

VEHICLE INFRASTRUCTURE INTEGRATION (VII)

TRAVELER INFORMATION POC APPLICATION REQUIREMENTS



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1 Introduction

Publicly-provided traveler information systems provide information that may be relevant to a traveler's current direction of travel, including, for example, travel times, incident alerts, road closures and work zones. With VII, the potential exists to provide this information in such a manner that is targeted to a driver's current direction of travel, and to update the information in real time as the Vehicle progresses along a route.

Within the scope of traveler information, public entities (both state and local) provide information derived from public data, and provide geographically-relevant information. Private entities can combine the public information with information from other public and private data sources to provide a more individually targeted service, providing enhanced "personalized" traveler information, depending on the trip details provided by a motorist subscribing to such information.

Public traveler information provided at POC will include travel times, delays, and incident information generated from VII probe data or from existing traveler information available from RCOC's FAST-TRAC system. This information will be provided through the VII System to POC test Vehicles that are within the geographic range for which the information may be relevant.

Interpretation, prioritization, and presentation of public traveler information within the Vehicle will be included as a part of the In-Vehicle Signage POC Application (see the In-Vehicle Signage Application Requirements for more details). Incident information notifications will use the same mechanisms as other road status notifications, except that these messages will be generated and disseminated as soon as they are detected by the Traveler Information Application.

The public traveler information will also be provided to private Information Service Providers (i.e. Navteq) involved in the POC, which in turn may provide value added services through the Off-Board Navigation POC application.

2 Requirements Guide

2.1 Precedence And Criticality Of Requirements

The following terms are used to qualify the requirements (shall), expectations (should) and assumptions (will) contained in this document and are based on RFC 2119.

WORD	MEANING
SHALL	This word means that the definition is an absolute requirement of the application.
SHOULD	This word means that valid reasons may exist for not meeting the specific expectation, but the full implications of this must be understood carefully.
WILL	This word indicates functionality that the operational environment surrounding the application is to provide.

2.2 Requirements Identification

All articles in this document will be categorized as follows:

- Assumption – assumption about the operation of entities external to the application
- Constraint – constraint specifies behaviors or characteristics levied on the application by external entities.
- Functional Requirements – functional requirements specify actionable behaviors of the application.
- Security Requirements – security requirements specify mechanisms to prevent the application from compromising connected resources.
- Performance Requirements – performance requirements specify quantifiable characteristics of application operations.
- Performance Expectations – end-to-end performance expected for each application.
- External Interface Requirements– external interface requirements define application interfaces with VII and non-VII Systems.

All articles in this document are identified by a tag of the form: **ST-Category-Number**. The definitions for the tags are listed below:

“S” stands for **Scope**, single character in the 1st position with the following value list

“A”	for Application
”V”	for VII System
“X”	for External Entity

“**T**” stands for **Type**, a single character in the 2nd position with the following value list

“A”	for “Assumption”
“C”	for “Constraint”
“F”	for “Functional Requirement”
“S”	for “Security Requirement”
“P”	for “Performance Requirement”
“X”	for “External Application Interface Requirement”
“N”	for “End-to-End Performance Expectation”

Category is a variable length text string, usually a defined VII acronym, which will identify a specific application.

“TI”	for Traveler Information
“WI”	for Weather Information
“CMLB”	for Corridor Management Load Balancing
“CMPA”	for Corridor Management Planning Assistance
“STO”	for Signal Timing Optimization
“RM”	for Ramp Metering
“PD”	for Pothole Detection

Number is a two digit numerical value which identifies the specific requirement. Child requirements are numbered using a hierarchical decimal system of numerical values.

