Connected Vehicle Pilot Deployment Program Phase 2

Operational Readiness Plan (ORP) – New York City

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Final Report - February 7, 2022

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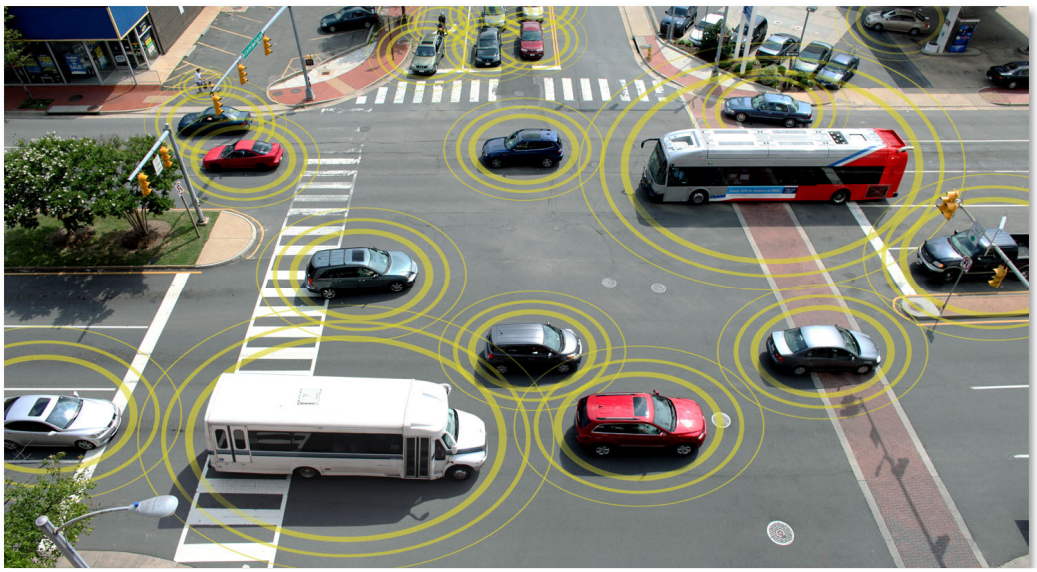

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Work performed for:

Program Manager: Kate Hartman
Agreement Officer (AO): Sarah Tarpgaard
Agreement Officer Representative (AOR): Jonathan Walker

16. Abstract

This document describes the Operational Readiness Plan (ORP) for the New York City (NYC) Connected Vehicle Pilot Deployment (CVPD) project. It consists of the Operational Readiness Test Plan (ORTP) and Operational Readiness Demonstration Plan (ORDP). The Operational Readiness Test Plan (ORTP) part of the ORP is to create clear documentation of the testing methods and processes used throughout Phase 2 of the NYC CVPD program. It is the first of the test design documents for Phase 2 implementation of connected vehicle technologies for light-duty vehicles, buses, and pedestrians. The Operational Readiness Demonstration Plan (ORDP) part of the ORP identifies the activities to demonstrate that the deployed connected vehicle (CV) system in NYC operates as designed in a safe and secure manner. This includes explanations of the objective, location, participants, equipment, and actions taken during demonstration of the key use cases in NYC CV pilot deployment environment. Each use case in the ORDP section ists the procedures and their sequence of events and describes the collected data before, during, and after the demonstration to support for observable validation criteria. Also, it outlines how the demonstration results will be summarized and documented for delivery to USDOT as part of Task 2H: Installation and Operational Readiness Testing.

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Finally, the team wants to thank the USDOT for sponsoring this project and laying the foundation for future connected vehicle deployments.

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Version History

Number	Date	Author	Summary of Changes
D1	01/04/2019	NYCDOT	Initial draft for USDOT review
D2	03/06/2019	NYCDOT	Draft 2 for USDOT review
D3	06/03/2019	NYCDOT	Draft 3 for Walkthrough
D4	08/20/2019	NYCDOT	D4 for ORD August 20-22, 2019
Ph2EditF1	12/31/2020	NYCDOT	Final Phase 2 Update
A2	4/15/2021	NYCDOT	Revised final phase 2 as-built update
A3	10/7/2021	NYCDOT	Final as-built update for 508 compliance

1. Operational Readiness Overview

1.1 Operational Readiness Plan Objectives

The Operational Readiness Plan (ORP) describes a series of tests and demonstrations used to evaluate and ensure the operational readiness of the system. The ORP consists of the Operational Readiness Test Plan (ORTP) and Operational Readiness Demonstration Plan (ORDP). The Operational Readiness Test Plan (ORTP) lays out the testing methods and processes used throughout Phase 2 of the NYC CVPD program. It is the first of the test design documents for Phase 2 implementation of CV technology for light-duty vehicles, buses, and pedestrians. The Operational Readiness Demonstration Plan (ORDP) part of the ORP identifies the activities to demonstrate that the deployed connected vehicle (CV) system in NYC operates as designed in a safe and secure manner. This includes explanations of the objective, location, participants, equipment, and actions taken during demonstration of the key use cases in NYC CV pilot deployment environment. Each use case in this ORDP lists the procedures and their sequence of events and describes the collected data before, during, and after the demonstration to support for observable validation criteria. Also, it outlines how the demonstration results will be summarized and documented for delivery to USDOT as part of Task 2H: Installation and Operational Readiness Testing.

1.2 Operational Readiness Plan Document Organization

In addition to the Overview (Section 1 of this document), the ORP document consists of the Operational Readiness Test Plan (ORTP) and the Operational Readiness Demonstration Plan (ORDP). Initially, these two sections were prepared and reviewed by USDOT as separate documents. Then, they were combined into a single ORP document upon review.

The ORP deliverables at the end of Phase 2 were the following:

- ORTP: test cases and procedures
- ORDP: test approach, strategy, and results from the Operational Readiness Demonstration (ORD) conducted in NYC on August, 2019.
- ORP: consolidation of the ORTP and ORDP

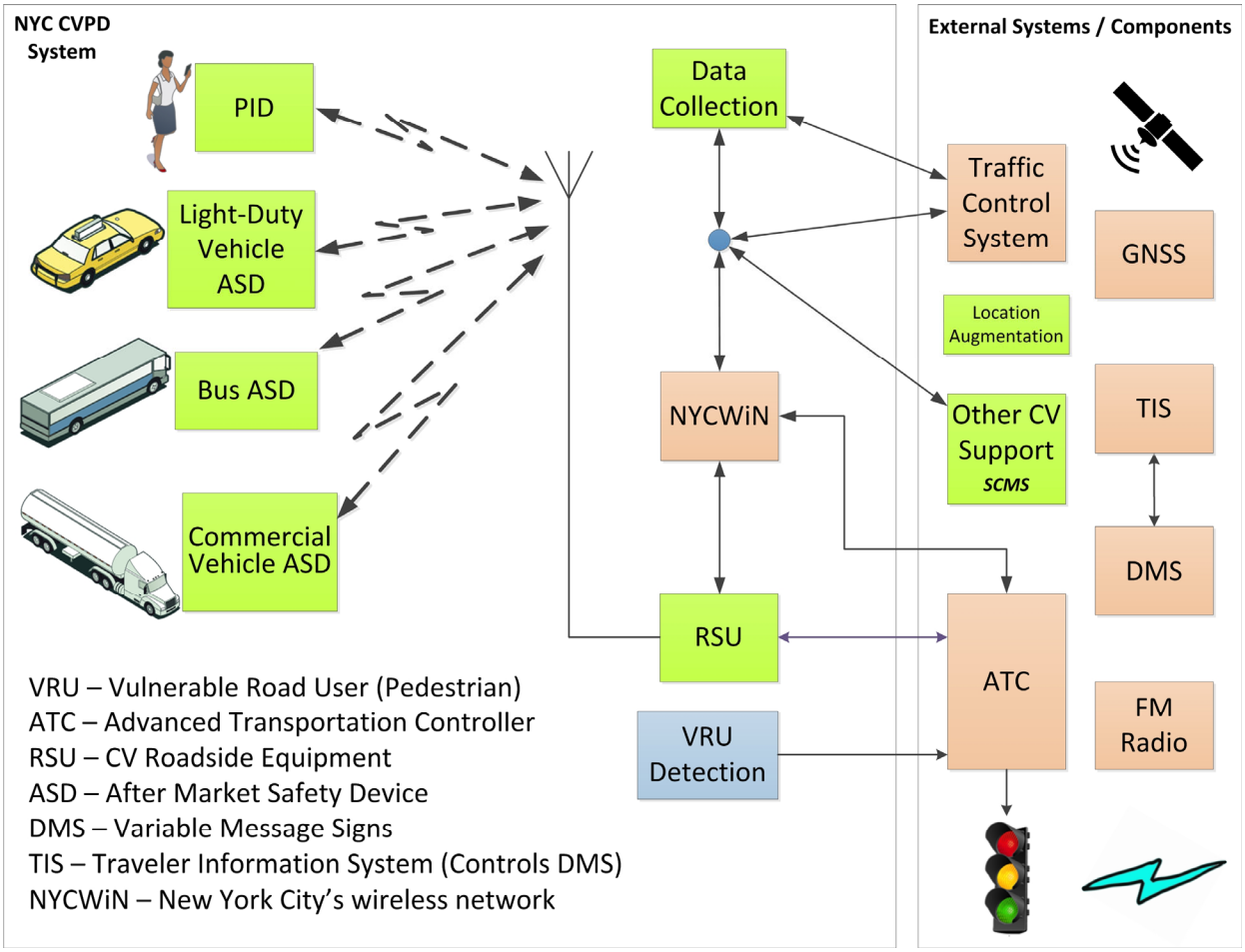
1.3 System Overview

This project brings New York City another step ahead towards reaching the Vision Zero goal of eliminating the injuries and fatalities due to traffic crashes. The project's concept is simple – it introduces CV technology and communications into the New York City travel environment by equipping several large vehicle fleets with the technology and equips several areas with the corresponding connected vehicle infrastructure.

It is important to understand the implications of the connected vehicle technology deployment in New York City. A total of 450 RSU locations in the New York City roadway network will have connected vehicle infrastructure installed. Vehicle-to-Infrastructure (V2I) applications such as Red Light Violation Warning, Speed Compliance, and Curve Speed Compliance will support connected vehicles operating in these areas. However, the geographic reach of the connected vehicle technology is much broader. Vehicles equipped with connected vehicle technology (i.e., aftermarket safety devices) will travel in this infrastructure equipped area *and throughout the City's transportation network*. Thus, the connected vehicle technology that supports Vehicle-to-Vehicle (V2V) applications will function anywhere two

equipped vehicles are within range of one another. Equipped vehicle encounters may occur on the surface streets, in the tunnels and bridges crossing the rivers, at the airports, and on the City's higher speed facilities such as the Franklin D. Roosevelt (FDR) Drive and the Long Island Expressway. The large fleet size means that there will be many opportunities for the connected vehicle technology to perform over a large geographic area and diverse roadway environments.

The envisioned NYC CVPD system is depicted in Figure 1. The existing system elements, critical to the operation of the pilot system, are illustrated with beige backgrounds. These existing elements include the traffic management system, the traffic controller (ASTC), and supporting NYC's Wireless Transportation Systems Network (TSN) communications infrastructure. New system elements which exist and will be reused, modified, or integrated into the NYC CVPD system have green backgrounds. Aftermarket safety devices (ASD), roadside units (RSU), personal information devices (PID), and data collection/processing systems comprise the new system elements. The Vulnerable Road User (VRU) detection devices to be added to the system are shown with a blue background as these devices are relatively new and will be deployed on a very limited basis.



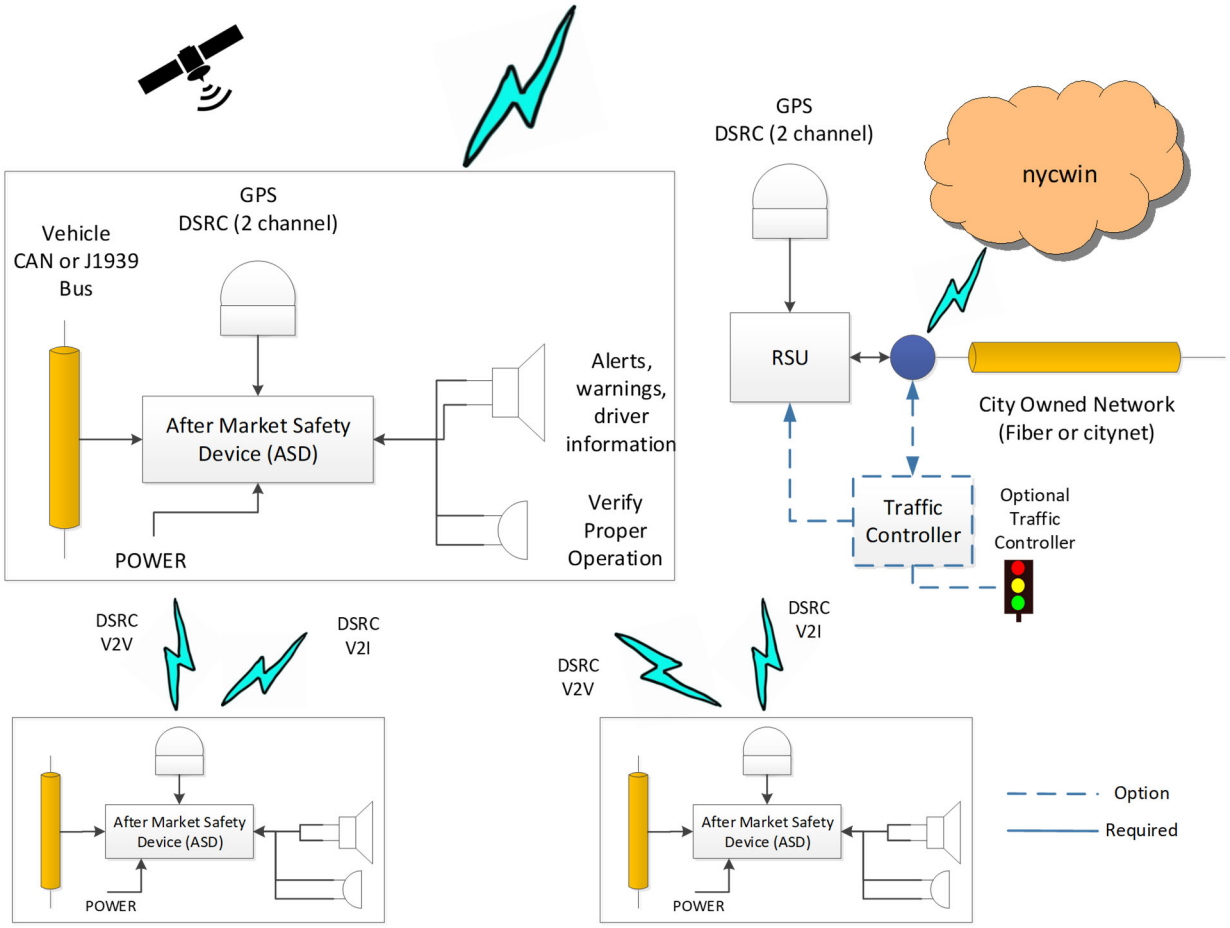
(Source: NYCDOT)

Figure 1 – NYC CVPD System Concept

NYC's initial system deployment is anticipated to be the largest CV technology deployment to date. It is anticipated that approximately 281 intersections in Manhattan and 28 intersections along Flatbush Avenue in Brooklyn will be instrumented with roadside units (RSU) to communicate with up to 3,000 vehicles equipped with aftermarket safety devices (ASD). These devices will monitor communications with other connected vehicles and the infrastructure and provide alerts to vehicle drivers/operators. Other

RSUs will be installed at locations to support system management functions such as providing security credentials, managing application and parameter configurations, and uploading logged information. These locations consist of fleet terminal facilities, airports, and river crossings (bridges and tunnels) where vehicles frequently travel.

