

VEHICLE INFRASTRUCTURE INTEGRATION (VII)

POTHOLE DETECTION POC APPLICATION REQUIREMENTS



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1 Introduction

The scope of this VII POC Pothole Detection application is to collect pothole-related data from vehicles (as available) and use this data to determine the likelihood, severity and location of potholes within the POC region.

The goals of the POC Pothole Detection application are focused on testing the feasibility of detection of potholes by vehicles. This includes the measurement of 3-axis acceleration data, the analysis of that data, determining the characteristics of that data and determining achievable approaches for automating its analysis. The application will incidentally test the VII System's ability to generate and deliver probe data, as this is the mechanism whereby the acceleration data is expected to be delivered.

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 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 “Assumptions”
“C”	for “Constraint”
“F”	for “Functional Requirement”
“P”	for “Performance Requirement”
“S”	for “Security 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.

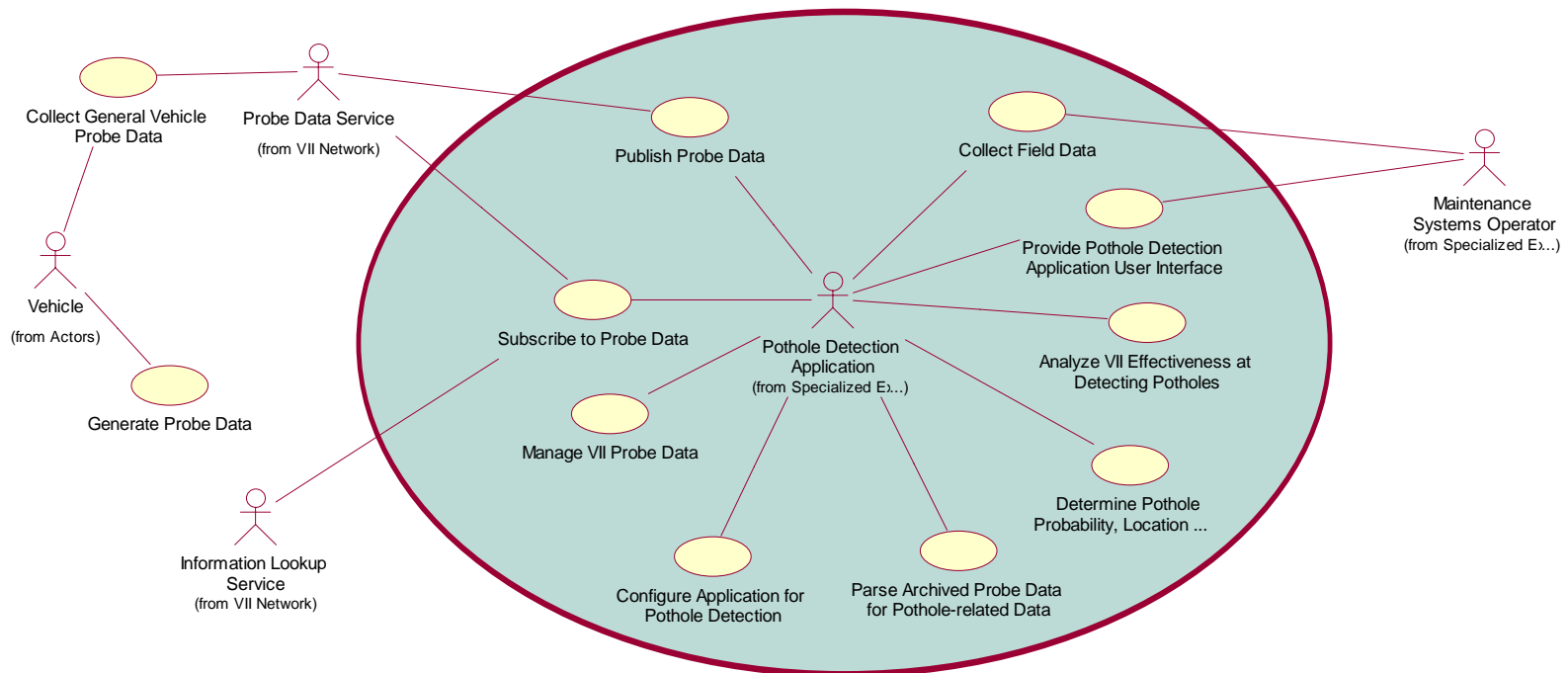
2.3 Requirements Relationship

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 Pothole Detection 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 Pothole Detection Application for POC.