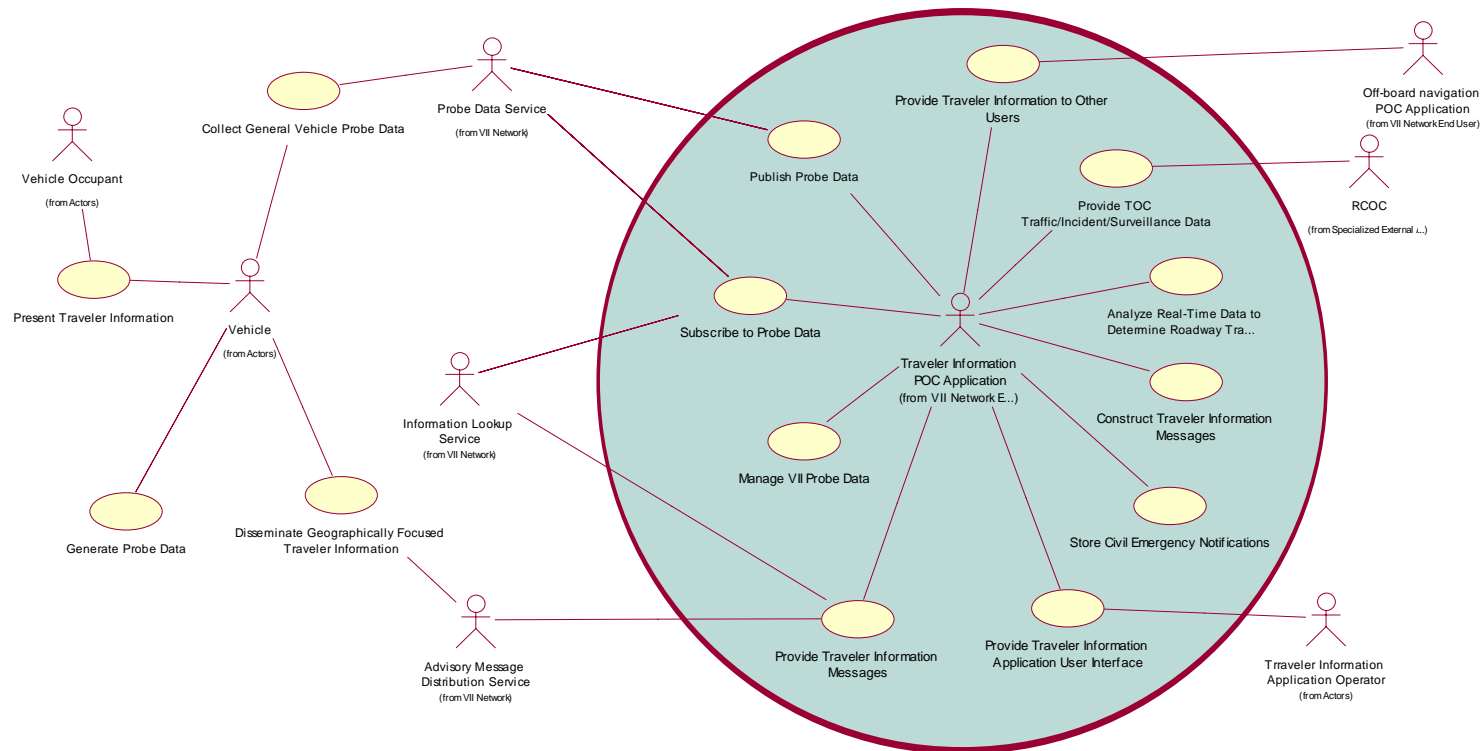
2.3 Requirements Relationship

The requirements have been developed as “parent-child” requirements and should be tested as such. In other words, verification of all “child” requirements automatically implies verification of their “parent” requirement.

3 Application Boundary Definition

The following POC use case diagram identifies the actors and basic functions involved in implementing the Traveler Information Application. This diagram was taken from the VII POC Applications Concept of Operations document version 1.4¹. The shaded portion of the diagram represents the boundary of the Traveler Information Application for POC.

Figure 3.1 – POC Traveler Information Application Use Case Diagram



¹ This is the most recent version of the Traveler Information POC Use Case diagram. Version 1.4 of the VII Applications Concept of Operations will eventually be updated with this edition of the diagram. The changes included in this diagram are critical to the writing of the functional requirements for the Traveler Information application, as they better identify the role of the Traveler Information Application Operator than the officially published version.

The following table maps the actors in the use case to the VII System Architecture, as defined within the VII National System Requirements Version 1.2.1

Table 3.1 – Traveler Information Application Actors

Actor	VII System Architecture Entities
Vehicle Occupant	Vehicle External Entity
Vehicle	Vehicle
Probe Data Service	VII System
Information Lookup Service	VII System
Advisory Message Distribution Service	VII System
Traveler Information POC Application	Network User
Off-Board Navigation POC Application	Network User
Traveler Information Application Operator	Network User External Entity
RCOC	Network User External Entity

As shown in the above table, the Traveler Information Application “lives” on the Network User side, outside of the VII System. However, in order for the application to function as intended, it requires all the other actors identified in the use case to perform appropriate actions.

The requirements in the following sections are developed around the basic functions identified within the shaded portion of the use case diagram. The actors in the use case diagram are used as “nouns” to describe the requirements. These requirements are levied on the POC implementation only, and may or may not apply to the Day-1 Traveler Information Application.

4 Assumptions and Constraints

4.1 Assumptions

Identifier	VII System Assumptions
VA-TI-01	The Vehicle will generate probe data snapshots in accordance with SAE J2735 version 15 and the POC Additions and Exceptions to J2735 (APP190-02).
VA-TI-01.1	All probe data snapshots generated by the Vehicle will include latitude and longitude of the vehicle location.
VA-TI-01.2	All probe data snapshots generated by the Vehicle will include elevation of the vehicle location.
VA-TI-01.3	All probe data snapshots generated by the Vehicle will include time (hour, minute and seconds) that the snapshot was generated.
VA-TI-01.4	All probe data snapshots generated by the Vehicle will include date (month, day, year) that the snapshot was generated.
VA-TI-01.5	All probe data snapshots generated by the Vehicle will include vehicle heading.
VA-TI-01.6	All probe data snapshots generated by the Vehicle will include vehicle brake application status.
VA-TI-01.7	All probe data snapshots generated by the Vehicle will include vehicle speed.
VA-TI-01.8	All probe data snapshots generated by the Vehicle will include the probe segment number.
VA-TI-01.9	The Vehicle's probe snapshot generation parameters will be configurable within the vehicle.
VA-TI-02	The Vehicle will buffer probe data snapshots in accordance with SAE J2735 version 15 and the POC Additions and Exceptions to J2735 (APP190-02).
VA-TI-02.1	The Vehicle's probe snapshot buffering parameters will be configurable within the vehicle.
VA-TI-03	The Vehicle will provide probe data snapshots to the Probe Data Service, when available, as part of Probe Data Messages in accordance with the process outlined in SAE J2735 version 15 and the POC Additions and Exceptions to J2735 (APP190-02).
VA-TI-04	The Vehicle will log information related to probe data generation and Probe Data Service interactions.
VA-TI-04.1	The Vehicle will log all probe data snapshots generated within the previous 24-hour period.
VA-TI-04.1.1	For each snapshot logged by the Vehicle, the snapshot type (periodic, start, stop, or event including the event trigger) will be recorded.
VA-TI-04.1.2	For each snapshot logged by the Vehicle, the time and type of buffer state changes will be recorded.
VA-TI-04.1.3	For each snapshot logged by the Vehicle, the probe data management scheme at time of each snapshot generation will be recorded.
VA-TI-04.1.4	Each snapshot logged by the Vehicle will be uniquely identifiable.