The ASD is shown in Figure 2 below along with its interfaces to the driver, the Global Navigation Satellite System (GNSS), the vehicle data bus (CAN or J1939), and Dedicated Short Range Communications (DSRC) to other equipped vehicles and the infrastructure. This figure represents three ASD equipped vehicles in addition to DSRC enabled infrastructure.



(Source: NYCDOT)

Figure 2 – Vehicle Equipment Concept

2. Operational Readiness Test Plan

2.1 Introduction

2.1.1 Objectives

The purpose of this Operational Readiness Test Plan is to create clear documentation of the testing methods and processes that will be used throughout Phase 2 of the New York City (NYC) CV Pilot Deployment (CVPD) program. The Operational Readiness Test Plan was developed to the Institute of Electrical and Electronics Engineers (IEEE) Standard for Software Test Documentation, IEEE Std 829-1998, and will be modified as required throughout the project. This Operational Readiness Test Plan supports the following objectives:

1) Define the overall test approach.
2) Identify the required project items to be tested.
3) Identify the hardware, software, tools and environment to be used to support the testing efforts.
4) Define the types of tests to be performed.
5) Define the resources and constraints.
6) Define the roles and responsibilities of participants.
7) Communicate to all responsible parties the tasks that they are to perform and the schedule to be followed in performing the tasks.

2.1.2 Background

The NYC Connected Vehicle Pilot Deployment (NYC CVPD) program seeks to spur innovation among early adopters of connected vehicle application concepts, using best available and emerging technologies. The pilot deployments are expected to integrate connected vehicle research concepts into practical and effective elements, enhancing existing operational capabilities. The pilot deployments are also expected to support an impact assessment and evaluation effort that will inform a broader cost-benefit assessment of connected vehicle concepts and technologies. The NYC CVPD is implementing 19 applications:

- Six vehicle-to-vehicle applications
- Six vehicle-to-infrastructure applications
- One pedestrian application
- Six operations and maintenance applications

The primary objective of the NYC CVPD team is to improve the safety of travelers and pedestrians in New York City through the application of connected vehicle technologies. The NYC site provides an ideal opportunity to evaluate the CV technology and applications in tightly-spaced intersections typical in a dense urban transportation system.

The operational readiness testing will test each available component and application of the NYC CVPD, the communication links between them, the data collected and shared, and the operations and maintenance elements of the pilot deployment.

The following documents serve as references for this Operational Readiness Test Plan:

- Concept of Operations (ConOps)
- Project Management Plan (PMP)
- System Requirements Specification (SyRS)
- System Architecture Design (SAD)
- System Design Document (SDD)
- Comprehensive Installation Plan (CIP)
- ASD, RSU, PID and Ped Detection Procurement Specifications
- DSRC standards (IEEE 1609.2, 1609.3, and 1609.4; IEEE 802.11; and SAE J2735)

2.2 Approach

This section of the project Operational Readiness Test Plan provides a high-level definition of the types of tests that will be used to provide verification testing of project items. Additional details and refinements for each project item are detailed in the applicable Test Design Specifications for each project test item.

The test documentation will include requirements to test case traceability matrixes, which will be used to confirm that all the requirements are covered in the test cases. This activity will identify any coverage gaps, inconsistencies, or errors in the test documentation. Additionally, a logic consistency check of the test procedures will be performed. The outcome of these reviews may result in corrections or additional test cases and/or test steps being added to the test documentation.

Test design documents will be entered into the project configuration management system upon delivery. Subsequent changes to the test design documents will be tracked in the project configuration management system and presented to the configuration management board via a change request form.

2.2.1 Items to Be Tested

This test plan addresses the following NYC CVPD items to be tested:

1. Roadside unit (RSU)
2. Aftermarket safety device (ASD) and applications
3. TMC & Back Office Software
4. Pedestrian Device (PID)
5. Pedestrian Detection Device
6. ASTC Interface

System elements will be tested independently and at various stages of integration. As described in more detail in the following sections, back office/TMC software and vendor device prototypes will be tested independently prior to integration. Back office/TMC software, vendor devices, and the communications network will be tested in a small scale, controlled environment prior to test/tune activities in the field.

2.2.2 Constraints

Pre-prototype back office testing and vendor prototype component testing will be conducted as bench tests. These tests will not be conducted in an integrated or real-world environment. System integration testing and subsequent testing will be separated into groups of user applications: V2V, V2I, and pedestrian applications.

Drivers and pedestrians will be included for prototype and integration testing in open sky and urban canyon environments. The PID will only be tested with non-participants. Drivers who test will not participate in “silent period” testing; their devices will continue to operate.

The necessary level of vehicular and pedestrian traffic for effective testing is to be determined.

2.2.3 Pre-Prototype Back Office Testing

Initial testing of the back office/TMC software will occur during software application development. This internal testing will be conducted with simulated data prior to integration with vendor devices and users outside the TMC. The pre-prototype back office test will demonstrate that the software requirements addressed in the Software Design Document are met.

2.2.4 Vendor Prototype Component Testing

Standalone ASD and RSU testing will be conducted by the vendors and witnessed by the NYC team. Vendors will submit test procedures for review and approval by the project team. Conformance testing is a testing activity concerned with determining directly or indirectly that relevant conformance requirements of a standard/specification are fulfilled by a product, process, or service. ASD and RSU vendors will provide evidence of successfully passing underlying standards testing and environmental testing. These tests may be self-performed by the vendors or performed by labs certified by the Certification Operating Council. The test documentation for DSRC standards (IEEE 1609.2, 1609.3, 1609.4, IEEE 802.11; and SAE J2735) define the test activities necessary to evaluate conformance.

2.2.5 System/Integration Testing

The goal of system/integration testing is to assess the response of the CV applications when subjected to a range of conditions. The NYC CVPD system test cases will demonstrate that all elements of the requirements matrix have been met. Test cases will also demonstrate failure response, the user interface, and end-to-end operational use to validate expected results. The test cases will be specified in the Test Design Specification and Test Case Specification documents. The unique test procedures or test steps required will be developed and included in the Test Procedure Specification document. A test operator will interact with the applications using the procedures included in the Test Procedure Specification.

2.2.6 Regression Testing

Regression testing consists of selective retesting of the system or major components to verify that modifications made to remedy a specific discrepancy (or discrepancies) or the addition of new features have not caused unintended effects and that the system still complies with its specified requirements.

Prior to acceptance testing, the decision regarding which application areas undergo regression testing will be made by the NYC test team, based on the areas of the application that have been modified or enhanced. In the event that any tests fail during acceptance testing, FHWA will make the determination of what areas undergo regression testing. The NYC team may be asked to make a recommendation for FHWA consideration.

2.2.7 Operational Readiness Acceptance Testing

Readiness acceptance testing will be performed to determine if the CVPD satisfies the requirements and

must be passed for the client to determine to accept the system. Readiness acceptance testing will be performed by FHWA with the assistance of the test manager, the technical lead, and other staff as defined in Table 3 in Section 2.5. The acceptance test will be done after completion of the system/integration test process and the final shakedown period. Products will enter into acceptance test after all critical and major defects have been corrected. Prior to final completion of acceptance testing, all open critical and major defects MUST be corrected and verified by FHWA.

2.2.8 Features to be Tested

The features to be verified for this project are identified as requirements found in the specification documents for the NYC CVPD. Table 1 provides details on where these requirements are found.

2.2.9 Features to be Tested

The features to be verified for this project are identified as requirements found in the specification documents for the NYC CVPD. Table 1 provides details on where these requirements are found.

Table 1 – Project Features to be Tested

Project Test Item	Source for Features to be Tested
RSU	DSRC Roadside Unit (RSU) Procurement Specification Version 1.2b February 2017 New York City Department of Transportation
ASD	DSRC Aftermarket Safety Device (ASD) Procurement Specification Version 2.2 April 2017 New York City Department of Transportation
PID	Procurement Specification Version 1.7a March 3, 2017 New York City Department of Transportation Needs to Requirements Traceability Matrix in the Software Requirements Specification
TMC / Back Office	Needs to Requirements Traceability Matrix in the Software Requirements Specification
Pedestrian Detection	Procurement Specification Version X.X March 2017 New York City Department of Transportation
ASTC Interface	ASTC to RSU Testing Revision 2 November 30, 2018 Peek Traffic

In particular, the PID testing and deployment was changed from its initial scope. The original intent of the PID program was to use the localized SPaT and MAP broadcast over DSRC to provide assistance for visually-impaired pedestrians while navigating the crosswalks at CV intersections. When DSRC enabled smartphones were no longer available, per the vendor's suggestion the project scope was modified to use cellular communications (4G, LTE) to the smartphone instead of the DSRC media from the local

Roadside Unit (RSU).

The advanced solid-state traffic controllers (ASTC) were modified to transmit SPaT information to the Traffic Management Center (TMC) for processing in preparation for use by the PID applications. This data is transmitted to the TMC from the ASTC "on change", such as when the values in the SPaT message changed. At the TMC, the information is time corrected to use Coordinated Universal Time (UTC) rather than Line Frequency Time and sent to the Amazon Web Services (AWS) cloud along with the MAP message content which is stored at the TMC. Thus, the AWS cloud is provided with the same data as the RSU so that the application can process this information and provide it to the PID to support intersection navigation assistance for a visually-impaired pedestrian.

The MAP message contents were developed using the USDOT "tool", updated with the sidewalk descriptions and augmented with the use of the Cyclomedia high resolution database to improve the accuracy of the location information for the crosswalks and landing zones. It should also be noted that the MAP message used by the PIDs is not size constrained in the same manner as the MAP message transmitted by the RSU such that the TMC sends more detailed information to the AWS cloud than is transmitted by the RSU. The TMC exports the MAP and SPaT information to the AWS cloud where it is used by the PED application as described in their design specification.

In addition, the vendor developed a "Location Augmentation Device" for use by the visually-impaired pedestrian to improve the overall accuracy of the location information when coupled with the smartphone to support the vendor's pedestrian SmartCross application. The location accuracy of a smartphone in the urban environment is inadequate for such applications. The Location Augmentation Device (LAD) is coupled to the smartphone using Bluetooth and the SmartCross application uses both the smartphone location and compass coupled with the location information from the augmentation device to provide the assistance to the visually impaired pedestrian. However, from testing the PID with the LAD, the location accuracy proved to be challenging. Along with inadequate application performance, it was determined and recognized that the overall PID deployment number will be reduced from 100 to 10 prototypes. Furthermore, the PID program will be considered experimental and a pilot trial of the technology for the pedestrian application.

2.2.10 Features/Items Not to be Tested

1. Interoperability testing with other CVPD sites is not included in this test plan. Interoperability testing will be part of the Operational Showcase planning/testing
2. Installation tests are independent tests that are part of Comprehensive Installation Plan
3. SCMS: Interface to the SCMS will be tested as part of the RSU device test
4. Maintenance standard operating procedures

2.2.11 Item Pass/Fail Criteria

System performance to pass/fail criteria will be measured against expected results for each test case and related set of test procedures as traced to the requirements matrix. Each feature will pass or fail depending upon the results of the test procedure(s). If the actual output from a procedure is equal to the expected output specified by a test case, then the test case passes; if not, it fails. Should any test case associated with a feature fail, the entire feature or sub feature shall fail. The specific criteria for test case success or failure will be documented in each test case.

2.2.12 Suspension Criteria and Resumption Requirements

There are several situations that can cause suspension of testing, including the severity and type of

discrepancies encountered during testing. These situations can impact the testing engagement as well as other outside testing engagements that may rely upon the same testing resources.

The test may be suspended at the convenience of test personnel between the performances of any two test procedures. The test shall always resume at the start of a selected test procedure.
If any modifications are made to the CVPD, a regression test may be required in order to pass this test plan. During system/integration testing, the decision to regression test will be made by the CVPD team. During acceptance testing, the decision to require regression testing will be made by FHWA after receiving a recommendation from the CVPD team.

2.2.13 Environmental Needs

The elements listed in Table 2 are required to support the overall testing effort at all levels within the NYC CVP project.

Table 2 – Hardware, Software, and Other Equipment Required

No.	Item
1	ASD – configurable for heavy vehicle, light vehicle, transit vehicle
2	Advance solid-state traffic controller (ASTC) configuration – data sharing, signal phasing and timing (SPaT), operation, pedestrian detection[1]
3	RSU (intersection configuration, including SPaT/MAP) with NYC's Wireless Transportation Systems Network (TSN) modem, router, and switch with network routing to SCMS and TMC
4	RSU (support configuration, including over the air (OTA) firmware/configuration download and data upload)
5	Personal information device (PID) unit (receive SPaT and MAP messages through Amazon web services (AWS) Cloud)
6	PID back office (New York University (NYU) data repository, firmware download from Savari)
7	AWS cloud for forwarding SPaT and MAP messages received from the Transportation Management Center (TMC)
8	TMC back office system (BOS) computer for performance data evaluation and scrubbing/sanitization of PII
9	TMC CV application server
10	TMC performance monitoring server for final post-processing and obfuscation
11	USDOT Secure Data Common (SDC) system interface
12	Hardware security module (HSM) in the TMC for signing and authenticating the MAP and traveler information message (TIM) messages in the TMC
13	HSM installed in the ASD for signing the basic safety message (BSM), in the RSU for signing the SPaT messages, and in both ASD and RSU for storing the certificates generated by ISS CMS
14	ISS CMS (commercially available security credential management system (SCMS) system from Green Hills ISS); version TBD
15	Ability to get updated certs from SCMS
16	ASTC with CV firmware for providing pedestrian detection inputs through SPaT data
17	Radio frequency (RF) testing device(s) - Anritsu
18	ASN.1 compiler

[1] The City is installing pedestrian detection video equipment to detect the presence of pedestrians within the crosswalk. This data is included in the SPaT message, and an I2V safety application provides a warning when the vehicle poses a immediate threat to the pedestrian. A toggle switch will be used to simulate a pedestrian presence during all testing.