Figure 3.1 – POC Pothole Detection Application Use Case Diagram



¹ This is the most recent version of the Pothole Detection 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 Pothole Detection application, as they better identify the role of the Maintenance Systems Operator than the officially published version.

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

Table 3.1 – Pothole Detection Application Actors

Actor	VII System Architecture Entities
Vehicle	Vehicles
Probe Data Service	VII System
Information Lookup Service	VII System
Pothole Detection Application	Network User External Entity
Maintenance Systems Operator	Network User External Entity

As shown in the above table, the Pothole Detection 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 Pothole Maintenance Application.

4 Assumptions and Constraints

4.1 Assumptions

Identifier	VII System Assumptions
VA-PD-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-PD-01.1	All probe data snapshots generated by the Vehicle will include latitude and longitude of the vehicle location.
VA-PD-01.2	All probe data snapshots generated by the Vehicle will include elevation of the vehicle location.
VA-PD-01.3	All probe data snapshots generated by the Vehicle will include time (hour, minute and seconds) that the snapshot was generated.
VA-PD-01.4	All probe data snapshots generated by the Vehicle will include date (year, month, day) that the snapshot was generated.
VA-PD-01.5	All probe data snapshots generated by the Vehicle will include vehicle heading.
VA-PD-01.6	All probe data snapshots generated by the Vehicle will include vehicle speed.
VA-PD-01.7	All probe data snapshots generated by the Vehicle will include the probe segment number.
VA-PD-01.8	All probe data snapshots generated by the Vehicle will include the vehicle's longitudinal acceleration.
VA-PD-01.8	All probe data snapshots generated by the Vehicle will include the vehicle's lateral acceleration.
VA-PD-01.9	All probe data snapshots generated by the Vehicle will include the vehicle's vertical acceleration.
VA-PD-01.10	All probe data snapshots generated by the Vehicle will include the wheel location where vertical acceleration has exceeded a configurable threshold.
VA-PD-01.11	The Vehicle's probe snapshot generation parameters will be configurable within the vehicle.
VA-PD-01.12	The Vehicle's vertical acceleration threshold will be configurable within the vehicle.
VA-PD-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-PD-02.1	The Vehicle's probe snapshot buffering parameters will be configurable within the vehicle.
VA-PD-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-PD-04	The Vehicle will log information related to probe data generation and Probe Data Service interactions.
VA-PD-04.1	The Vehicle will log all probe data snapshots generated within the previous 24-hour period.

Identifier	VII System Assumptions
VA-PD-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-PD-04.1.2	For each snapshot logged by the Vehicle, the time and type of buffer state changes will be recorded.
VA-PD-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-PD-04.1.4	Each snapshot logged by the Vehicle will be uniquely identifiable.
VA-PD-04.2	The Vehicle will log all of the locations and times at which the probe segment number changes.
VA-PD-04.3	The Vehicle will log the location and times at which the snapshot buffer overflows.
VA-PD-04.4	The Vehicle will log the times at which the vehicle location information is not available.
VA-PD-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-PD-04.6	The Vehicle will log probe messages provided to the Probe Data Service within the previous 24-hour period.
VA-PD-04.6.1	For each message logged, the Vehicle will record information necessary to identify the specific probe snapshots included in each message.
VA-PD-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-PD-04.6.3	For each message logged, the Vehicle will record information necessary to identify which RSE the message was transmitted to.
VA-PD-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-PD-05	The Probe Data Service will accept a subscription from the Pothole Detection 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-PD-06	The Probe Data Service will attempt to deliver all Probe Data Snapshots received from Vehicles to the Pothole Detection Application, if the snapshot parameters meet the Pothole Detection Application's probe data subscription profile.
VA-PD-07	The Information Lookup Service will respond to a request from the Pothole Detection Application with the information necessary for the Pothole Detection Application to subscribe to probe data within a specified geographic boundary.

Identifier	Non-VII External Entity Assumptions
XA-PD-01	The Maintenance System Operator will identify the location and severity of existing potholes within the geographic extent of the Pothole Detection Application.

4.2 Constraints

Identifier	Constraints
AC-PD-01	The geographic extent of the Pothole Detection Application is limited to the Detroit POC Development and Test Environment.
AC-PD-02	The Pothole Detection Application is constrained by the number of vehicles instrumented with accelerometers.

5 Functional Requirements

5.1 Subscribe to Probe Data

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

5.2 Publish Probe Data

Identifier	Functional Requirements
AF-PD-02	The Pothole Detection Application shall receive probe data snapshots from the Probe Data Service.

