yellow_pages_service_description+yellow_pages_service_location
+yellow_pages_service_time};

yellow_pages_tourist_services

* This data flow is used within the Provide Driver and Traveler Services function and contains details of travel agents in the area served by the function. The type character code will define the service(s) provided by the agent and the description will define the agent's address. The data flow consists of the following data items each of which is defined in its own DDE: *

list_size
+ list_size{yellow_pages_service_type
+ yellow_pages_service_contact
+ yellow_pages_service_description
+ yellow_pages_service_location}.

Additional sizing assumptions:

SIZE=list_size+YP_GLOBAL_ITEMS{yellow_pages_service_type+yellow_pages_service_contact
+yellow_pages_service_description+yellow_pages_service_location};

yellow_pages_transaction_information

* This data flow is sent from the information and service providers terminator to the Provide Driver and Traveler Services function. It contains information which will be specific to the area covered by the function and which will include details of what facilities are currently available for purchase, etc. The data flow consists of the following items each of which is defined in its own DDE: *

yellow_pages_lodging_reservations
+ yellow_pages_dining_information
+ yellow_pages_ticket_information.

Additional sizing assumptions:

None