No.	Item
19	Wireshark for network traffic analysis
20	Display connected to TMC/BOS
21	Display connected to other components (SDC, NYU, fleet owners)
22	Secure method (e.g., USB thumb-drive 4GB or higher) to transfer collected logs and configuration files
23	Support computers for reference, logging of actions, and observed results
24	Printer
25	XML validation parser
26	TMC location of in-office testing (tentative)
27	Open sky testing location (TBD)
28	Decryption tool for use with ASD encrypted logs
29	ASTC configuration for data sharing, SPaT, operations
30	Two tables set up to provide workspace surface space for test items, reference computers, books, and projectors
31	Chairs for up to six participants
32	Sniffer and/or CalmCar for location accuracy

2.3 Operational Readiness Test Deliverables

The following items will be developed, entered into the configuration management system, and provided as deliverables:

- Test Plan
- Test Design Specifications
- Test Case Specifications
- Test Procedure Specifications
- Test Data
- Test Anomaly Reports
- Test Anomaly Resolution Reports
- Test Summary Reports

2.4 Responsibilities

Table 3 below defines the roles and responsibilities in this test plan.

Table 3 – Roles and Responsibilities

Name	Responsibility
Mohamad Talas	NYC Team Project Management Lead: Obtain client approval of test documents, provide test environment
Test Team	Develop test design specifications, test case specifications, test procedure specifications; review vendor test procedures; internal testing; prepare internal testing anomaly reports
Bob Rausch	Site Deployment Lead
Rami Khashashina	Team safety manager, test witness
David Benevelli	Systems engineering lead: Test manager: lead/direct

	testing operation
Samuel Sim, Letecia Tomusiak	Test operator: carries out test procedure steps
Betsy Williams	Test analyst, record test step results, prepare test reports
Keith Patton	Configuration management: Prepare testing anomaly reports, document configuration management
Hisham Khanzada	Client representative/team: Review and approve test documentation, test witness, confirm requirements tested and met
Development Team (vendor and NYC Team)	Develop Pilot Deployment components to be tested; test environment requirements, respond to testing anomaly reports
CM Board	Configuration management (covered under CIP)
Ivan Nunez Wesam Daraghmeh	Vehicle installation testing (covered under CIP)

2.5 Staffing and Training Needs

Staff needs for NYC CVPD testing are identified in the Roles and Responsibilities table in the previous chapter. The staff participating in live operational readiness testing include the following:

- Team Project Management Lead
- Test Manager
- Test Operator(s)
- Test Analyst
- Project Team Witness(es)
- Client Representative(s)

Test operators must be familiar with the component of the NYC CVPD being tested for which they are responsible (e.g., RSU, ASD, TMC/BOS). An individual test operator is not expected to be familiar with the details all pilot deployment components.

One or more project team staff members trained to use Anritsu radio frequency (RF) tools will participate in testing. This staff member will have access to equipment, support tools, and best practice techniques for troubleshooting RF communication issues during testing.

Test vehicle drivers will be trained using the driver training video produced under the project and will participate in test dry runs prior to actual testing.

2.6 Risks and Contingencies

Table 4 below identifies the high-level assumptions, in the verification phase, that may lead to project delays and added costs if not addressed.

Table 4 – Risks and Contingencies

No	Risk	Contingency
1.	RSU procurement delayed	Test data-centric functions (BOS/ASD) using sample data
2.	ASD procurement delayed	Test data-centric functions (BOS/RSU) using sample data
3.	RSU certification requirements	Test data-centric functions (BOS/ASD) using

	delayed	sample data
4.	ASD certification requirements delayed	Test data-centric functions (BOS/RSU) using sample data
5.	Primary test location not available (e.g., Aqueduct parking lot)	Identify primary and alternative test locations
6.	Pilot deployment component does not operate correctly	Spot check test equipment that will be used for acceptance testing at least a week prior to the scheduled start of testing.

2.7 Test Procedures

2.7.1 RSU-Monitor: Configure Alarms in the System

Requirements: Not specified.
Precondition: The user is already logged into the Web UI.

Table 5 – RSU-Monitor: Configure Alarms in the System

No	Test Step	Expected Result	Test Results
1.	Click on **Connected Vehicle System -> Alarm Configuration** from the left panel	Configure Alarms page loads	
2.	Check the **Alarm Enabled** box next to an alarm	Input accepted	
3.	Click on **Connected Vehicle System -> Devices** from the left panel	Device List page loads	
4.	Click on **Connected Vehicle System -> Alarm Configuration**	Alarms page loads	
5.	Click the **Show Enabled Messages** radio button	List shows all alarms enabled in the system The alarm just enabled is NOT shown in the list	
6.	Check the **Alarm Enabled** box next to a few alarms. Record these alarms	Inputs accepted	
7.	Click **Save Alarms**	Save operation successful	
8.	Click the **Show Enabled Messages** radio button	List shows all alarms enabled in the system The alarms just enabled are shown in the list	
9.	Click the **Show All Messages** radio button	List shows all alarm configured in the system	
10.	Click on **Connected Vehicle System -> Devices** from the left panel	Device List page loads	
11.	Click on **Connected Vehicle System -> Alarm Configuration**	Alarms page loads	
12.	Click the **Show Enabled Messages** radio button	List shows all alarms enabled in the system The alarms just enabled are still shown in the list	

2.7.2 RSU-Monitor: Sort and Search Data on the Configure Alarms page

Requirements: Not specified.
Precondition: The user is already logged into the Web UI.

Table 6 – RSU-Monitor: Sort and Search Data on the Configure Alarms page

No	Test Step	Expected Result	Test Results
1.	Click on **Connected Vehicle System -> Alarm Configuration** from the left panel	Configure Alarms page loads	
2.	Run **TWC-1660 (steps below)**	Test case passes	
3.	**TWC-1660 Test Step:** If applicable: Click once on a column cell.	The items are sorted in ascending/descending alphabetical order regardless of capitalization.	
4.	If applicable: Click again on the same cell.	The items are sorted in reverse order.	
5.	Click again on the same cell. **Repeat steps 1 through 2** for each remaining column.	All the test steps passed.	
6.	If applicable: Select the number of rows to show per page.	Verify that the correct number of rows are shown per page	
7.	Select on a few of the pages shown in the result.	Data is shown on each of the selected pages.	
8.	If applicable: Select the number of rows to show per page.	Verify that the correct number of rows are shown per page	
9.	Select on a few of the pages shown in the result.	Data is shown on each of the selected pages.	
10.	If applicable: Select the number of rows to show per page. Use the scrollbar as needed.	Verify that the correct number of rows are shown per page	
11.	Select on a few of the pages shown in the result.	Data is shown on each of the selected pages.	
12.	Select the number of rows to show per page. Use the scrollbar as needed.	Verify that the correct number of rows are shown per page	
13.	Click on a few of the pages shown in the result.	Data is shown on each of the selected pages.	
14.	If applicable: Enter a valid value in the search input box on the page.	The result returns data having the search value cross any of the columns. For example: If the user enters a search value = 2, then the result will return rows of data where any column had the value 2 in it.	
15.	If applicable: Enter the value for an invalid value in the search input box on the page.	The result returns no matching	
16.	If applicable: Enter no value in the search	The result returns the default list of entries	

	input box on the page.		

2.7.3 RSU-Monitor: Hide Columns on the Configure Alarms Page

Requirements: Not specified.
Precondition: The user is already logged into the Web UI.

Table 7 – RSU-Monitor: Hide Columns on the Configure Alarms Page

No	Test Step	Expected Result	Test Results
1.	Click on **Connected Vehicle System -> Alarm Configuration** from the left panel	Configure Alarms page loads	
2.	Run TWC-1659 (steps below)	Test case passes	
3.	**TWC-1659 Test Step:** Click on the icon with flyover text Columns on the right section of the page.	The column drop down list is shown with the details.	
4.	Un-check a column from the column view list.	No data is shown for hidden column.	
5.	Check the same column from the column view list.	Data is now shown for column.	
6.	**Repeat steps 2 through 3** for each remaining column.	All the test steps passed.	
7.	Attempt to un-check all the boxes at the same time. Record the page on which the boxes are unchecked	Verify that at least one box is grayed out. At least one column must be checked.	
8.	Restart the TransSuite Web UI Log back into the application	Logon successful	
9.	Click on the page related to the columns that were unchecked (recorded at step 5) Click on the icon with flyover text **Columns** on the right section of the page.	System still shows the same columns unchecked	
10.	Check all the columns again on the same page	Data is shown for all columns.	

2.7.4 RSU-Monitor: Perform Multi-Sorting on the Configure Alarms Page

Requirements: Not specified.
Precondition: The user is already logged into the Web UI.

Table 8 – RSU-Monitor: Perform Multi-Sorting on the Configure Alarms Page

No	Test Step	Expected Result	Test Results
1.	Click on Connected Vehicle System -> Alarm Configuration from the left panel	Configure Alarms page loads	
2.	Run **TWC-1662 (steps below)**	Test case passes	
3.	**TWC-1662 Test Step:** Click on the icon to the left corner of the window view with the flyover text Multiple Sort.	The Multiple Sort window opens.	
4.	Click the CANCEL button.	The Multiple Sort window closes.	
5.	Click on the icon to the left corner of the window view with the flyover text Multiple Sort.	The Multiple Sort window opens.	
6.	Select a sort by column.	The value is stored.	
7.	Select sort order.	The value is stored.	
8.	Click the SORT button.	The devices shown in the table view are sorted correctly.	
9.	Click on the icon to the left corner of the window view with the flyover text Multiple Sort.	The Multiple Sort window opens.	
10.	Select a sort by column.	The value is stored.	
11.	Select sort order.	The value is stored.	
12.	Click the ADD LEVEL button.	A new then by row is added.	
13.	Select a then by column.	The value is stored.	
14.	Select sort order.	The value is stored.	
15.	Click the SORT button.	The devices shown in the table view are sorted correctly. For example: If SORT BY = Timing Status = Ascending THEN BY = ID = Ascending The result should show all devices sorted by the "Timing Status" column. Then for each Timing Status group, the system will then sort by ID. For example: If the first sort shows "Timing Status" sorted in ascending order = Comm Failed, Coordinated and then Offline, the system will first sort the "Comm Failed" column group by the "Id" column, then sort the "Coordinated" column by the "Id" column and so on.	
16.	Click on the icon to the left corner of the window view with the flyover text " Multiple Sort".	The Multiple Sort window opens.	
17.	Click the DELETE LEVEL button next to each row.	At least one sort by row must be left in the system.	
18.	Click the SORT button.	The devices shown in the table view are sorted correctly by one remaining "Sort	

		by" column	

2.7.5 RSU-Monitor: Launch Online Help on the Configure Alarms Page

Requirements: Not specified.
Precondition: The user is already logged into the Web UI.

Table 9 – RSU-Monitor: Launch Online Help on the Configure Alarms Page

No	Test Step	Expected Result	Test Results
1.	Click on Connected Vehicle System -> Alarm Configuration from the left panel	Configure Alarms page loads	
2.	Run **TWC-1658 (steps below)**	Test case passes	
3.	**TWC-1658 Test Step:** Click on the icon to the left corner of the window view with the flyover text Multiple Sort.	The Multiple Sort window opens.	
4.	Click the CANCEL button.	The Multiple Sort window closes.	
5.	Click on the icon to the left corner of the window view with the flyover text Multiple Sort.	The Multiple Sort window opens.	
6.	Select a sort by column.	The value is stored.	
7.	Select sort order.	The value is stored.	
8.	Click the SORT button.	The devices shown in the table view are sorted correctly.	
9.	Click on the icon to the left corner of the window view with the flyover text Multiple Sort.	The Multiple Sort window opens.	
10.	Select a sort by column.	The value is stored.	
11.	Select sort order.	The value is stored.	
12.	Click the ADD LEVEL button.	A new then by row is added.	
13.	Select a then by column.	The value is stored.	
14.	Select sort order.	The value is stored.	
15.	Click the SORT button.	The devices shown in the table view are sorted correctly. For example: If SORT BY = Timing Status = Ascending THEN BY = ID = Ascending The result should show all devices sorted by the "Timing Status" column. Then for each Timing Status group, the system will then sort by ID. For example:	

		If the first sort shows "Timing Status" sorted in ascending order = Comm Failed, Coordinated and then Offline, the system will first sort the "Comm Failed" column group by the "Id" column, then sort the "Coordinated" column by the "Id" column and so on.	
16.	Click on the icon to the left corner of the window view with the flyover text " Multiple Sort".	The Multiple Sort window opens.	
17.	Click the DELETE LEVEL button next to each row.	At least one sort by row must be left in the system.	
18.	Click the SORT button.	The devices shown in the table view are sorted correctly by one remaining "Sort by" column	

2.7.6 RSU-Monitor: Verify Window View Sizing on the Configure Alarms Page

Requirements: Not specified.
Precondition: The user is already logged into the Web UI.

Table 10 – RSU-Monitor: Verify Window View Sizing on the Configure Alarms Page

No	Test Step	Expected Result	Test Results
1.	Click on Connected Vehicle System -> Alarm Configuration from the left panel	Configure Alarms page loads	
2.	Run **TWC-3378 (steps below)**	Test case passes	
3.	**TWC-3378 Test Step:** Click on the - button	Window view is minimized	
4.	Click on the + button	Window view is maximized	
5.	Click on the X button	Window view is closed	
6.			
7.			
8.			

2.7.7 RSU-Monitor: Verify That Messages Are Logged When Starting and Stopping the RSU Monitoring Service

Requirements: Not specified.
Precondition:

1. The user is already logged into the Web UI
2. The Alarm System is connected to the RSU Monitor Process
3. The following alarms are enabled on the Connected Vehicle System -> Alarm Configuration page: 14401,14402,14403,14404,14405,14407,14408,14409,14410

Table 11 – RSU-Monitor: Verify That Messages Are Logged When Starting and Stopping the RSU

Monitoring Service

No	Test Step	Expected Result	Test Results
1.	Open Windows Services window Click on the **RSU Monitoring Service** and then click on **Stop**	Status of RSU Monitoring Service should not show "Running"	
2.	Move back to the web UI Click on **System Log Viewer** from the left panel	System Log Viewer opens without errors	
3.	Select a **Source** Click **SIMPLE QUERY**	A message with ID 14409 similar to this is logged: "<TEMP>Connected Vehicle RSU Monitor Process has a STOP command from the Windows Service Manager</TEMP>",NULL,"RSU Monitor has received a Stop from the Windows Service Manager",2	
4.	Check if the **Connected Vehicle System -> Devices** from the left panel is shown	Verify that if the Connected Vehicle System is shown then no status is shown for the RSU devices	
5.	Open the WPF Map and activate the RSU Map layer	Verify that no status details are shown for RSU devices on the map	
6.	Move back to the Windows Services window Click on the **RSU Monitoring Service** and then click on **Start**	Status of RSU Monitoring Service should show "Running"	
7.	Move back to the System Log Viewer Click **SIMPLE QUERY**	A message with ID 14401 similar to this is logged: "<TEMP>Connected Vehicle RSU Monitor Process started</TEMP>",NULL,"The RSU Monitor process started",2 A message with ID 14402 similar to this is logged: Connected Vehicle RSU Monitor Process has connected to </FUNC></TEMP>",NULL,"The RSU Monitor Process has a connection to the specified function (DB, System Log, RSU Communications, etc)",	
8.	Click **SIMPLE QUERY** button again	A message with ID 14408 similar to this is logged: "<TEMP>Connected Vehicle RSU Monitor Process has completed startup and is ready to receive	

		data</TEMP>",NULL,"RSU Monitor is ready to receive data",2 A message with ID 14404 similar to this is logged: <TEMP>Connected Vehicle RSU Monitor Process received <MSGCNT/> from <RSUNAME/> in last 60 minutes</TEMP>","MSGCNT:integer, RSUNAME:string","Gives a count of messages",2 A message with ID 14405 similar to this is logged: <TEMP>Connected Vehicle RSU Monitor Process retrieved <RSUCNT/> RSUs from database.</TEMP>",NULL,"Logs the number of RSUs received from the database",2	
9.	From the web UI: Select **Connected Vehicle System -> Devices** from the left panel	Verify that the system provides real-time status values for all RSU devices at a rate of 5 seconds Verify that the system provides a detailed status for an RSU within 2 seconds of the request	
10.	Move back to the WPF Map that has the RSU Map layer activated	Verify that the system provides real-time status values for all RSU devices at a rate of 5 seconds Verify that the system provides a detailed status for an RSU within 2 seconds of the request	
11.	Move back to the Web UI: Click on **Alarms ->Alarms List** Check which active alarm was when the RSU Monitor Process was stopped	An alert with alarm code 14409 similar to this is logged: "<TEMP>Connected Vehicle RSU Monitor Process has a STOP command from the Windows Service Manager</TEMP>",NULL,"RSU Monitor has received a Stop from the Windows Service Manager"	
12.	Check which active alarms were created when the RSU Monitor Process was started	An alert with alarm code 14401 similar to this is logged: "<TEMP>Connected Vehicle RSU Monitor Process started</TEMP>",NULL,"The RSU Monitor process started" An alert with alarm code 14402 similar to this is logged: Connected Vehicle RSU Monitor Process has connected to </FUNC></TEMP>",NULL,"The RSU	