5.3 Manage VII Probe Data

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

5.4 Configure Application for Pothole Detection

Identifier	Functional Requirements
AF-PD-04	The Pothole Detection Application shall allow for changes in the configuration of pothole determination parameters by the Maintenance System Operator.

5.5 Parse Archived Probe Data for Pothole-Related Data

Identifier	Functional Requirements
AF-PD-05	The Pothole Detection Application shall parse stored probe data snapshots for pothole related data.
AF-PD-05.1	The Pothole Detection Application shall extract the stored probe data snapshots, which have a vertical acceleration exceeding a threshold value configurable by the Maintenance System Operator.
AF-PD-05.2	The Pothole Detection Application shall obtain the latitude, longitude, elevation, time (hour, minute and seconds), date (year, month, day), heading, speed, longitudinal acceleration, lateral acceleration, vertical acceleration, and wheel location where vertical acceleration has exceeded the threshold value, for each extracted probe data snapshot.

5.6 Determine Pothole Location, Severity, and Probability

Identifier	Functional Requirements
AF-PD-06	The Pothole Detection Application shall determine the location, severity and probability of a pothole.
AF-PD-06.1	The Pothole Detection Application shall determine the location of a pothole using longitude, latitude, and elevation.
AF-PD-06.2	The Pothole Detection Application shall determine the severity of a pothole using a range of values from one (1) being the least severe pothole to ten (10) being the most severe pothole.
AF-PD-06.3	The Pothole Detection Application shall determine the probability of a pothole using a range of values from one (1) being the least probable pothole to five (5) being the most probable pothole..
AF-PD-06.4	The Pothole Detection Application shall store determined potholes.
AF-PD-06.4.1	The Pothole Detection Application shall store the determined pothole location (latitude/longitude/elevation).
AF-PD-06.4.2	The Pothole Detection Application shall store the determined pothole severity.
AF-PD-06.4.3	The Pothole Detection Application shall store the determined pothole probability.
AF-PD-06.4.4	The Pothole Detection Application shall store the number of times a pothole has been detected at the same location.
AF-PD-06.4.5	The Pothole Detection Application shall store if the pothole has been confirmed or denied by the Maintenance Systems Operator.

5.7 Collect Field Data

Identifier	Functional Requirements
AF-PD-07	The Pothole Detection Application shall store pothole-related field data, including existence, location, and severity of potholes, collected by Maintenance Systems Operator.

5.8 Analyze VII Effectiveness at Detecting Potholes

Identifier	Functional Requirements
AF-PD-08	The Pothole Detection Application shall compare the location, severity and probability of potholes detected using probe data with field data collected by the Maintenance System Operator to determine the effectiveness of detecting potholes using probe data.
AF-PD-08.1	The Pothole Detection Application shall compare pothole locations determined from probe data with pothole locations in the field data collected by the Maintenance System Operator.
AF-PD-08.2	The Pothole Detection Application shall compare pothole severity determined from probe data with pothole severity in the field data

Identifier	Functional Requirements
	collected by the Maintenance System Operator.
AF-PD-08.3	The Pothole Detection Application shall compare pothole probability determined from probe data with the existence of potholes in the field data collected by the Maintenance System Operator.

5.9 Provide Pothole Detection Application User Interface

Identifier	Functional Requirements
AF-PD-09	The Pothole Detection Application shall provide a User Interface (UI) for the Maintenance System Operator to manage the Pothole Detection Application.
AF-PD-09.1	The Pothole Detection Application shall provide a User Interface (UI) for the Maintenance System Operator to manage the probe data subscription.
AF-PD-09.1.1	The Pothole Detection Application UI shall provide the Maintenance System Operator the ability to add and modify the probe data elements of the probe data subscription profile.
AF-PD-09.1.2	The Pothole Detection Application UI shall provide the Maintenance System Operator the ability to add and modify the geographic boundary of the probe data subscription profile.
AF-PD-09.1.3	The Pothole Detection Application UI shall provide the Maintenance System Operator the ability to add and modify the start and end times of the probe data subscription profile.
AF-PD-09.1.4	The Pothole Detection Application UI shall provide the Maintenance System Operator the ability to send a probe data subscription request.
AF-PD-09.1.5	The Pothole Detection Application UI shall provide the Maintenance System Operator the ability to cancel a probe data subscription request.
AF-PD-09.2	The Pothole Detection Application shall provide a UI for the Maintenance System Operator to manage probe data.
AF-PD-09.2.1.1	The Pothole Detection Application UI shall provide the Maintenance System Operator the ability to view, in a tabular form, probe data stored by the Pothole Detection Application.
AF-PD-09.2.1.2	The Pothole Detection Application UI shall provide the Maintenance System 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-PD-09.2.1.3	The Pothole Detection Application UI shall provide the Maintenance System 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-PD-09.2.1.4	The Pothole Detection Application UI shall provide the Maintenance System Operator the ability to view the most recently received probe data snapshots.
AF-PD-09.2.5	The Pothole Detection Application UI shall provide the