Identifier	VII System Assumptions
VA-TI-04.2	The Vehicle will log all of the locations and times at which the probe segment number changes.
VA-TI-04.3	The Vehicle will log the location and times at which the snapshot buffer overflows.
VA-TI-04.4	The Vehicle will log the times at which the vehicle location information is not available.
VA-TI-04.5	The Vehicle will log the location and times at which the vehicle operational data used for probe data generation is not available.
VA-TI-04.6	The Vehicle will log probe messages provided to the Probe Data Service within the previous 24-hour period.
VA-TI-04.6.1	For each message logged, the Vehicle will record information necessary to identify the specific probe snapshots included in each message.
VA-TI-04.6.2	For each message logged, the Vehicle will record the location and time of transmission of the message to the Probe Data Service.
VA-TI-04.6.3	For each message logged, the Vehicle will record information necessary to identify which infrastructure component (i.e. which RSE) of the Probe Data Service the message was transmitted to.
VA-TI-04.6.4	For each message logged, the Vehicle will record the probe data management scheme at the time the message was transmitted to the Probe Data Service.
VA-TI-05	The Probe Data Service will accept a subscription from the Traveler Information Application as specified in Network User to Service Delivery Node (SDN) Subsystem Software Interface Requirements Specification - Version 1.1 (or latest), using the X-031 interface.
VA-TI-06	The Probe Data Service will attempt to deliver all Probe Data Snapshots received from Vehicles to the Traveler Information Application, if the snapshot parameters meet the Traveler Information Application's probe data subscription profile.
VA-TI-07	The Advisory Message Distribution Service will accept advisory message delivery requests from the Traveler Information Application as specified in Network User to Service Delivery Node (SDN) Subsystem Software Interface Requirements Specification - Version 1.1 (or latest), using the X-032 interface.
VA-TI-08	The Advisory Message Distribution Service will forward the Traveler Information Application provided advisory messages to vehicles, as specified in SDN to RSE Subsystem Software Interface Requirements Specification - Version 1.1 (or latest) and RSE to OBE Subsystem Software Interface Requirements Specification.
VA-TI-09	The Vehicle will present the Traveler Information Application provided advisory messages to the Vehicle Occupant, as specified in APP110-01 POC In-Vehicle Signage Application SFPR – Version 1.0.
VA-TI-10	The Information Lookup Service will respond to a request from the Traveler Information Application with the information necessary for the Traveler Information Application to subscribe to probe data within a specified geographic boundary.

Identifier	VII System Assumptions
VA-TI-11	The Information Lookup Service will respond to a request from the Traveler Information Application with the information necessary for the Traveler Information Application to deliver an advisory message within a specified geographic boundary.
VA-TI-12	The Advisory Message Distribution Service will allow for creating, modifying, deleting, and querying advisory message delivery requests by the Traveler Information Application.
VA-TI-13	The Information Lookup Service will respond to a request from the Traveler Information Application with the information necessary for the Traveler Information Application to submit advisory messages within a specified geographic boundary.
VA-TI-14	The Advisory Message Distribution Service will accept advisory messages from the Traveler Information Application, as specified in Network User to Service Delivery Node (SDN) Subsystem Software Interface Requirements Specification - Version 1.1 (or latest), using the X-032 interface.
VA-TI-15	The Off-Board Navigation Application will utilize the travel information messages provided by the Traveler Information Application in providing navigation guidance to the Vehicles.

Identifier	Non-VII External Entity Assumptions
XA-TI-01	Noblis, as part of USDOT's "VII Data Characteristics for Traffic Management" study, will provide algorithms for estimating current travel times using probe data.
XA-TI-02	Noblis, as part of USDOT's "VII Data Characteristics for Traffic Management" study, will provide algorithms for estimating link delays using probe data.
XA-TI-03	The Road Commission for Oakland County (RCOC) will provide traveler information content to the Traveler Information Application, including link travel times, link delays, and incidents within the geographic extent of the Traveler Information Application.

4.2 Constraints

Identifier	Constraints
AC-TI-01	The geographic extent of the Traveler Information Application is limited to the Detroit POC Development and Test Environment.

5 Functional Requirements

5.1 Subscribe to Probe Data

Identifier	Functional Requirements
AF-TI-01	The Traveler Information Application shall subscribe to probe data from the Probe Data Service.
AF-TI-01.1	The Traveler Information Application shall have the ability to obtain information about the availability of Probe Data Service.
AF-TI-01.1.1	The Traveler Information Application shall send a Probe Data Service availability lookup request to the Information Lookup Service, when directed by the Traveler Information Application Operator.
AF-TI-01.1.2	The Traveler Information Application shall receive information from the Information Lookup Service about the availability of the Probe Data Service.
AF-TI-01.2	The Traveler Information Application shall include a probe data subscription profile.
AF-TI-01.2.1	The Traveler Information Application's probe data subscription profile shall include a geographic boundary defined by the Traveler Information Application Operator.
AF-TI-01.2.2	The Traveler Information Application's probe data subscription profile shall include a start time (month, day, year, hour, and minute) of the subscription defined by the Traveler Information Application Operator.
AF-TI-01.2.3	The Traveler Information Application's probe data subscription profile shall include an end time (month, day, year, hour, and minute) of the subscription defined by the Traveler Information Application Operator.
AF-TI-01.2.4	The Traveler Information Application's probe data subscription profile shall include probe data elements defined by the Traveler Information Application Operator.
AF-TI-01.3	The Traveler Information Application shall update the probe data subscription profile when directed by the Traveler Information Application Operator.
AF-TI-01.4	The Traveler Information Application shall send a subscription request based on the subscription profile to the Probe Data Service, when directed by the Traveler Information Application Operator.
AF-TI-01.5	The Traveler Information Application shall cancel a subscription to the Probe Data Service when directed by the Traveler Information Application Operator.