		Monitor Process has a connection to the specified function (DB, System Log, RSU Communications, etc)",	
13.	Check which active alarm was created when the RSU Monitor Process completed startup	An alert with alarm code 14408 similar to this is logged: "<TEMP>Connected Vehicle RSU Monitor Process has completed startup and is ready to receive data</TEMP>",NULL,"RSU Monitor is ready to receive data"	
14.	Check which active alarm was created when the RSU Monitor Process received updates	An alert with alarm code 14404 similar to this is logged: <TEMP>Connected Vehicle RSU Monitor Process received <MSGCNT/> from <RSUNAME/> in last 60 minutes</TEMP>","MSGCNT:integer, RSUNAME:string","Gives a count of messages"	
15.	Check which active alarm was created when the RSU Monitor Process retrieved RSU inventory data from the database	An alert with alarm code 14405 similar to this is logged: <TEMP>Connected Vehicle RSU Monitor Process retrieved <RSUCNT/> RSUs from database.</TEMP>",NULL,"Logs the number of RSUs received from the database"	

2.7.8 RSU-Monitor: Verify That a Message is Logged When the RSU Fails a Connection Attempt

Requirements: Not specified.
Precondition:

1. The user is already logged into the Web UI
2. The Alarm System is connected to the RSU Monitor Process
3. The following alarms are enabled on the Connected Vehicle System -> Alarm Configuration page: 14401,14402,14403,14404,14405,14407,14408,14409,14410

Table 12 – RSU- Monitor: Verify That a Message is Logged When the RSU Fails a Connection Attempt

No	Test Step	Expected Result	Test Results
1.	Trigger a failure connection by the RSU Monitoring Service	Trigger action sent	
2.	Wait at least 1 minute	Verify that the RSU Monitor Process waits 10 seconds before another connection attempt Verify that a message is logged for each set of 10 consecutive connection attempts	
3.	Move back to the web UI Click on **System Log Viewer** from the left panel	System Log Viewer opens without errors	
4.	Select a **Source** Click **SIMPLE QUERY**	A message with ID 14410 similar to this is logged:	

		"<TEMP>Connected Vehicle RSU Monitor Process has failed to connect to <FUNC/> for 10 attempts</TEMP>",NULL,"The Process is attempting to connect but is unable to get a connection" Verify that the system logs a message after each set of 10 consecutive connection attempts has failed.	
5.	Check if the **Connected Vehicle System -> Devices** from the left panel is shown	Verify that if the Connected Vehicle System is shown then no status is shown for the RSU devices	
6.	Open the WPF Map and activate the RSU Map layer	Verify that no status details are shown for RSU devices on the map	
7.	Re-establish connection to the RSU Monitoring service	Connection is established	
8.	Open Windows Services window Check the status of the **RSU Monitoring Service**	Status of RSU Monitoring Service should show "Running"	
9.	Move back to the System Log Viewer Click **SIMPLE QUERY**	A message with ID 14401 similar to this is logged: "<TEMP>Connected Vehicle RSU Monitor Process started</TEMP>",NULL,"The RSU Monitor process started" A message with ID 14402 similar to this is logged: Connected Vehicle RSU Monitor Process has connected to </FUNC></TEMP>",NULL,"The RSU Monitor Process has a connection to the specified function (DB, System Log, RSU Communications, etc)",	
10.	Click **SIMPLE QUERY** button again	A message with ID 14408 similar to this is logged: "<TEMP>Connected Vehicle RSU Monitor Process has completed startup and is ready to receive data</TEMP>",NULL,"RSU Monitor is ready to receive data",2 A message with ID 14404 similar to this is logged: <TEMP>Connected Vehicle RSU Monitor Process received <MSGCNT/> from <RSUNAME/> in last 60 minutes</TEMP>","MSGCNT:integer, RSUNAME:string","Gives a count of messages",2 A message with ID 14405 similar to this is logged: <TEMP>Connected Vehicle RSU Monitor Process retrieved <RSUCNT/> RSUs from database.</TEMP>",NULL,"Logs the number of RSUs received from the database",2	

11.	From the web UI: Click on **Connected Vehicle System -> Devices** from the left panel	Verify that the system provides real-time status values for all RSU devices at a rate of 5 seconds Verify that the system provides a detailed status for an RSU within 2 seconds of the request.	
12.	Move back to the WPF Map that has the RSU Map layer activated	Verify that the system provides real-time status values for all RSU devices at a rate of 5 seconds Verify that the system provides a detailed status for an RSU within 2 seconds of the request.	
13.	Move back to the Web UI: Click on **Alarms ->Alarms List** Check which active alarm was when the RSU Monitor Process fails a connection attempt	An alert with alarm code 14410 similar to this is logged: "<TEMP>Connected Vehicle RSU Monitor Process has failed to connect to <FUNC/> for 10 attempts</TEMP>",NULL,"The Process is attempting to connect but is unable to get a connection" Verify that the system creates an alert message after each set of 10 consecutive connection attempts has failed.	

2.7.9 RSU-Monitor: Verify That a Message is Logged When the RSU Loses Connection to the Database

Requirements: Not specified.
Precondition:

1. The user is already logged into the Web UI
2. The Alarm System is connected to the RSU Monitor Process
3. The following alarms are enabled on the Connected Vehicle System -> Alarm Configuration page: 14401,14402,14403,14404,14405,14407,14408,14409,14410

Table 13 – RSU-Monitor: Verify That a Message is Logged When the RSU Loses Connection to the Database

No	Test Step	Expected Result	Test Results
1.	Stop the database service that is communicating to the RSU Monitoring Service	Database service is not running	
2.	Move back to the web UI Click on **System Log Viewer** from the left panel	System Log Viewer opens without errors	
3.	Select a **Source** Click **SIMPLE QUERY**	A message with ID 14403 similar to this is logged: "<TEMP>Connected Vehicle RSU Monitor Process has lost connection with </FUNC></TEMP>",NULL,"The RSU Monitor Process has lost the connection to the specified function (DB, System Log, RSU Communications, etc)",2	
4.	Check if **Connected Vehicle**	Verify that if the Connected Vehicle	

	System -> Devices from the left panel is shown	System is shown then no status is shown for the RSU devices	
5.	Open the WPF Map and activate the RSU Map layer	Verify that no RSU devices are shown on the map	
6.	Re-establish connection to the RSU Monitoring service	Connection is established	
7.	Open Windows Services window Check the status of the **RSU Monitoring Service**	Status of RSU Monitoring Service should show "Running"	
8.	Move back to the System Log Viewer Click **SIMPLE QUERY**	A message with ID 14401 similar to this is logged: "<TEMP>Connected Vehicle RSU Monitor Process started</TEMP>",NULL,"The RSU Monitor process started",2 A message with ID 14402 similar to this is logged: Connected Vehicle RSU Monitor Process has connected to </FUNC></TEMP>",NULL,"The RSU Monitor Process has a connection to the specified function (DB, System Log, RSU Communications, etc)",	
9.	Click **SIMPLE QUERY** button again	A message with ID 14408 similar to this is logged: "<TEMP>Connected Vehicle RSU Monitor Process has completed startup and is ready to receive data</TEMP>",NULL,"RSU Monitor is ready to receive data",2 A message with ID 14404 similar to this is logged: <TEMP>Connected Vehicle RSU Monitor Process received <MSGCNT/> from <RSUNAME/> in last 60 minutes</TEMP>","MSGCNT:integer, RSUNAME:string","Gives a count of messages",2 A message with ID 14405 similar to this is logged: <TEMP>Connected Vehicle RSU Monitor Process retrieved <RSUCNT/> RSUs from database.</TEMP>",NULL,"Logs the number of RSUs received from the database",2	
10.	From the web UI: Click on **Connected Vehicle System -> Devices** from the left panel	Verify that the system provides real-time status values for all RSU devices at a rate of 5 seconds Verify that the system provides a detailed status for an RSU within 2 seconds of the request.	

11.	Move back to the WPF Map that has the RSU Map layer activated	Verify that the system provides real-time status values for all RSU devices at a rate of 5 seconds Verify that the system provides a detailed status for an RSU within 2 seconds of the request.	
12.	Move back to the Web UI: Click on **Alarms ->Alarms List** Check which active alarm was when the RSU Monitor Process loses connection to the database	An alert with alarm code 14403 similar to this is logged: "<TEMP>Connected Vehicle RSU Monitor Process has lost connection with </FUNC></TEMP>",NULL,"The RSU Monitor Process has lost the connection to the specified function (DB, System Log, RSU Communications, etc)"	

2.7.10 RSU-Monitor: Verify that a message is logged when the RSU loses Connection to the System Log Viewer

Requirements: Not specified.
Precondition:

1. The user is already logged into the Web UI
2. The Alarm System is connected to the RSU Monitor Process
3. The following alarms are enabled on the Connected Vehicle System -> Alarm Configuration page: 14401,14402,14403,14404,14405,14407,14408,14409,14410

Table 14 – RSU-Monitor: Verify that a message is logged when the RSU loses Connection to the System Log Viewer

No	Test Step	Expected Result	Test Results
1.	Disconnect the System Log Viewer from communicating with the RSU Monitoring Service	System Log Viewer is not running	
2.	Access the local text file used as backup to any failure to connect to the TransSuite System Log Examine the details in the file	A message with ID 14403 similar to this is logged: "<TEMP>Connected Vehicle RSU Monitor Process has lost connection with </FUNC></TEMP>",NULL,"The RSU Monitor Process has lost the connection to the specified function (DB, System Log, RSU Communications, etc)",2	
3.	Click on **Connected Vehicle System -> Devices** from the left panel	Verify that status is shown for the RSU devices	
4.	Open the WPF Map and activate the RSU Map layer	Verify that status is shown for RSU devices on the map	
5.	Re-establish connection between the System Log Viewer and the RSU Monitoring service	Connection is established	

6.	Open Windows Services window Check the status of the **RSU Monitoring Service**	Status of RSU Monitoring Service should show "Running"	
7.	Move back to the System Log Viewer Click **SIMPLE QUERY**	A message with ID 14401 similar to this is logged: "<TEMP>Connected Vehicle RSU Monitor Process started</TEMP>",NULL,"The RSU Monitor process started",2 A message with ID 14402 similar to this is logged: Connected Vehicle RSU Monitor Process has connected to </FUNC></TEMP>",NULL,"The RSU Monitor Process has a connection to the specified function (DB, System Log, RSU Communications, etc)",	
8.	Click **SIMPLE QUERY** button again	A message with ID 14408 similar to this is logged: "<TEMP>Connected Vehicle RSU Monitor Process has completed startup and is ready to receive data</TEMP>",NULL,"RSU Monitor is ready to receive data",2 A message with ID 14404 similar to this is logged: <TEMP>Connected Vehicle RSU Monitor Process received <MSGCNT/> from <RSUNAME/> in last 60 minutes</TEMP>","MSGCNT:integer, RSUNAME:string","Gives a count of messages",2 A message with ID 14405 similar to this is logged: <TEMP>Connected Vehicle RSU Monitor Process retrieved <RSUCNT/> RSUs from database.</TEMP>",NULL,"Logs the number of RSUs received from the database",2	
9.	From the web UI: Click on **Connected Vehicle System -> Devices** from the left panel	Verify that the system provides real-time status values for all RSU devices at a rate of 5 seconds Verify that the system provides a detailed status for an RSU within 2 seconds of the request.	
10.	Move back to the WPF Map that has the RSU Map layer activated	Verify that the system provides real-time status values for all RSU devices at a rate of 5 seconds Verify that the system provides a detailed status for an RSU within 2 seconds of the request.	