Identifier	Functional Requirements
	Maintenance System Operator the ability to view any probe data verification errors generated by the Pothole Detection Application.
AF-PD-09.3	The Pothole Detection Application shall provide a UI for the Maintenance Systems Operator to set parameters for the algorithms used to determine a pothole location, severity, and probability using probe data.
AF-PD-09.3.1	The Pothole Detection Application UI shall provide the Maintenance System Operator the ability to set the parameters for determining if a set of snapshots identify a single pothole.
AF-PD-09.3.2	The Pothole Detection Application UI shall provide the Maintenance System Operator the ability to set the vertical acceleration parameters which determine the severity and probability of a pothole.
AF-PD-09.3.3	The Pothole Detection Application UI shall provide the Maintenance System Operator the ability to confirm or deny the existence of a pothole detected from probe data.
AF-PD-09.4	The Pothole Detection Application UI shall provide the Maintenance Systems Operator with a list of potholes detected using probe data, with the most recent potholes first.
AF-PD-09.4.1	The Pothole Detection Application UI shall provide the Maintenance Systems Operator with the pothole location (latitude/longitude/elevation).
AF-PD-09.4.2	The Pothole Detection Application UI shall provide the Maintenance Systems Operator with the pothole severity.
AF-PD-09.4.3	The Pothole Detection Application UI shall provide the Maintenance Systems Operator with the pothole probability.
AF-PD-09.4.4	The Pothole Detection Application UI shall provide the Maintenance Systems Operator with the number of times a pothole has been detected at the same location.
AF-PD-09.5	The Pothole Detection Application UI shall provide the Maintenance Systems Operator with the ability to enter field data collected by the Maintenance Systems Operator.
AF-PD-09.5.1	The Pothole Detection Application UI shall provide the Maintenance Systems Operator with the ability to enter the field collected location (latitude/longitude/elevation) of a pothole.
AF-PD-09.5.2	The Pothole Detection Application UI shall provide the Maintenance Systems Operator with the ability to enter the field collected severity of a pothole.
AF-PD-09.6	The Pothole Detection Application UI shall provide the Maintenance Systems Operator with the ability to view probe data detected potholes along with field data collected potholes.
AF-PD-09.7	The Pothole Detection Application UI shall provide the Maintenance Systems Operator with the ability to delete a detected or field data collected pothole.
AF-PD-09.8	The Pothole Detection Application shall provide a UI for the Maintenance Systems Operator to create lookup requests to the Information Lookup Service about information on VII System managed entities (i.e. RSEs and Probe Data Service availability).

Identifier	Functional Requirements
AF-PD-09.9	The Pothole Detection Application shall provide a UI for the Maintenance Systems Operator to view information about VII System managed entities (i.e. RSEs and Probe Data Service availability).

6 Security Requirements

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

7 External Interface Requirements

Identifier	External Interface Requirements
AX-PD-01	The Pothole Detection 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-PD-02	The Pothole Detection 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 .

8 Performance Requirements

Identifier	Performance Requirements
	None

9 End-to-End Performance Expectations

Identifier	Performance Expectations
AN-PD-01	The Pothole Detection Application should determine a pothole's location to within 10 feet of the field data collected location.
AN-PD-02	The Pothole Detection Application should determine existence of ninety-nine percent (99%) of potholes over five (5) inches deep using probe data.
AN-PD-03	The Pothole Detection Application should determine existence of ninety-five percent (95%) of potholes one (1) to five (5) inches deep using probe data.
VN-PD-01	Latitude and Longitude included in Probe Data Snapshots should be accurate to determine a vehicle's horizontal position to within one (1) meter.
VN-PD-02	Elevation included in Probe Data Snapshots should be sufficiently accurate to determine a vehicle's vertical position within three (3) meters.
VN-PD-03	Time associated with Vehicle position included in Probe Data Snapshots should be accurate to within one (1) second.
VN-PD-04	Speed associated with a Vehicle position included in Probe Data Snapshots should be accurate to within two (2) kph.
VN-PD-05	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.

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