5.2 Publish Probe Data

Identifier	Functional Requirements
AF-TI-02	The Traveler Information Application shall receive probe data snapshots from the Probe Data Service.

5.3 Manage VII Probe Data

Identifier	Functional Requirements
AF-TI-03	The Traveler Information Application shall manage probe data snapshots received from the Probe Data Service.
AF-TI-03.1	The Traveler Information Application shall store all probe data snapshots received from the Probe Data Service.
AF-TI-03.1.1	The Traveler Information Application shall store all probe data snapshots received from the Probe Data Service, in received form.
AF-TI-03.1.2	The Traveler Information Application shall store the time the snapshot was received by the Traveler Information Application, for all probe data snapshots received from the Probe Data Service.
AF-TI-03.1.3	The Traveler Information Application shall have a mechanism to access stored probe data snapshots, based on the value of any parameter included within the snapshots.
AF-TI-03.2	The Traveler Information Application shall verify the contents of probe data snapshots received from the Probe Data Service.
AF-TI-03.2.1	The Traveler Information Application shall verify that the contents of probe data snapshots received from the Probe Data Service match with the corresponding subscription requests.
AF-TI-03.2.2	The Traveler Information Application shall store the result of the verification for all probe data snapshots.

5.4 Analyze Real-Time Data to Determine Roadway Travel Conditions

Identifier	Functional Requirements
AF-TI-04	The Traveler Information Application shall analyze real-time probe data to determine roadway travel conditions.
AF-TI-04.1	The Traveler Information Application shall estimate travel times.
AF-TI-04.1.1	The Traveler Information Application shall have up-to-date geographic information data covering the geographic extent of the Traveler Information Application, to geo-locate roadway travel times.
AF-TI-04.1.2	The Traveler Information Application shall define the freeways and arterials included in the geographic information data into travel time reporting links.
AF-TI-04.1.3	The Traveler Information Application shall define the start and end points of the travel time reporting links using freeway interchanges, arterial intersections, or pre-defined landmarks.
AF-TI-04.1.4	When enabled by the Traveler Information Application Operator, the Traveler Information Application shall utilize the stored probe data to estimate current travel times along the travel time reporting links, using the algorithms developed by Noblis as part of USDOT's "VII Data Characteristics for Traffic Management" study.
AF-TI-04.1.5	The Traveler Information Application shall store estimated link

Identifier	Functional Requirements
	travel times.
AF-TI-04.1.6	The Traveler Information Application shall verify that all estimated travel times are within threshold values defined by the Traveler Information Application Operator.
AF-TI-04.1.7	The Traveler Information Application shall store the result of the verification for all estimated travel times.
AF-TI-04.2	The Traveler Information Application shall detect incidents.
AF-TI-04.2.1	The Traveler Information Application shall have up-to-date geographic information data covering the geographic extent of the Traveler Information Application, to geo-locate roadway incidents.
AF-TI-04.2.2	The Traveler Information Application shall define the freeways and arterials included in the geographic information data into incident detection links.
AF-TI-04.2.3	The Traveler Information Application shall define the start and end points of the incident detection links using freeway interchanges, arterial intersections, or pre-defined landmarks.
AF-TI-04.2.4	When enabled by the Traveler Information Application Operator, the Traveler Information Application shall utilize the stored probe data to detect occurrence of incidents, incident locations and incident detection times along the incident detection links.
AF-TI-04.2.5	The Traveler Information Application shall geo-locate incidents, utilizing geographic information data.
AF-TI-04.2.6	The Traveler Information Application shall store incident information.
AF-TI-04.2.7	The Traveler Information Application shall require verification of incidents by the Traveler Information Application Operator.
AF-TI-04.2.8	The Traveler Information Application shall log false incident alarms designated by the Traveler Information Application Operator.
AF-TI-04.3	The Traveler Information Application shall estimate link delays.
AF-TI-04.3.1	The Traveler Information Application shall have up-to-date geographic information data covering the geographic extent of the Traveler Information Application, to geo-locate roadway link delays.
AF-TI-04.3.2	The Traveler Information Application shall define the freeways and arterials included in the geographic information data into delay reporting links.
AF-TI-04.3.3	The Traveler Information Application shall define the start and end points of the delay reporting links using freeway interchanges, arterial intersections, or pre-defined landmarks.
AF-TI-04.3.4	When enabled by the Traveler Information Application Operator, the Traveler Information Application shall utilize the stored probe data to estimate current link delays along the delay reporting links, using the algorithms developed by Noblis as part of USDOT's "VII Data Characteristics for Traffic Management" study.
AF-TI-04.3.5	The Traveler Information Application shall store estimated link delays.