11.	Move back to the Web UI: Click on **Alarms ->Alarms List** Check which active alarm was when the RSU Monitor Process loses connection to the System Log Viewer stopped	An alert with alarm code 14403 similar to this is logged: "<TEMP>Connected Vehicle RSU Monitor Process has lost connection with </FUNC></TEMP>",NULL,"The RSU Monitor Process has lost the connection to the specified function (DB, System Log, RSU Communications, etc)"	

2.7.11 RSU-Monitor: Verify that a message is logged when the RSU loses Connection to the RSU Communication Server

Requirements: Not specified.
Precondition:

1. The user is already logged into the Web UI
2. The Alarm System is connected to the RSU Monitor Process
3. The following alarms are enabled on the Connected Vehicle System -> Alarm Configuration page: 14401,14402,14403,14404,14405,14407,14408,14409,14410

Table 15 – RSU- Monitor: Verify that a message is logged when the RSU loses Connection to the RSU Communication Server

No	Test Step	Expected Result	Test Results
1.	Disconnect the RSU Communication Server from communicating with the RSU Monitoring Service	RSU Communication Server is not running	
2.	Move back to the web UI Click on **System Log Viewer** from the left panel	System Log Viewer opens	
3.	Select a **Source** Click **SIMPLE QUERY**	A message with ID 14403 similar to this is logged: "<TEMP>Connected Vehicle RSU Monitor Process has lost connection with </FUNC></TEMP>",NULL,"The RSU Monitor Process has lost the connection to the specified function (DB, System Log, RSU Communications, etc)",2	
4.	Click on **Connected Vehicle System -> Devices** from the left panel	Verify that no status is shown for the RSU devices	
5.	Open the WPF Map and activate the RSU Map layer	Verify that no status is shown for RSU devices on the map	
6.	Re-establish connection between the RSU Communication Server and the RSU Monitoring service	Connection is established	
7.	Open Windows Services window Check the status of the **RSU Monitoring Service**	Status of RSU Monitoring Service should show "Running"	

8.	Move back to the System Log Viewer Click **SIMPLE QUERY**	A message with ID 14401 similar to this is logged: "<TEMP>Connected Vehicle RSU Monitor Process started</TEMP>",NULL,"The RSU Monitor process started",2 A message with ID 14402 similar to this is logged: Connected Vehicle RSU Monitor Process has connected to </FUNC></TEMP>",NULL,"The RSU Monitor Process has a connection to the specified function (DB, System Log, RSU Communications, etc)",	
9.	Click **SIMPLE QUERY** button again	A message with ID 14408 similar to this is logged: "<TEMP>Connected Vehicle RSU Monitor Process has completed startup and is ready to receive data</TEMP>",NULL,"RSU Monitor is ready to receive data",2 A message with ID 14404 similar to this is logged: <TEMP>Connected Vehicle RSU Monitor Process received <MSGCNT/> from <RSUNAME/> in last 60 minutes</TEMP>","MSGCNT:integer, RSUNAME:string","Gives a count of messages",2 A message with ID 14405 similar to this is logged: <TEMP>Connected Vehicle RSU Monitor Process retrieved <RSUCNT/> RSUs from database.</TEMP>",NULL,"Logs the number of RSUs received from the database",2	
10.	From the web UI: Click on **Connected Vehicle System -> Devices** from the left panel	Verify that the system provides real-time status values for all RSU devices at a rate of 5 seconds Verify that the system provides a detailed status for an RSU within 2 seconds of the request.	
11.	Move back to the WPF Map that has the RSU Map layer activated	Verify that the system provides real-time status values for all RSU devices at a rate of 5 seconds Verify that the system provides a detailed status for an RSU within 2 seconds of the request.	
12.	Move back to the Web UI: Click on **Alarms ->Alarms List** Check which active alarm was when the RSU Monitor Process loses connection to the RSU	An alert with alarm code 14403 similar to this is logged: "<TEMP>Connected Vehicle RSU Monitor Process has lost connection with </FUNC></TEMP>",NULL,"The	

	Communication Server	RSU Monitor Process has lost the connection to the specified function (DB, System Log, RSU Communications, etc)"	

2.7.12 RSU-Monitor: Verify that Messages are Logged After Restarting the RSU Monitoring Service

Requirements: Not specified.
Precondition:

1. The user is already logged into the Web UI
2. The Alarm System is connected to the RSU Monitor Process
3. The following alarms are enabled on the Connected Vehicle System -> Alarm Configuration page: 14401,14402,14403,14404,14405,14407,14408,14409,14410

Table 16 – RSU-Monitor: Verify that Messages are Logged After Restarting the RSU Monitoring Service

No	Test Step	Expected Result	Test Results
1.	Open Windows Services window Click on the **RSU Monitoring Service** and then click on **Restart**	Status of RSU Monitoring Service should show "Running" after the restart operation is done	
2.	Move back to the web UI Click on **System Log Viewer** from the left panel	System Log Viewer opens without errors	
3.	Select a **Source** Click **SIMPLE QUERY**	A message with ID 14409 similar to this is logged: "<TEMP>Connected Vehicle RSU Monitor Process has a STOP command from the Windows Service Manager</TEMP>",NULL,"RSU Monitor has received a Stop from the Windows Service Manager",2	
4.	Click **SIMPLE QUERY** button again	A message with ID 14401 similar to this is logged: "<TEMP>Connected Vehicle RSU Monitor Process started</TEMP>",NULL,"The RSU Monitor process started",2 A message with ID 14402 similar to this is logged: Connected Vehicle RSU Monitor Process has connected to </FUNC></TEMP>",NULL,"The RSU Monitor Process has a connection to the specified function (DB, System Log, RSU Communications, etc)",	
5.	Click **SIMPLE QUERY** button again	A message with ID 14408 similar to this is logged: "<TEMP>Connected Vehicle RSU Monitor Process has completed	

		startup and is ready to receive data</TEMP>",NULL,"RSU Monitor is ready to receive data",2 A message with ID 14404 similar to this is logged: <TEMP>Connected Vehicle RSU Monitor Process received <MSGCNT/> from <RSUNAME/> in last 60 minutes</TEMP>","MSGCNT:integer, RSUNAME:string","Gives a count of messages",2 A message with ID 14405 similar to this is logged: <TEMP>Connected Vehicle RSU Monitor Process retrieved <RSUCNT/> RSUs from database.</TEMP>",NULL,"Logs the number of RSUs received from the database",2	
6.	From the web UI: Select **Connected Vehicle System -> Devices** from the left panel	Verify that the system provides real-time status values for all RSU devices at a rate of 5 seconds Verify that the system provides a detailed status for an RSU within 2 seconds of the request.	
7.	Move back to the WPF Map that has the RSU Map layer activated	Verify that the system provides real-time status values for all RSU devices at a rate of 5 seconds Verify that the system provides a detailed status for an RSU within 2 seconds of the request.	
8.	Move back to the Web UI: Click on **Alarms ->Alarms List** Check which active alarm was when the RSU Monitor Process was stopped	An alert with alarm code 14409 similar to this is logged: "<TEMP>Connected Vehicle RSU Monitor Process has a STOP command from the Windows Service Manager</TEMP>",NULL,"RSU Monitor has received a Stop from the Windows Service Manager"	
9.	Check which active alarms were created when the RSU Monitor Process was started	An alert with alarm code 14401 similar to this is logged: "<TEMP>Connected Vehicle RSU Monitor Process started</TEMP>",NULL,"The RSU Monitor process started" An alert with alarm code 14402 similar to this is logged: Connected Vehicle RSU Monitor Process has connected to </FUNC></TEMP>",NULL,"The RSU Monitor Process has a connection to the specified function (DB, System Log, RSU Communication)	

10.	Check which active alarm was created when the RSU Monitor Process completed startup	An alert with alarm code 14408 similar to this is logged: "<TEMP>Connected Vehicle RSU Monitor Process has completed startup and is ready to receive data</TEMP>",NULL,"RSU Monitor is ready to receive data"	
11.	Check which active alarm was created when the RSU Monitor Process received updates	An alert with alarm code 14404 similar to this is logged: <TEMP>Connected Vehicle RSU Monitor Process received <MSGCNT/> from <RSUNAME/> in last 60 minutes</TEMP>","MSGCNT:integer, RSUNAME:string","Gives a count of messages"	
12.	Check which active alarm was created when the RSU Monitor Process retrieved RSU inventory data from the database	An alert with alarm code 14405 similar to this is logged: <TEMP>Connected Vehicle RSU Monitor Process retrieved <RSUCNT/> RSUs from database.</TEMP>",NULL,"Logs the number of RSUs received from the database"	

2.7.13 NYCVPD - Add a Weather Station - 1

Table 17 – NYCVPD – Add a Weather Station – 1

No	Test Step	Expected Result	Test Results
1.	Double-click the **WeatherLogConfigTest.exe** Tool	Tool opens successfully	
2.	Enter the **Weather Station ID** ID = KJFK	Input accepted	
3.	Click **SUBMIT**	Input dialog is shown	
4.	Enter the number of attempts Attempts = 2	Input accepted	
5.	Click **OK**	The system reports that the minimum attempts allowed is 3	
6.	Enter the URL URL =http://w1.weather.gov/xml/current_obs/ Click **OK**	Input accepted	
7.	Click **OK** on the message dialog	Attempts shown for the station is 3 Station added to the list Full name = KJFK – New York, Kennedy international	

		Airport, NY	
8.	Enter the **Weather Station ID** ID = KNYC	Input accepted	
9.	Click **SUBMIT**	Input dialog shown	
10.	Enter the URL URL =http://w1.weather.gov/xml/current_obs/ Click **OK**	Input accepted	
11.	Enter the number of attempts Attempts = 4	Input accepted	
12.	Click **OK**	Station added to the list Full name = KNYC – New York City, Central Park, NY	
13.	Enter the **Weather Station ID** ID = KLGA	Input accepted	
14.	Click **SUBMIT**	Input dialog shown	
15.	Enter the URL URL =http://w1.weather.gov/xml/current_obs/ Click **OK**	Input accepted	
16.	Enter the number of attempts Attempts = 3	Input accepted	
17.	Click **OK**	Station added to the list Full name = KLGA – New York, La Guardial Airport, NY	
18.	Enter the **Weather Station ID** ID = KN03	Input accepted	
19.	Click **SUBMIT**	Input dialog shown	
20.	Enter the URL URL =http://w1.weather.gov/xml/current_obs/ Click **OK**	Input accepted	
21.	Enter the number of attempts Attempts = 5	Input accepted	
22.	Click **OK**	Station added to the list Full name = KN03 -Cortland County – Chase Field, NY	
23.	Enter the **Weather Station ID** ID = KART	Input accepted	
24.	Click **SUBMIT**	Input dialog shown	
25.	Enter the URL URL =http://w1.weather.gov/xml/current_obs/ Click **OK**	Input accepted	
26.	Enter the number of attempts Attempts = 4	Input accepted	
27.	Click **OK**	Station added to the list	

		Full name = KART – Watertown, Watertown International Airport, NY	
28.	Enter the **Weather Station ID** ID = KRME	Input accepted	
29.	Click **SUBMIT**	Input dialog shown	
30.	Enter the URL URL =http://w1.weather.gov/xml/current_obs/ Click **OK**	Input accepted	
31.	Enter the number of attempts Attempts = 3	Input accepted	
32.	Click **OK**	Station added to the list Full name = KRIME – Griffliss Air Force Base / Rome, NY	
33.	Click **SAVE** Click **OK** on each message dialog indicating that the weather station is added to the system	Each weather station is shown in the list	
34.	Click **X** to close the tool	Tool closes	
35.	Double-click the **WeatherLogConfigTest.exe** Tool	Tool opens successfully	
36.	Examine the list	Verify that list shows: • KJFK • KNYC • KLGA • KN03 • KART KRME	
37.	Open the System Log Viewer	Application opens	
38.	Select the source Source = Connveh	Input accepted	
39.	Click **SIMPLE**	For each weather station added: A message is logged similar to this " Weather station "[Weather station ID]" has been added for logging" Verify that the message # used = 1 Details logged is correct	

2.7.14 NYCVPD – Delete a Weather Station and Trigger Alarm

Table 18 – NYCVPD – Delete a Weather Station and Trigger Alarm

No	Test Step	Expected Result	Test Results
1.	Double-click the **WeatherLogConfigTest.exe** Tool	Tool opens successfully	
2.	Click **CONFIGURE ALARMS**	Alarm Configuration dialog opens	
3.	Check the box under **SendAlarm** for the System Log Event Code Test Data: SysLogEventCode = 2	Box is checked	
4.	Click **OK** Test Data: SysLogEventCode = 2	Weather station list view is shown	
5.	Click on a weather station in the list	Selected item highlighted	
6.	Click **DELETE**	Station removed from the list	
7.	Click **X** to close the tool	Tool closes	
8.	Double-click the **WeatherLogConfigTest.exe** Tool	Tool opens successfully	
9.	Examine the list	List still shows the station that the user tried to delete	
10.	Click on a weather station in the list	Selected item highlighted	
11.	Click **DELETE**	Station removed from the list	
12.	Click **SAVE**	A message is shown that the station is deleted from the database	
13.	Click **OK** on the message dialog	Message dialog closes A message is shown that the weather station is logged in the System Log Viewer	
14.	Click **OK** on the message dialog	Message dialog closes A message is shown indicating the message number configured/not configured to be sent to the alarm service	
15.	Click **OK** on the message dialog	Message dialog closes	
16.	Click **X** to close the tool	Tool closes	
17.	Double-click the **WeatherLogConfigTest.exe** Tool	Tool opens successfully	
18.	Examine the list	List still does not show the station that was deleted	
19.	Open the System Log Viewer	Application opens	
20.	Select the source	Input accepted	

21.	Click **SIMPLE**	A message is logged similar to this " Weather station "[Weather station ID]" has been deleted from the logging" Verify that the message # used = 2 Details logged is correct	
22.	Open the TransSuite Alarm Viewer Examine the Alarm Summary list	Verify that an event is logged that a weather station is deleted	

2.7.15 NYCVPD - Verify the Weather Station Data that is Stored in the Database

Table 19 – NYCVPD - Verify the Weather Station Data that is Stored in the Database

No	Test Step	Expected Result	Test Results
1.	Log onto the database machine Open Microsoft SQL Server Management Studio tool	Tool opens	
2.	Open the **NYCVPD-TransSuite** database Click on the table **CVPD_WeatherStation**	Table opens	
3.	Examine the baseline information stored for each weather station	Verify that the data shown for each weather station matches the details in the attached file.	
4.	Compare the data shown in the database with the data shown in the **WeatherLogConfigTest.exe** Tool for the defined weather stations	The data is the same	

2.7.16 NYCVPD - Verify the Weather Station Vehicle Data that is Stored in the Database

Requirements: Not specified.
Precondition:

1. System is configured to receive weather station data from:
    a. KJFK
    b. KNYC
2. At least 1 hour and 15 minutes has passed since system configured

Table 20 – NYCVPD - Verify the Weather Station Vehicle Data that is Stored in the Database

No	Test Step	Expected Result	Test Results
1.	Open a web browser: URL: http://w1.weather.gov/xml/current_obs/KJFK.xml	Web page opens	

	Enter the URL for the weather station		
2.	Right-click and select **Save As** Enter a file name Click **SAVE**	File is saved	
3.	Move to the location of the file and right-click and open in an editor such as (Notepad ++)	File opens	
4.	Repeat steps 3 through 5 for the other weather station URL: http://w1.weather.gov/xml/current_obs/KNYC.xml	Test case passes	
5.	Wait for 1 hour and 15 minutes to pass	Time passed	
6.	Log onto the database machine Open Microsoft SQL Server Management Studio tool	Tool opens	
7.	Open the **NYCVPD-TransSuite** database Click on the table **CVPD_WeatherObs** Run this query: SELECT * FROM [NYCVPD-TransSuite].[dbo].[CVPD_WeatherObs] ORDER BY observation_time_rfc822	Table opens	
8.	Examine the number of records shown	Verify that only 2 records are shown in the database Verify that 1 record is shown for each weather station	
9.	Compare the data generated from the first URL earlier with the data in the database	The data is the same Verify that no duplicate records are shown	
10.	Compare the data generated from the second URL earlier with the data in the database	The data is the same Verify that no duplicate records are shown	
11.	Examine the details shown for each record Verify that the details match the data shown in the attached files.		
12.	Wait for 2 hour and 15 minutes to pass	Time passed	
13.	Repeat steps 3 through 12	Test steps pass	
14.	Examine the number of records shown	Verify that only 4 records shown in the database. Verify that 2 records are shown for each weather station.	
15.	Compare the data generated from the first URL earlier with the data in the database	The data is the same	
16.	Compare the data generated from the second URL earlier with the data in the database	The data is the same	
17.	Wait for 24 hours to pass	Time passed	
18.	Repeat steps 3 through 12	Verify that the number of records shown is = [number of defined weather stations x 24]	

		This means that if 2 weather stations were defined then after one day, the system show should [2x24] records. Note: A record is created every hour for each weather station	

2.7.17 NYCVPD - Update a Weather Station

Table 21 – NYCVPD - Update a Weather Station

No	Test Step	Expected Result	Test Results
1.	Double-click the **WeatherLogConfigTest.exe** Tool	Tool opens successfully	
2.	Click on a Weather Station in the list ID = KRME	Selected item highlighted	
3.	Double-click in the **Attempts** cell Enter an updated number of attempts Attempts = 6	Input accepted	
4.	Click **CANCEL**	Weather station still shown with old attempts value	
5.	Click on a Weather Station in the list ID = KRME	Selected item highlighted	
6.	Double-click in the **Attempts** cell Enter an updated number of attempts Attempts = 6	Input accepted	
7.	Click **OK**	Station shows updated attempts value	
8.	Click on the Weather Station in the list ID = KRME	Selected item highlighted	
9.	Click on **Configure URL** cell URL = http://w1.weather.gov/xml/current_obs/KNYC2.xml Enter an updated URL	Input accepted	
10.	Click **OK**	Station shows updated attempts value	
11.	Click **SAVE**	Change saved successfully	
12.	Click **X** to close the tool	Tool closes	
13.	Double-click the **WeatherLogConfigTest.exe** Tool	Tool opens successfully	
14.	Examine the list	Verify that the weather station is shown with the updated attempts value	
15.	Open the System Log Viewer	Application opens	
16.	Select the source Source = Connveh	Input accepted	
17.	Click **SIMPLE**	A message is logged similar to this " Weather station "KRME" has been added for logging"	

		Details logged is correct	

2.7.18 NYCVPD - Verify the Connected Vehicle Weather Logger Tool

Table 22 – NYCVPD - Verify the Connected Vehicle Weather Logger Tool

No	Test Step	Expected Result	Test Results
1.	Double-click the **WeatherLogConfigTest.exe** Tool	Weather Logger Configuration tool opens successfully Verify tool is a Windows program	

2.7.19 NYCVPD - Add a Weather Station - 2

Table 23 – NYCVPD - Add a Weather Station - 2

No	Test Step	Expected Result	Test Results
1.	Double-click the **WeatherLogConfigTest.exe** Tool	Tool opens successfully	
2.	Examine the list Record the weather stations shown	List recorded	
3.	Enter the **Weather Station ID** Test Data: ID = KJFKA	Input accepted	
4.	Click **SUBMIT**	The system report that the ID is not valid	
5.	Click **OK** on message dialog	Message dialog closes	
6.	Enter the **Weather Station ID** Test Data: ID = KJFK	Input accepted	
7.	Click **SUBMIT**	Input dialog is shown	
8.	Enter the number of attempts Attempts = 2	Input accepted	
9.	Click **CANCEL**	Weather station is shown in the list and attempts shown = 3	
10.	Click **X** to close the tool	Tool closes	
11.	Double-click the **WeatherLogConfigTest.exe** Tool	Tool opens successfully	
12.	Examine the list	Verify that list shows weather stations that were recorded earlier	

2.7.20 NYCVPD - Verify That Data is Logged When Weather Observations Have

Not Been Updated for a Long Time

Table 24 – NYCVPD - Verify That Data is Logged When Weather Observations Have Not Been Updated for a Long Time

No	Test Step	Expected Result	Test Results
1.	Double-click the **WeatherLogConfigTest.exe** Tool	Tool opens successfully	
2.	Click **CONFIGURE ALARMS**	Alarm Configuration dialog opens	
3.	Check the box under **SendAlarm** for the a System Log Event Code SysLogEventCode = 11	Box is checked	
4.	Click **APPLY**	Command successful	
5.	Click **OK**	Weather station list view is shown	
6.	Setup the system so that a weather station weather observations is not updated for 2 hours or more	Weather station weather observations not updated for 2 hours or more	
7.	Open the System Log Viewer	Application opens	
8.	Select the source	Input accepted	
9.	Click **SIMPLE**	A message is logged similar to this " weather station [weather station ID] observation time has not been not updated in 2 hours" Verify that the message # used = 11	

2.7.21 NYCVPD - Verify Data is Logged and Alarm Triggered When Weather Station Site Cannot Be Reached

Table 25 – NYCVPD - Verify Data is Logged and Alarm Triggered When Weather Station Site Cannot Be Reached

No	Test Step	Expected Result	Test Results
1.	Double-click the **WeatherLogConfigTest.exe** Tool	Tool opens successfully	
2.	Click **CONFIGURE ALARMS**	Alarm Configuration dialog opens	
3.	Check the box under **SendAlarm** for a System Log Event Code SysLogEventCode = 10	Box is checked	
4.	Click **APPLY**	Command successful	
5.	Click **OK**	Weather station list view is shown	
6.	Click on a weather station in the list Click **Configure URL**	Weather station URL set to an invalid value	

	Enter an invalid URL Click **SAVE**		
7.	Open the System Log Viewer	Application opens	
8.	Select the source Source = Connveh	Input accepted	
9.	Click **SIMPLE**	A message is logged similar to this " weather station [weather station ID] cannot be reached" Verify that the message # used = 10 Verify that the log entry contains the reason returned by the attempt.	
10.	Open the TransSuite Alarm Viewer Examine the Alarm Summary list	Verify that an event is logged that a weather station site cannot be reached	

2.7.22 NYCVPD - Add a weather Station and Trigger Alarm

Table 26 – NYCVPD - Add a weather Station and Trigger Alarm

No	Test Step	Expected Result	Test Results
1.	Double-click the **WeatherLogConfigTest.exe** Tool	Tool opens successfully	
2.	Click **CONFIGURE ALARMS**	Alarm Configuration dialog opens	
3.	Check the box under **SendAlarm** for the a System Log Event Code SysLogEventCode = 1	Box is checked	
4.	Click **CANCEL**	Box closes	
5.	Click **CONFIGURE ALARMS**	Alarm Configuration dialog opens The box for "SysLogEventCode = 1"is not checked	
6.	Check the box under **SendAlarm** for the a System Log Event Code SysLogEventCode = 1	Box is checked	
7.	Click **APPLY**	Command successful	
8.	Select the **Display Type** Display Type = Show Sent Alarm Messages	"SysLogEventCode = 1" is shown in the list	
9.	Select the **Display Type**	All messages are shown in the list	

	Display Type = Show All Messages		
10.	Click **OK**	Weather station list view is shown	
11.	Enter the **Weather Station ID** ID = KRME	Input accepted	
12.	Click **SUBMIT**	Input dialog shown	
13.	Enter the **Base URL for the Weather Station** URL = http://w1.weather.gov/xml/current_obs/ Click **OK**	Input accepted	
14.	Enter the number of attempts Attempts = 3	Input accepted	
15.	Click **OK**	Station added to the list Full name = KRIME - Griffliss Air Force Base / Rome, NY	
16.	Click **SAVE** Click **OK** on the message dialog indicating that the weather station is added to the system	Weather station is shown in the list	
17.	Click **X** to close the tool	Tool closes	
18.	Double-click the **WeatherLogConfigTest.exe** Tool	Tool opens successfully	
19.	Examine the list	Verify that list shows: KRME	
20.	Open the System Log Viewer	Application opens	
21.	Select the source Source = Connveh	Input accepted	
22.	Click **SIMPLE**	A message is logged similar to this " Weather station "KRME" has been added for logging" Details logged is correct	
23.	Open the TransSuite Alarm Viewer Examine the Alarm Summary list	Verify that an event is logged that a new weather station is created The alarm text should be similar to this " Weather station "KRME" has been added for logging"	

2.7.23 NYCVPD - Verify the Connected Vehicle Weather Logger Configuration Tool

Table 27 – NYCVPD - Verify the Connected Vehicle Weather Logger Configuration Tool

No	Test Step	Expected Result	Test Results
1.	Double-click the **WeatherLogConfigTest.exe** Tool	Weather Logger Configuration tool opens successfully Verify tool is a Windows program	
2.	Examine the weather stations view section of the window	A list of configured weather stations is shown	

2.7.24 NYCVPD - Create a Windows Scheduler Task for the Vehicle Weather Logger Tool

Table 28 – NYCVPD - Create a Windows Scheduler Task for the Vehicle Weather Logger Tool

No	Test Step	Expected Result	Test Results
1.	Move to this path on your workstation " Control Panel\All Control Panel Items\Administrative Tools" Double click on **Task Scheduler**	Task scheduler opens	
2.	Right-click on **Task Scheduler Library** and select **Create Task**	Create task dialog is shown	
3.	on the **General** tab: Enter a name Name = Weather Logger Tool Click radio button = Run whether user is logged on or not Select a **Security Option**	Input accepted	
4.	Click on the **Actions** tab: Click the **New...** button Select an action Action = Start a program Program/script = WeatherLogger.exe Click the **BROWSE** button next to the **Program/script** input field and then browse to the location to find " WeatherLogger.exe*, then click on the file and then click **OPEN**	Inputs accepted	
5.	Click on the **Triggers** tab: Click the **New...** button Select a value for *Begin a task * Begin a task = On a schedule	Inputs accepted	

	Settings = One time Check box for = Synchronize across time zones Start = Current date and time Advanced settings = Check the box for *Repeat task every [5 minutes] for a duration of - Indefinitely Enabled = checked Select a **Settings** Define the advanced settings		
6.	Click **OK** on Edit Trigger dialog	Trigger shown in the list	
7.	Click **OK** on Properties dialog	Scheduler task shown in the list	
8.	Right-click on the newly created task and select * Run*	Task shows: Status = Running	
9.	Wait for 5 minutes when the task should first run	Verify that the **Last Run Time** could shows the time when the scheduler task was executed. Verify that the **Last Run Result** should show = The operation completed successfully	

2.8 Schedule

The schedule for Task 2G: Operational Readiness Test is shown in Table 29 below.

Table 29 – NYC CVPD Operational Readiness Test Schedule

No.	Activity	Start	Stop	Dependencies
1.	Operational Readiness Test Plan (this document)	2/22/17	8/9/17	
2.	ORP Walkthrough	6/3/19	6/4/19	1
3.	Revised ORP with Comment Resolution Report	6/5/19	6/21/19	2
4.	Final ORP	6/24/19	7/12/19	3
5.	Pre-prototype Back Office Testing Design Docs	7/10/17	9/1/17	
6.	Pre-prototype Back Office Testing	9/4/17	9/26/17	5
7.	Post-prototype Regression Testing	11/24/17	12/14/17	6
8.	Post-prototype Ancillary Software Regression Testing	1/12/18	6/26/19	7
9.	Installation and Operational Readiness Test Design Documents	2/1/18	6/14/19	5, 7
10.	Install, Integrate, Tune, and Test RSUs/ASDs (20%)	6/17/19	7/12/19	9
11.	Operational Readiness Testing – Dry Run Demonstrations (After 20% ASD Installation)	7/15/19	8/23/19	10

2.9 Approvals

This plan is effective as of the most recent date from the signatures provided below. All signatures indicate acceptance of the test plan.

Jonathan Walker, Agreement Officer Representative	Date
Mohamad Talas, Project Management Lead	Date

3. Operational Readiness Demonstration Plan

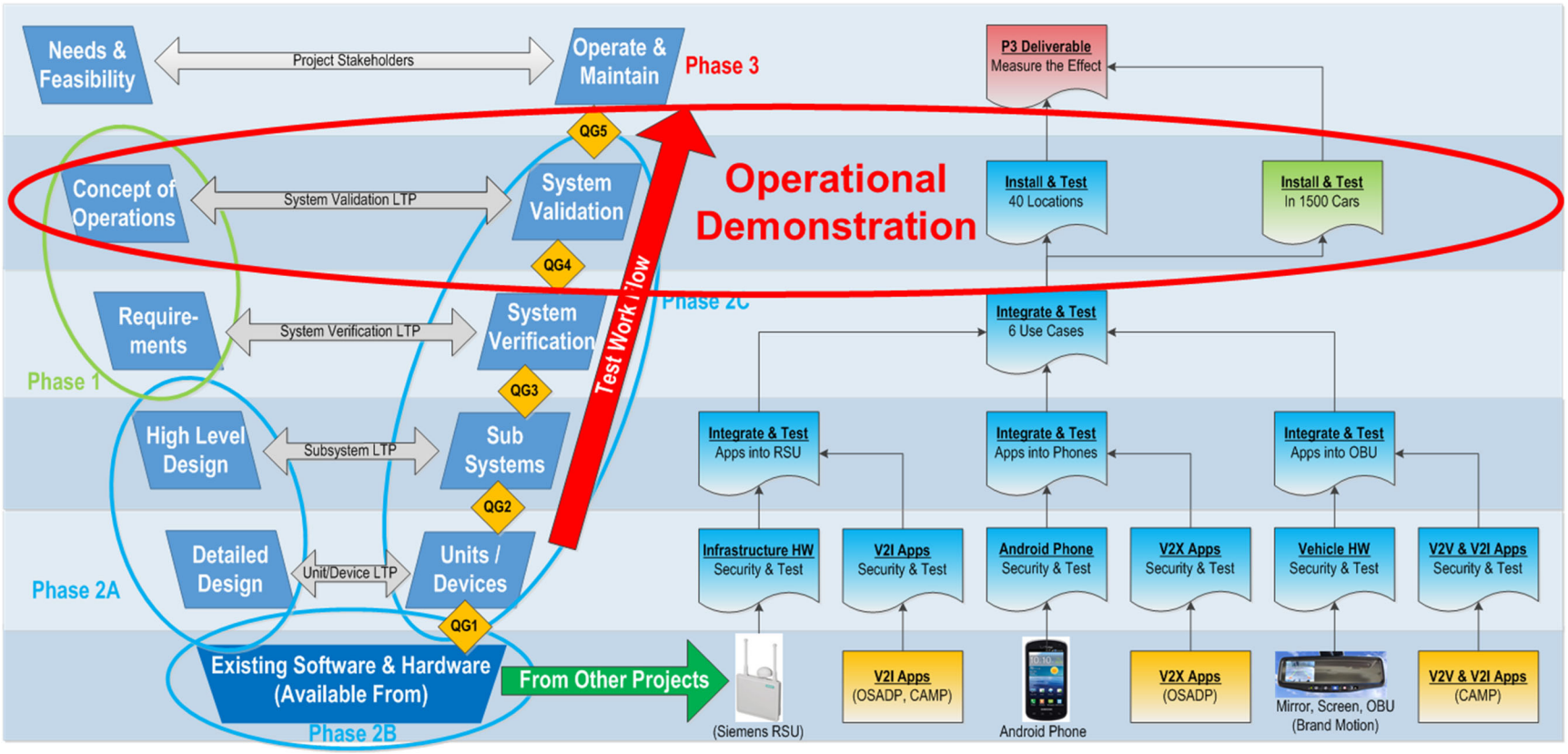
3.1 Objectives

The Operational Readiness Demonstration Plan (ORDP) is the second part of the Operational Readiness Plan (ORP) with Operational Readiness Test Plan (ORTP) being the first part of the ORP. The ORDP consists of a series of coordinated demonstrations, including participants, to ensure the operational readiness of the system. The objectives of these activities are to demonstrate the deployed system operates as designed in a safe and secure manner. The ORDP is designed and conducted by the New York City Connected Vehicle Pilot Deployment (NYC CVPD) Program team for the United States Department of Transportation (USDOT) to demonstrate that the system substantially performs according to the system requirements. THE ORDP will be executed following the successful execution of the ORTP by the TransCore team. The ORTP results will be shared with USDOT prior to the execution of the ORDP.