Identifier	Functional Requirements
AF-TI-04.3.6	The Traveler Information Application shall verify that all estimated delays are within threshold values defined by the Traveler Information Application Operator.
AF-TI-04.3.7	The Traveler Information Application shall store the result of the verification for all estimated delays.

5.5 Provide TOC Traffic/Incident/Surveillance Data

Identifier	Functional Requirements
AF-TI-05	The Traveler Information Application shall process traveler information content received from RCOC.
AF-TI-05.1	The Traveler Information Application shall receive traveler information content, including link travel times, link delays, and incidents, from RCOC.
AF-TI-05.2	The Traveler Information Application shall store traveler information content, including link travel times, link delays, and incidents, received from RCOC.

5.6 Store Civil Emergency Notifications

Identifier	Functional Requirements
AF-TI-06	The Traveler Information Application shall store simulated civil emergency alert information created by the Traveler Information Application Operator.

5.7 Construct Traveler Information Messages

Identifier	Functional Requirements
AF-TI-07	The Traveler Information Application shall construct traveler information messages.
AF-TI-07.1	The Traveler Information Application shall construct all traveler information messages using the Traffic Advisory Message format specified in APP190-02 POC Additions and Exceptions to the POC Version of SAE J2735.
AF-TI-07.2	The Traveler Information Application shall utilize estimated and RCOC provided travel times to construct travel time messages.
AF-TI-07.3	The Traveler Information Application shall store constructed travel time messages.
AF-TI-07.4	The Traveler Information Application shall utilize estimated and RCOC provided incident information to construct incident messages.
AF-TI-07.5	The Traveler Information Application shall store constructed incident messages.
AF-TI-07.6	The Traveler Information Application shall utilize estimated and RCOC provided link delays to construct link delay messages.

Identifier	Functional Requirements
AF-TI-07.7	The Traveler Information Application shall store constructed link delay messages.
AF-TI-07.8	The Traveler Information Application shall utilize simulated civil emergency information to construct civil emergency alert messages.
AF-TI-07.9	The Traveler Information Application shall store constructed civil emergency alert messages.

5.8 Provide Traveler Information Messages

Identifier	Functional Requirements
AF-TI-08	The Traveler Information Application shall provide traveler information messages to the Advisory Message Distribution Service.
AF-TI-08.1	The Traveler Information Application shall have the ability to obtain information about the availability of Advisory Message Distribution Service.
AF-TI-08.1.1	The Traveler Information Application shall send a Advisory Message Distribution Service availability lookup request to the Information Lookup Service, when directed by the Traveler Information Application Operator.
AF-TI-08.1.2	The Traveler Information Application shall receive information from the Information Lookup Service about the availability of the Advisory Message Distribution Service.
AF-TI-08.2	The Traveler Information Application shall provide the Traveler Information Application Operator the ability to construct broadcast strategies which identify the distribution parameters of advisory messages.
AF-TI-08.2.1	The Traveler Information Application broadcast strategies shall be for any given combination of traveler information message type (travel time, link delay, incident information, and civil emergency), location, duration, and priority.
AF-TI-08.2.2	The Traveler Information Application broadcast strategies shall include the distribution parameters specified in Network User to Service Delivery Node (SDN) Subsystem Software Interface Requirements Specification - Version 1.1 (or latest), using the X-032 interface.
AF-TI-08.2.3	The Traveler Information Application shall store broadcast strategies.
AF-TI-08.3	The Traveler Information Application shall generate advisory message delivery requests.
AF-TI-08.3.1	The Traveler Information Application shall generate an advisory message delivery request when a new advisory message is constructed, unless the Traveler Information Application Operator has chosen to broadcast only verified messages and the new advisory message has not been verified.

Identifier	Functional Requirements
AF-TI-08.3.2	The Traveler Information Application shall include in the advisory message delivery request, a broadcast strategy based on the newly constructed advisory message's type, location, duration, and priority.
AF-TI-08.3.3	The Traveler Information Application shall include, as part of the advisory message delivery request, the newly constructed advisory message.
AF-TI-08.4	The Traveler Information Application shall send advisory message delivery requests to the Advisory Message Distribution Service.
AF-TI-08.5	The Traveler Information Application shall store advisory message delivery requests.
AF-TI-08.6	The Traveler Information Application shall cancel advisory message delivery requests to the Advisory Message Distribution Service, when directed by the Traveler Information Application Operator.

5.9 Provide Traveler Information to Other Users

Identifier	Functional Requirements
AF-TI-09	The Traveler Information Application shall make available to the Off-Board Navigation Application the constructed travel time, link delay, incident, and civil emergency alert messages.

5.10 Provide Traveler Information Application User Interface

Identifier	Functional Requirements
AF-TI-10	The Traveler Information Application shall provide a User Interface (UI) for the Traveler Information Application Operator to manage the Traveler Information Application.
AF-TI-10.1	The Traveler Information Application shall provide a User Interface (UI) for the Traveler Information Application Operator to manage the probe data subscription.
AF-TI-10.1.1	The Traveler Information Application UI shall provide the Traveler Information Application Operator the ability to add and modify the probe data elements of the probe data subscription profile.
AF-TI-10.1.2	The Traveler Information Application UI shall provide the Traveler Information Application Operator the ability to add and modify the geographic boundary of the probe data subscription profile.
AF-TI-10.1.3	The Traveler Information Application UI shall provide the Traveler Information Application Operator the ability to add and modify the start and end times of the probe data subscription profile.
AF-TI-10.1.4	The Traveler Information Application UI shall provide the Traveler Information Application Operator the ability to send a probe data subscription request.
AF-TI-10.1.5	The Traveler Information Application UI shall provide the Traveler