Demonstration objectives include the following:

- Exhibiting a set of selected integrated, end-to-end system capabilities central to the deployment concept of operations and key use cases.
- Conducting the demonstration as a set of live, real-time activities for the Agreement Officer Representative (AOR) and federal team wherein success and failure of the demonstration are directly observable.

Within the NYC CVPD Program project workflow, the ORDP occurs at Level 5 of the VEE model following successful ORTP of Level 4 as shown in Figure 3 below.
.



(Source: NYCDOT)

Figure 3 – Level 5 Operational Demonstration

The high-level objective of the ORDP is not to demonstrate the effectiveness of each connected vehicle (CV) application, but rather to demonstrate the system's ability to support the evaluation of CV application by the researchers during Phase 3 of the project.

3.1.1 Test Approach

The testing approach that will be used is scenario-based testing. The operational scenarios outlined in the Concept of Operations (ConOps) are used to develop the use cases to demonstrate how the program will be used in real life situations.

3.1.2 Project Items to be Tested

The following items for the operational scenarios will be tested. The scenarios listed below are subject to adjustment due to local conditions (e.g., weather and the presence of pedestrians and other vehicles). Participants will make a best effort to demonstrate these scenarios.

1. Traffic Manager Scenarios
    a. Speed Compliance
    b. Speed Compliance/Work Zones
    c. Curve Speed Compliance (postponed)
    d. Oversize Vehicle Compliance
    e. Emergency Communications and Evacuation Information
    f. Travel Time Data Collection (postponed)
2. Roadway User Scenarios
    a. Vehicle Trip Initiation (postponed)
    b. Driver Reporting Suspected Aftermarket Safety Device (ASD) Failure (postponed)
    c. Pedestrian in Signalized Intersection Warning (postponed)
    d. Mobile Accessible Pedestrian Signal System for Visually Impaired Users (postponed)
    e. Blind Spot Warning (BSW)
    f. Lane Change Warning (LCW)
    g. Intersection Movement Assist (IMA)
    h. Forward Collision Warning (FCW)
    i. Emergency Electronic Brake Lights (EEBL)
    j. Vehicle Turning Right in Front of Bus Warning (VTRW) (postponed)
3. System Manager Scenarios
    a. ASD CV Application Configuration Download
    b. ASD Firmware Update
    c. Roadside Safety Unit (RSU) radio frequency (RF) Monitoring
    d. ASD RF Monitoring (postponed)
4. Evaluation Data Collection
    a. ASD Event Data Reporting
    b. ASD Event Data Upload
    c. Performance Measurement Data Processing

3.1.3 Hardware, Software, and Other Equipment Required

Table 30 shows the hardware and software components and other physical equipment necessary at the demonstration phase of ORDP.

Table 30 – Hardware, Software, and Other Equipment Required

No.	Item
1	ASD – configurable for heavy vehicle, light vehicle, transit vehicle
2	Advance solid-state traffic controller (ASTC) configuration – data sharing, signal phasing and timing (SPaT), operation, pedestrian detection[2]
3	RSU (intersection configuration, including SPaT/MAP) with NYC's Wireless Transportation Systems Network (TSN) modem, router, and switch with network routing to SCMS and TMC
4	RSU (support configuration, including over the air (OTA) firmware/configuration download and data upload)
5	Personal information device (PID) unit (receive SPaT and MAP messages through Amazon web services (AWS) Cloud)
6	PID back office (New York University (NYU) data repository, firmware download from Savari)
7	AWS cloud for forwarding SPaT and MAP messages received from the Transportation Management Center (TMC)
8	TMC back office system (BOS) computer for performance data evaluation and scrubbing/sanitization of PII
9	TMC CV application server
10	TMC performance monitoring server for final post-processing and obfuscation
11	USDOT Secure Data Common (SDC) system interface
12	Hardware security module (HSM) in the TMC for signing and authenticating the MAP and traveler information message (TIM) messages in the TMC
13	HSM installed in the ASD for signing the basic safety message (BSM), in the RSU for signing the SPaT messages, and in both ASD and RSU for storing the certificates generated by ISS CMS
14	ISS CMS (commercially available security credential management system (SCMS) system from Green Hills ISS); version TBD
15	Ability to get updated certs from SCMS
16	ASTC with CV firmware for providing pedestrian detection inputs through SPaT data
17	Radio frequency (RF) testing device(s) - Anritsu
18	ASN.1 compiler
19	Wireshark for network traffic analysis
20	Display connected to TMC/BOS
21	Display connected to other components (SDC, NYU, fleet owners)
22	Secure method (e.g., USB thumb-drive 4GB or higher) to transfer collected logs and configuration files
23	Support computers for reference, logging of actions, and observed results
24	Printer
25	XML validation parser
26	TMC location of in-office testing (tentative)
27	Open sky testing location (TBD)
28	Decryption tool for use with ASD encrypted logs
29	ASTC configuration for data sharing, SPaT, operations

[2] The City is installing pedestrian detection video equipment to detect the presence of pedestrians within the crosswalk. This data is included in the SPaT message, and an I2V safety application provides a warning when the vehicle poses a immediate threat to the pedestrian. A toggle switch will be used to simulate a pedestrian presence during all testing.

No.	Item
30	Two tables set up to provide workspace surface space for test items, reference computers, books, and projectors
31	Chairs for up to six participants
32	Sniffer and/or CalmCar for location accuracy

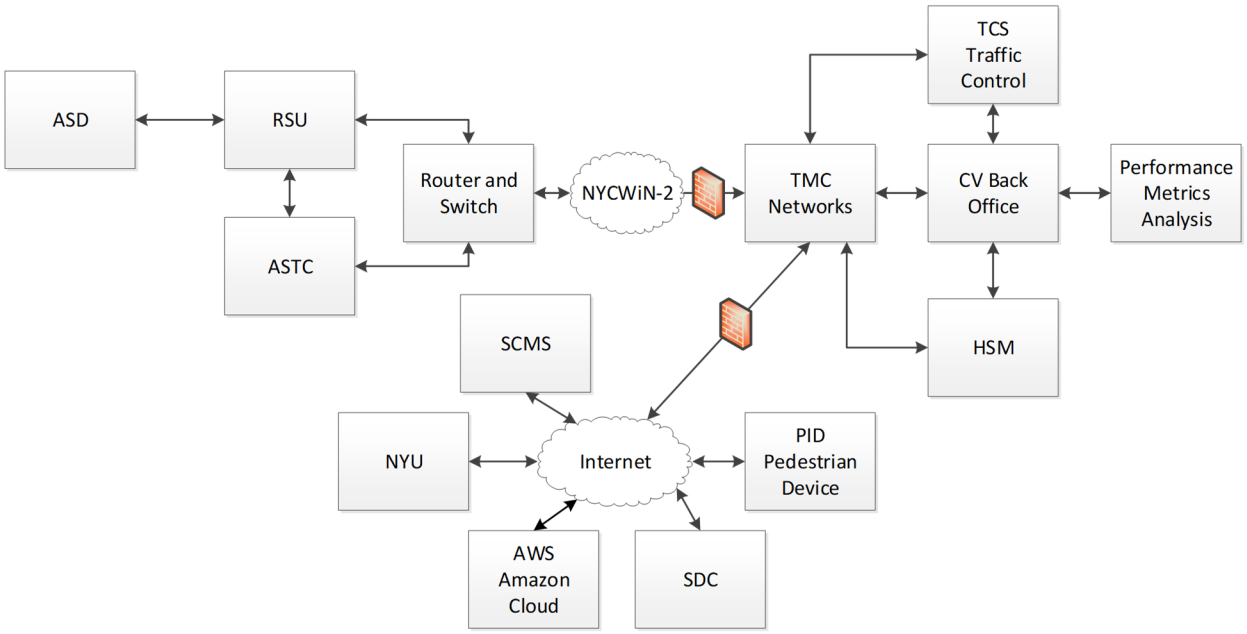
3.1.4 Software/Communication Link

Table 31 lists all the software and communication links between the various components that will be used during demonstration testing. Figure 4 illustrates the communication links.

Table 31 – Software/Communication Link

No.	Equipment/Software Description
1	Enrollment certificates (QA/QC) installed in devices (ASD, RSU, TMC-HSM)
2	NYC's Wireless Transportation Systems Network (TSN) communication links between RSU and TMC (Digi)
3	Wired[3] (Ethernet) communication link between RSU and ASTC
4	NYC's Wireless Transportation Systems Network (TSN) communication link between ASTC and TMC (Digi)
5	Communication link (cellular carrier) between PID and AWS (postponed)
6	Communication link between PID and NYU (cellular carrier) (postponed)
7	Communication link between TMC and AWS
8	Communication link between TMC computer and SDC (or simulated)
9	Communication link between TMC and NYU for PID applications status data (postponed)
10	Communication link between TMC and owner fleet center (optional; not currently installed)
11	Communication link between TMC HSM and SCMS
12	Internet access for reference to support personnel not on site SCMS and AWS

[3] For testing purposes, a wired link will be used. In the street, the system uses a wireless ethernet link to connect the traffic controller cabinet to the RSU because conduit is not available.



(Source: NYCDOT)

Figure 4 – Communications Links

3.1.5 Testing Tools

A commercial version of Zephyr for Jira will be used for test management. With the use of this tool, tests can be created and viewed for the project, linked to other issues, executed immediately or as part of a test cycle and detailed test metrics can be tracked via customized gadgets. The baseline Jira tool will be used for bug and issue tracking.

3.1.6 Locations and Resources

The demonstration locations, vehicles required, and personnel needs for ORDP demonstration types are outlined in Table 32.

Table 32 – Resources and Constraints

Demonstration Type	Location Type	Vehicle Type
ASD-ASD	Open sky, urban canyon	Light-duty vehicle, MTA bus, DSNY truck
ASD-RSU	Open sky, urban canyon	Light-duty vehicle, MTA bus, DSNY truck
RSU-SCMS	Open sky	Light-duty vehicle, MTA bus, DSNY truck
ASD-SCMS	Open sky, urban canyon	Light-duty vehicle, MTA bus, DSNY truck

3.1.7 Control Procedures

3.1.7.1 Problem Reporting

When an incident is encountered during the testing process, a standard form has been used. The testing

team will create a bug report using the form provided in Appendix A. This form is used to document all relevant details, including description, severity level, screenshots, and version for the newly identified bug.

3.1.7.2 Change Requests

Change requests to address problems identified and reported will be managed by following a four-step process and will be signed off by the Test Manager:

1. Determine the scope of the change
2. Determine the scope of incorporating the change
3. Gain approval or rejection of the change
4. Communicate and implement an approved change request

3.1.8 Test Metrics to be Collected

Test metrics will be collected during the readiness demonstration phases. Defect severity correlates with the priority assigned to incidents encountered as described in Section 3.1.7.1.

Table 33 shows a list of test metrics that will be tracked to help measure the effectiveness of the process.

Table 33 – Testing Metrics

No.	Testing Metrics
1	Total number of requirements
2	Average number of test cases written per requirement
3	Total number of test cases executed
4	Number of test cases passed
5	Number of test cases failed
6	Number of test cases blocked
7	Number of test cases not executed
8	Total number of defects identified
9	Total number of critical defects identified
10	Total number of major defects identified
11	Total number of minor defects identified
12	Total number of trivial defects identified
13	Total number of re-opened defects

The following are definitions of the four (4) types of defects identified and considered in the test metrics:

- Critical defect: a defect that is considered to be unsafe or hazardous; most serious of the four (4) defect types identified
- Major defect: a defect that is considered to possibly lead to failure of the unit and/or system
- Minor defects: a defect that is considered to be non-conformant to the standard(s) and may have some impact on the unit and/or system
- Trivial defects: a defect that is least likely to have any impact on the unit and/or system; least serious of the four (4) defect types identified

3.2 Test Strategy

3.2.1 Demonstration Action Preview

This section outlines the actions to be taken within the demonstration to illustrate the successful deployment of key use cases. The details are shown in Table 34 below.

Table 34 – Use Case Demonstration Action Preview

No.	Use Case	Demonstration Actions
1	Speed Compliance	Drive test vehicle towards an RSU Drive the test vehicle below and at speed limit Drive the test vehicle above speed limit and over overspeed threshold
2	Speed Compliance/Work Zone	Drive test vehicle inbound towards an RSU Drive the test vehicle below and at speed limit in school zone or work zone Drive the test vehicle above speed limit and over overspeed threshold in school zone or work zone
3	Curve Speed Compliance	Drive test vehicle towards an RSU loaded with curve speed parameters Drive test vehicle and exit onto a road
4	Oversize Vehicle Compliance	Drive test vehicle towards RSU simulating roadway height restriction
5	Emergency Communications and Evacuation Information	Operate test vehicle while TMC distributes emergency TIM messages.
6	Vehicle Trip Initiation	Drive test vehicle towards the RSU placed at a designated entry and exit point for the vehicle barn or garage
7	Driver Reporting Suspected ASD Failure	Observe test vehicle start-up ASD message(s). Drive test vehicle pass multiple RSU devices and checks for failures
8	Pedestrian in Signalized Intersection Warning	Drive a test vehicle towards a pedestrian who will clear the crosswalk Drive a test vehicle towards a pedestrian who will be in crosswalk
9	Mobile Accessible Pedestrian Signal System	Pedestrian places call using PID
10	ASD CV Application Configuration Download	Launch the ASD CV application configuration tool and the vehicle configuration parameters are downloaded
11	ASD Firmware Update	Launch the ASD CV application configuration tool and install the ASD Firmware Update application
12	ASD RF Monitoring	Drive test vehicle pass multiple RSU devices and check the RSU logs
13	RSU RF Monitoring	Drive test vehicle pass multiple RSU devices and check the ASD logs
14	ASD Event Data Reporting	Drive test vehicle pass multiple RSU devices and check the event logs
15	ASD Event Data Upload	Drive test vehicle towards the fleet barn or other support location
16	Performance Measurement Data Processing	Evaluate event data at the TMC

Note that for the above applications, the warnings were continuous until the threshold condition was no longer met (i.e. vehicle speed less than 25 mph for Speed Compliance (SPDCOMP) app trigger).

Variables for the use cases are defined in Table 35 below. Note that the specific variable values or

ranges for use cases demonstrated in the Operational Readiness Demonstration (ORD) are specified in Section 3.2.2. However, not all use cases were demonstrated during the Operational Readiness Demonstration (ORD). Therefore, not all variable values or ranges for use cases are specified in this document.