Identifier	Functional Requirements
	Information Application Operator the ability to cancel a probe data subscription request.
AF-TI-10.2	The Traveler Information Application shall provide a UI for the Traveler Information Application Operator to manage probe data.
AF-TI-10.2.1	The Traveler Information Application UI shall provide the Traveler Information Application Operator the ability to view, in a tabular form, probe data stored by the Traveler Information Application.
AF-TI-10.2.2	The Traveler Information Application UI shall provide the Traveler Information Application Operator the ability to select a subset of stored probe data for viewing, based on the value of any parameter of the probe data snapshot.
AF-TI-10.2.3	The Traveler Information Application UI shall provide the Traveler Information Application Operator the ability to select a subset of stored probe data for viewing, based on the time the probe data snapshot was received from the Probe Data Service.
AF-TI-10.2.4	The Traveler Information Application UI shall provide the Traveler Information Application Operator the ability to view the most recently received probe data snapshots.
AF-TI-10.2.5	The Traveler Information Application UI shall provide the Traveler Information Application Operator the ability to view any probe data verification errors generated by the Traveler Information Application.
AF-TI-10.3	The Traveler Information Application shall provide a UI for the Traveler Information Application Operator to manage travel time messages.
AF-TI-10.3.1	The Traveler Information Application UI shall provide the Traveler Information Application Operator the ability to define the active regions (i.e. region within which a link travel time message gets presented to the Vehicle Occupant) for each travel time reporting link.
AF-TI-10.3.2	The Traveler Information Application UI shall provide the Traveler Information Application Operator the ability to view travel time messages in a tabular format, using one row for each pre-defined travel time reporting link.
AF-TI-10.3.3	The Traveler Information Application UI shall provide the Traveler Information Application Operator the ability to view the most recently generated travel time messages.
AF-TI-10.3.4	The Traveler Information Application UI shall provide the Traveler Information Application Operator the ability to view any travel time related errors generated by the Traveler Information Application.
AF-TI-10.4	The Traveler Information Application shall provide a UI for the Traveler Information Application Operator to manage incident messages.
AF-TI-10.4.1	The Traveler Information Application UI shall provide the Traveler Information Application Operator the ability to define the active regions (i.e. region within which an incident message gets presented to the Vehicle Occupant) for each incident reporting link.

Identifier	Functional Requirements
AF-TI-10.4.2	The Traveler Information Application UI shall provide the Traveler Information Application Operator the ability to view incident messages in a tabular format, using one row for each detected incident.
AF-TI-10.4.3	The Traveler Information Application UI shall provide the Traveler Information Application Operator the ability to view the most recently generated incident messages.
AF-TI-10.4.4	The Traveler Information Application UI shall provide the Traveler Information Application Operator the ability to view any incident detection related errors generated by the Traveler Information Application.
AF-TI-10.4.5	The Traveler Information Application UI shall provide the Traveler Information Application Operator the ability to designate an incident detected by the Traveler Information Application as a false alarm.
AF-TI-10.5	The Traveler Information Application shall provide a UI for the Traveler Information Application Operator to manage link delay messages.
AF-TI-10.5.1	The Traveler Information Application UI shall provide the Traveler Information Application Operator the ability to define the active regions (i.e. region within which a link delay message gets presented to the Vehicle Occupant) for each delay reporting link.
AF-TI-10.5.2	The Traveler Information Application UI shall provide the Traveler Information Application Operator the ability to view link delay messages in a tabular format, using one row for each pre-defined delay reporting link.
AF-TI-10.5.3	The Traveler Information Application UI shall provide the Traveler Information Application Operator the ability to view the most recently generated link delay messages.
AF-TI-10.5.4	The Traveler Information Application UI shall provide the Traveler Information Application Operator the ability to view any link delay related errors generated by the Traveler Information Application.
AF-TI-10.6	The Traveler Information Application shall provide a UI for the Traveler Information Application Operator to create, update, and delete simulated civil emergency alert messages.
AF-TI- 10.6.1	The Traveler Information Application UI shall provide the Traveler Information Application Operator the ability to geo-locate simulated civil emergency alert messages using geographic information data covering the geographic extent of the Traveler Information Application.
AF-TI- 10.6.2	The Traveler Information Application UI shall provide the Traveler Information Application Operator the ability to define the active regions (i.e. region within which a civil emergency alert gets presented to the Vehicle Occupant) for each civil emergency alert.
AF-TI-10.6.3	The Traveler Information Application UI shall provide the Traveler Information Application Operator the ability to view current civil emergency alert messages in a tabular format, using one row for each civil emergency alert message.

Identifier	Functional Requirements
AF-TI- 10.6.4	The Traveler Information Application UI shall provide the Traveler Information Application Operator the ability to view the most recently created civil emergency alert message.
AF-TI-10.6.5	The Traveler Information Application UI shall provide the Traveler Information Application Operator the ability to view any civil emergency alert management related errors generated by the Traveler Information Application.
AF-TI-10.7	The Traveler Information Application shall provide a UI for the Traveler Information Application Operator to define travel time reporting links, incident detection links, and links for reporting delays.
AF-TI-10.8	The Traveler Information Application shall provide a UI for the Traveler Information Application Operator to view in tabular form estimated travel times, detected incidents, estimated link delays, and created civil emergency alerts stored by the Traveler Information Application.
AF-TI-10.9	The Traveler Information Application shall provide a UI for the Traveler Information Application Operator to view advisory message delivery requests.
AF-TI-10.9.1	The Traveler Information Application shall provide a UI for the Traveler Information Application Operator to view the active, scheduled, and expired advisory message delivery requests in a tabular format, using one row for each delivery request.
AF-TI-10.9.2	The Traveler Information Application UI shall update the view with the latest advisory message delivery requests generated by the Traveler Information Application.
AF-TI-10.9.3	The Traveler Information Application UI shall provide the Traveler Information Application Operator the ability to view any delivery request related errors reported by the Advisory Message Distribution Service.
AF-TI-10.10	The Traveler Information Application UI shall provide the Traveler Information Application Operator the ability to cancel an advisory message delivery request.
AF-TI-10.11	The Traveler Information Application shall provide a UI for the Traveler Information Application Operator to view errors generated by the Traveler Information Application related to RCOC provided data.
AF-TI-10.12	The Traveler Information Application shall provide a UI for the Traveler Information Application Operator to create, view, modify, and delete broadcast strategies for broadcasting travel information messages at various RSEs within geographic extent of the Traveler Information Application.
AF-TI-10.13	The Traveler Information Application shall provide a UI for the Traveler Information Application Operator to choose to broadcast all travel time, delay, and incident messages, or only those that have been verified.
AF-TI-10.14	The Traveler Information Application shall provide a UI for the Traveler Information Application Operator to create lookup requests to the Information Lookup Service about information on

Identifier	Functional Requirements
	VII System managed entities (i.e. RSEs, Probe Data Service availability, and Advisory Message Distribution Service availability).
AF-TI-10.15	The Traveler Information Application shall provide a UI for the Traveler Information Application Operator to view information about VII System managed entities (i.e. RSEs, Probe Data Service availability, and Advisory Message Distribution Service availability).
AF-TI-10.16	The Traveler Information Application shall provide a UI for the Traveler Information Application Operator to set parameters for the algorithms used to estimate travel times, detect incidents, and estimate delays.
AF-TI-10.17	The Traveler Information Application shall provide a UI for the Traveler Information Application Operator to set threshold values for link travel times and delays.
AF-TI-10.18	The Traveler Information Application shall provide a UI for the Traveler Information Application Operator to enable or disable, either separately or together, the analysis of probe data for estimating travel times, detecting incidents, and estimating delays.

6 Security Requirements

Identifier	Security Requirements
AS-TI-01	The Traveler Information Application shall be coded to ensure that adequate security measures are in place to prevent it from compromising connected system resources both within the host computing and VII infrastructure environments.
AS-TI-02	The Traveler Information Application shall be subject to a code security assessment to ensure it complies with safe coding practices.
AS-TI-03	The Traveler Information Application shall validate all user input to prevent maliciously entered data from being accepted.
AS-TI-04	The Traveler Information Application shall enforce access policies associated with specific user roles.
AS-TI-05	Upon detection of any security event, the Traveler Information Application shall isolate the compromised component in order to render it harmless to the rest of the network.
AS-TI-06	The Traveler Information Application shall prevent known message-based attacks from inbound XML formatted data.
AS-TI-07	The Traveler Information Application shall only use FIPS 140-2 compliant crypto algorithms wherever encryption is needed.
AS-TI-08	The Traveler Information Application shall encrypt a user's ID and password while performing authentication.
AS-TI-09	The Traveler Information Application shall encrypt it's own user ID and password used to establish connectivity to the DBMS.
AS-TI-10	The Traveler Information Application shall store all user ID's and password's in the DBMS in either encrypted or hashed format.
AS-TI-11	The Traveler Information Application shall be designed with user roles which employ the concept of least privileges.
AS-TI-12	The Traveler Information Application shall be designed to connect to the DBMS with an account that is consistent with the concept of least privileges.
AS-TI-13	The Traveler Information Application shall only communicate with the VII CA Subsystem via a private, or virtual private communications link.
AS-TI-14	The Traveler Information Application shall only communicate with Managed Entities via a private, or virtual private communications link.

7 External Interface Requirements

Identifier	External Interface Requirements
AX-TI-01	The Traveler Information Application shall utilize the X-034 interface, as defined in the Network User to Service Delivery Node (SDN) Subsystem Software Interface Requirements Specification - Version 1.1 (or latest), when communicating with the Information Lookup Service .
AX-TI-02	The Traveler Information Application shall utilize the X-031 interface, as defined in the Network User to Service Delivery Node (SDN) Subsystem Software Interface Requirements Specification - Version 1.1 (or latest), when communicating with the Probe Data Service.
AX-TI-03	The Traveler Information Application shall utilize the X-032 interface, as defined in the Network User to Service Delivery Node (SDN) Subsystem Software Interface Requirements Specification - Version 1.1 (or latest), when communicating with the Advisory Message Distribution Service.
AX-TI-04	The Traveler Information Application shall receive traveler information content from RCOC, using an interface specified by RCOC.
AX-TI-05	The Traveler Information Application shall provide traveler information content to the Off-Board Navigation Application, using an interface specified by the Off-Board Navigation Application.

8 Performance Requirements

Identifier	Performance Requirements
AP-TI-01	It shall take no longer than five (5) seconds for the Traveler Information Application to obtain all stored probe data for a fifteen (15) minute period.
AP-TI-02	The Traveler Information Application shall generate a travel information message (travel time, incident, or link delay) within two (2) minutes of obtaining stored probe data.

9 End-to-End Performance Expectations

Identifier	Performance Expectations
VN-TI-01	Vehicle snapshots provided to the Traveler Information Application should be of sufficient frequency and accuracy to allow the determination of vehicle lane changes.
VN-TI-02	Latitude and Longitude included in Probe Data Snapshots should be accurate to determine a vehicle's horizontal position to within one (1) meter.
VN-TI-03	Elevation included in Probe Data Snapshots should be sufficiently accurate to determine a vehicle's vertical position within three (3) meters.
VN-TI-04	Time associated with Vehicle position included in Probe Data Snapshots should be accurate to within one (1) second.
VN-TI-05	Speed associated with a Vehicle position included in Probe Data Snapshots should be accurate to within two (2) kph.
VN-TI-06	Vehicle snapshots should be provided to the Traveler Information Application within two (2) minutes of their transmission by the Vehicle.
VN-TI-07	The Probe Data Service should provide probe data snapshots within one (1) minute of the subscription start time, if probe data snapshots are available and meet the subscription profile.
VN-TI-08	The Advisory Message Distribution Service should commence distribution of traveler information messages within one (1) minute of the advisory message broadcast start time, for all advisory message delivery requests received from the Traveler Information Application.

Appendix A. List of Acronyms

AAM	Alliance of Automobile Manufacturers
AASHTO	American Association of State and Highway Transportation Officials
ABS	Antilock Braking System
AMDS	Advisory Message Distribution Service
AMI-C	Automotive Multimedia Interface Collaboration
ASTM	American Society for Testing and Materials
CA	Certification Authority
CAMP	Crash Collision Avoidance Metrics Partnership
CICAS	Cooperative Intersection Collision Avoidance Systems
CSP	Content Service Provider
DIC	DSRC Industry Consortium
DiD	Defense In Depth
DOT	Departments of Transportation
DSRC	Dedicated Short Range Communications
DTE	Development and Test Environment
EDMap	Enhanced Digital Map
ENOC	Enterprise Network Operations Center
ENS	Event Notification System
ESS	Environmental Sensor Stations
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FTA	Federal Transit Administration
GHz	Gigahertz
GPS	Global Positioning System
GSA	General Services Administration
HMI	Human Machine Interface
IdAM	Identity and Access Management
IEEE	Institute of Electrical and Electronic Engineers
ILS	Information Lookup Service
ISTEA	Intermodal Surface Transportation Efficiency Act
IT	Information Technology
ITIL	Information Technology Infrastructure Library
ITS	Intelligent Transportation System
ITSM	Information Technology Service Management
IVHS	Intelligent Vehicle Highway Systems
IVI	Intelligent Vehicle Initiative
LBS	Location Based Services
MDSS	Maintenance Decision Support System
MPO	Metropolitan Planning Organization
NAP	Network Access Point
NHS	National Highway System
NHTSA	National Highway Traffic Safety Administration
NMS	Network Management System

NOC	Network Operations Center
NWS	National Weather Service
O&M	Operations and Maintenance
OBE	On Board Equipment
OBU	On Board Unit
OEM	Original Equipment Manufacturer
OSI	Open Systems Interconnection
PATH	Partners for Advanced Transit and Highways
PDS	Probe Data Service
PSAP	Public Service Answering Point
QoS	Quality of Service
RSE	Road Side Equipment
RSU	Road Side Unit
RWIS	Road Weather Information System
SAE	Society of Automotive Engineers
SDLC	System Development Life Cycle
SDN	Service Delivery Node
SNMP	Simple Network Management Protocol
SOC	Security Operations Center
SSL	Secure Sockets Layer
TEA-21	Transportation Equity Act for the 21 st Century
TMC	Traffic Management Center
TOC	Traffic Operations Center
VII	Vehicle Infrastructure Integration
VPN	Virtual Private Network
VSC	Vehicle Safety Communications
U.S. DOT	U.S. Department of Transportation

Appendix B. References

REF #	REFERENCE	VERSION
1	VII POC Applications Concept of Operations	Version 1.4
2	VII National System Requirements	Version 1.2.1
3	Road Side Equipment (RSE) Subsystem Specification	Version 1.0
4	Enterprise Network Operations Center (ENOC) Subsystem Specification	Version 1.1
5	Certificate Authority (CA) Subsystem Specification	Version 1.1
6	ENOC to Administrative User Subsystem Software IRS [X-011]	Version 1.1
7	Network User to SDN Subsystem Software IRS [X-031, X-032, X-033]	Version 1.1
8	ENOC to Managed Entity Subsystem Software IRS	Version 1.1
9	ENOC to Managed Network Element Software IRS	Version 1.1
10	SDN to RSE Subsystem Software IRS [I-06]	Version 1.1
11	ENOC to CA Subsystem Software IRS [I-13]	Version 1.1
12	ENOC to SDN Subsystem Software IRS [I-11]	Version 1.1
13	VII USDOT Day-1 Use Case Descriptions (May 2006)	Version 1.0
14	Network Subsystem Specification	Version 1.0
15	VII Concept of Operations	Draft 1.2
16	VII Systems Security Plan	Version 2.1
17	SDN Subsystem Specification (SSS)	Version 1.1
18	VII Infrastructure Lexicon	Version 1.0
19	Draft SAE J2735 Dedicated Short Range Communications (DSRC) Message Set Dictionary	Rev. 15
20	APP190-02 POC Additions & Exceptions to the POC Version of SAE J2735	R00
21	VII x.509 Certificate Authority Certificate Practice Statement (CPS)	TBD