Table 35 – Use Case Variables

Variable	Definition
RSU Range	RF range of RSU
RSU1 Range	RF range of RSU
RSU2 Range	RF range of RSU
RSU Relative Distance	Distance between two RSUs to avoid or achieve RF range overlap
Speed Limit	Speed limit defined in RSU
Time of Day schedule	Schedule of hours during which a parameter is valid (e.g., school zone speed limit)
Day of Week schedule	Schedule of days during which a parameter is valid (e.g., school zone speed limit)
Over speed limit parameter	Miles/hr over speed limit at which SCW alert will be issued, defined in ASD configuration file.
Speed Margin 1	Miles/hr over/under the speed limit at which demonstration will be conducted (typically under speed limit)
Speed Margin 2	Miles/hr over/under the speed limit at which demonstration will be conducted (typically enough over speed limit to trigger alerts)
Speed Margin 3	Miles/hr over/under the speed limit at which demonstration will be conducted (typically over speed limit but not enough to trigger alerts)
Warning Time-Outs	Length of time for which work zone speed message is active
Curve Speed Limit	Curve speed limit defined in RSU for curve speed compliance
Excessive Curve Speed Threshold	Miles/hr over curve speed limit at which alert will be issued, defined in ASD configuration file.
Roadway Restriction Height 1	Overhead clearance restriction height for oversize vehicle restriction; defined in RSU
Roadway Restriction Height 2	Overhead clearance restriction height for oversize vehicle restriction; defined in RSU
Roadway Restriction Height 3	Overhead clearance restriction height for oversize vehicle restriction; defined in RSU
Advisory Distance Threshold	Distance from overhead clearance restriction at which “alternate route” warning is delivered
Warning Distance Threshold	Distance from overhead clearance restriction at which “stop vehicle” warning is delivered
Entry Point RSU	RSU located at fleet or parking facility entrance
Exit Point RSU	RSU located at fleet or parking facility exit
Old ASD Firmware	Firmware version currently loaded on ASD
New ASD Firmware	Firmware version to be loaded OTA to ASD
RSU RF Collection Duration	Length of time for RSU RF data collection prior to upload to TMC
ASD Collection Duration	Length of time for ASD

3.2.2 Use Case Demonstration Procedures

Table 7 Demonstration Procedure Template describes the sequence of events demonstrated, along with the observable validation criteria associated with the overall purpose of the demonstration. For each use case, the following are defined:

- Demonstration ID - is a significant alphanumeric of Use Case number and the Demonstration number. For example, UC1D1 identifies the first demonstration of Use Case 1.
- Purpose - states reason, subsystem and operation of the demonstration\
- Variables – define a list of elements whose values are defined in the precondition and referenced throughout the given test case
- Pre-Conditions – list all the conditions that must be fulfilled before the test case can be executed
- Test Cases - lists the traceability from Demonstration to Test Cases, limited to those Requirements verified by “T”
- Requirements - lists the traceability from Demonstration to Requirements for all Requirements, which are verified by “T”, “D” and “I”
- Demonstrators - identifies the representative of the organization conducting the demonstration, which will be the owner / operators of the system during project Phase 2, and have received system operational training
- Facilitator - identifies a representative of the organization that designed and built the portion of the system being demonstrated.
- Observer - identifies the USDOT AOR and Reviewers present during the demonstrations
- Observer Experience - describes the demonstration from the viewpoint of the Observers
- Expectation - describes the system response to the demonstration actions
- Demonstration Site View - depicts the view seen by the Observers
- Demonstration Site Location - depicts the location on the map of the study area as well as the location of the demonstration, if different from the study area.

The Demonstration Action table follows each scene containing the Use Case number, Demonstration Step number, Demonstration Action for each step, Expected Result and checklist for PASS/FAIL plus notes by Observer.

Table 36 – Demonstration Procedure Template

Use Case 1: **Demonstration ID:** **Purpose:** **Variables:** **Pre-Conditions:** **Test Cases:** **Requirements:** **Demonstrators:** **Facilitators:** **Observers:** **Observer Experience:** **Expectation:**	Demonstration Site View: Demonstration Site Location:

3.2.2.1 Use Case 1 Demonstration 1(a) Scene

The demonstrations and steps listed below are subject to adjustment due to local conditions (e.g., weather, the presence of pedestrians and other vehicles).

Table 37 – UC1D1(a) Scene

Use Case 1: Traffic Manager Functionality **Demonstration 1(a): Speed compliance application** **Purpose: Demonstrate that when a vehicle's speed exceeds the over speed parameter and the configured time-of-day and day-of-week parameters are set to the day of testing then a warning message is issued to the driver.** **Variables:** • **Speed Limit = [SpeedLimitVar] = 25 mph** • **Over speed Limit parameter = [OverSpeedLimitVar] = 0 mph** • **Speed Margin 1 = [SpeedMargin1] = -5 mph** • **Speed Margin 2 = [SpeedMargin2] = +5mph** • **Vehicle 1 driver = VEH-1** **Pre-Conditions:** • **Define a speed limit for the roadway segment. For example, [SpeedLimitVar] = 25MPH** • **One of the following vehicle types are available for testing: Light Duty Vehicle ASD, Bus vehicle ASD or Commercial Vehicle ASD** • **A decryption tool is available that is not the event log processing center** **Test Cases:** **Requirements:** **503.1.1,503.1.1.2,503.1.1.3,503.1.1.4,503.1.1.5,503.1.1.6,503.1.2,503.2.1,503.2.2,503.2.3,503.2.4,101.2.17,503.2.7, 503.2.7.1,503.2.7.2,503.2.7.3,503.2.7.4,503.2.8,503.3.1,503.3.2,503.3.3,503.3.4, 503.3.4.1,503.3.4.2,503.3.4.3,503.3.4.4, 503.3.5, 101.1.1,101.1.2,101.1.3,101.1.4,101.1.5,401.1.2,501.1.3,501.1.4,501.1.5,501.1.6,501.2.1,501.2.1.1,501.2.1.2,501.2.1.3,401.14.4,110.1.1 9,102.5.2,102.5.3,102.5.4,102.5.5,102.5.6,102.5.7,102.5.8,102.5.9,102.5.17,102.5.26, 102.5.27,102.5.33,102.6.1,102.6.2,102.6.3.1,102.6.5,102.6.6,102.6.7,102.6.8, 102.6.9,102.6.10,102.6.11,102.6.18,102.6.12,102.6.12.1, 102.6.13, 102.6.14,102.6.15,102.6.16,204.5.1** **Demonstrator: Phase 2 Participant Driver** **Facilitator: TransCore employee** **Observer: USDOT AOR and Reviewers representatives** **Observer Experience:** **Observers ride in participant vehicle equipped with an ASD on which the software is installed and commissioned. Vehicle begins at the starting point and travels inbounds towards the beginning edge of the RSU. The observers note that when the ASD is in range of the RSU; at this point the ASD receives the speed limit information. The observers note that when the driver**	Location: NYCDOT **Vicinity of 34-02 Queens Blvd.** Long Island City, Queens, NY

is driving below or at the speed limit that no alert message is received. The observers note that: when the driver is driving above the speed limit threshold, an alert message is received. Otherwise no alert is received. **Four demonstration runs:** • **Run 1: Vehicle is driven below [SpeedLimitVar]** • **Run 2: Vehicle is driven at [SpeedLimitVar]** • **Run 3: Vehicle is driven above the [SpeedLimitVar] and exceeds the [OverSpeedLimitVar]** • **Run 4: If enough distance is available at test location, vehicle is driven above the [SpeedLimitVar] and exceeds the [OverSpeedLimitVar], then reduces to the [SpeedLimitVar], then the vehicle is driven again above the [SpeedLimitVar] and exceeds the [OverSpeedLimitVar]** **Expectation:** • **Run 1, below speed limit:** ○ **Roadway speed limit sign (if present) matches the ASD detection speed limit** ○ **No speed warning is issued** ○ **Margin to be specified SpeedMargin1** • **Run 2, at speed limit:** ○ **Roadway speed limit sign (if present) matches the ASD detection speed limit** ○ **No speed warning is issued** • **Run 3, above speed limit and above the overspeed parameter:** ○ **Roadway speed limit sign (if present) matches the ASD detection speed limit** ○ **Margin to be specified SpeedMargin1** ○ **Margin to be specified SpeedMargin2** ○ **Speed warning is issued via an audible message (tones and/or words).** ○ **Event log created with warning trigger near real-time** ○ **Stored encrypted event logs are uploaded and purged from the device** ○ **Incident log examined to show speeds and alert and location** • **Run 4, above speed limit, above the overspeed parameter and then at the speed limit. Then above speed limit, above the overspeed parameter:** ○ **Roadway speed limit sign (if present) matches the ASD detection speed limit** ○ **Margin to be specified SpeedMargin1** ○ **Margin to be specified SpeedMargin2** ○ **Speed warning is issued via an audible message (tones and/or words)** ○ **No speed warning is issued when driving is below the speed limit** ○ **Speed warning is issued via an audible message (tones and/or words)** ○ **Event log created with warning trigger near real-time** ○ **Stored encrypted event logs are uploaded and purged from the device** ○ **Incident log examined to show speeds and alert and location**	

3.2.2.2 Use Case 1 Demonstration 1(a) Actions

Note that it is recommended that SpeedMargin1 be set to 5 MPH to minimize the human error in maintaining the speed of the vehicle. Each test run can be repeated at different SpeedMargin1 variables.

SpeedMargin3 is set to a value which will test the variability of the detection and should be set to avoid false alerts.

SpeedMargin2 is set to a value which must trigger an alert above the high threshold.

Table 38 – UC1D1(a) Actions

No.	Actions	Expected Result	Pass/Fail/ Comments
Run 1:			
1	VEH-1 drives from starting point towards start cone		
2	VEH-1 reaches start cone driving at **[SpeedMargin1]** below **[SpeedLimitVar]**	No warning issued to driver	Pass ___ Fail ___ Comments:
3	VEH-1 drives at **[SpeedMargin1]** below **[SpeedLimitVar]** through the RSU range	No warning issued to driver	Pass ___ Fail ___ Comments:
4	VEH-1 reaches stop cone	No warning issued to driver	Pass ___ Fail ___ Comments:
Run 2:			
5	VEH-1 drives from starting point towards start cone		
6	VEH-1 reaches start cone driving at **[SpeedMargin1]** below **[SpeedLimitVar]**	No warning issued to driver	Pass ___ Fail ___ Comments
7	VEH-1 drives at **[SpeedLimitVar]** through the RSU range	No warning issued to driver	Pass ___ Fail ___ Comments:
8	VEH-1 reaches stop cone	No warning issued to driver	Pass ___ Fail ___ Comments:
Run 3			
13	VEH-1 drives from starting point towards start cone		
14	VEH-1 reaches start cone driving at **[SpeedMargin1]** below **[SpeedLimitVar]**	No warning issued to driver	Pass ___ Fail ___ Comments:
15	VEH-1 drives **[SpeedMargin2]** above the over speed parameter through the RSU range to stop cone	Speed limit warning issued to the driver	Pass ___ Fail ___ Comments:
17	Park VEH-1 and check the event logs for the ASD performance monitoring application	An encrypted event log is created for the warning trigger issued during the test run.	Pass ___ Fail ___ Comments:

No.	Actions	Expected Result	Pass/Fail/ Comments
18	VEH-1 drives through the same RSU again that advertises that it can upload the event logs	The stored encrypted event logs are uploaded and purged from the device	Pass ___ Fail ___ Comments:
19	Use the event log processing center tool with public key to decrypt one of the created event logs	Event log cannot be decrypted	Pass ___ Fail ___ Comments:
20	Use the event log processing center tool with private key to decrypt one of the created event logs	Event log is decrypted/translated	Pass ___ Fail ___ Comments:
Run 4			
21	VEH-1 drives from starting point towards start cone	No warning issued to driver	
22	VEH-1 reaches start cone driving at **[SpeedMargin1]** below **[SpeedLimitVar]**	No warning issued to driver	
23	VEH-1 drives **[SpeedMargin2]** above the over speed parameter for 200 feet through the RSU range	Speed limit warning issued to the driver	Pass ___ Fail ___ Comments:
24	VEH-1 drives **[SpeedLimitVar]** for 200 feet through the RSU range	No warning issued to driver	Pass ___ Fail ___ Comments:
25	VEH-1 drives **[SpeedMargin2]** above the over speed parameter through the rest of the RSU range	Speed limit warning issued to the driver	Pass ___ Fail ___ Comments:
26	VEH-1 reaches stop cone		
27	Park VEH-1 and check the event logs for the ASD performance monitoring application	An encrypted event log is created for the warning trigger issued during the test run.	Pass ___ Fail ___ Comments:
28	VEH-1 drives through the same RSU again that advertises that it can upload the event logs	The stored encrypted event logs are uploaded and purged from the device	Pass ___ Fail ___ Comments:

3.2.2.3 Use Case 1 Demonstration 1(b) Scene – NOT DEMONSTRATED 8/19

The demonstrations and steps listed below are subject to adjustment due to local conditions (e.g., weather, the presence of pedestrians and other vehicles). Figure 5 shows the sample MAP message configuration that was developed for demonstrating the Speed Compliance (SPDCOMP) application at the Aqueduct. However, this application was demonstrated around NYCDOT at 47th Ave. @ 34th and 35th St. in Long Island City, Queens, NY.

Table 39 – UC1D1(b) Scene

Use Case 1: Traffic Manager Functionality

Demonstration 1(b): Speed compliance application

Purpose: Demonstrate that when a vehicle's speed exceeds the over speed parameter and the configured time-of-day and day-of-week parameters are not set to the day of testing then a warning message is not issued to the driver.

Variables:

- **RSU Range = [RSURangeVar]**
- **Speed Limit = [SpeedLimitVar] = 25 mph**
- **Time of Day schedule = [TODScheduleVar]**
- **Day of Week schedule = [DOWScheduleVar]**
- **Over speed limit parameter = [OverSpeedLimitVar]**
- **Speed Margin 1 = [SpeedMargin1] = -5 mph**
- **Speed Margin 2 = [SpeedMargin2] = + 5 mph**
- **Vehicle 1 driver = VEH-1**

Pre-Conditions:

- **Set the RSU range. For example, [RSURangeVar] = 300 ft distance**
- **Mark the vehicle starting point**
- **Place start cone at the beginning edge of RSU range**
- **Place stop cone at the end of RSU range**
- **Define a speed limit for the roadway segment. For example, [SpeedLimitVar] = 25MPH**
- **Define a time-of-day and day-of-week schedule to NOT include the testing date. For example, [TODScheduleVar] = 1PM and [DOWScheduleVar] = January 10, 2019**
- **Define the "over speed" parameter. For example, [OverSpeedLimitVar] = 10MPH**
- **One of the following vehicle types are available for testing: Light Duty Vehicle ASD, Bus vehicle ASD or Commercial Vehicle ASD**

Test Cases:

Requirements:
503.1.1,503.1.1.2,503.1.1.3,503.1.1.4,503.1.1.5,503.1.1.6,503.1.2,503.2.1,503.2.2,503.2.3,503.2.4,101.2.17,503.2.7, 503.2.7.1,503.2.7.2,503.2.7.3,503.2.7.4,503.2.8,503.3.1,503.3.2,503.3.3,503.3.4, 503.3.4.1,503.3.4.2,503.3.4.3,503.3.4.4, 503.3.5, 101.1.1,101.1.2,101.1.3,101.1.4,101.1.5,401.1.2,501.1.3,501.1.4,501.1.5,501.1.6,501.2.1,501.2.1.1,501.2.1.2,501.2.1.3,401.14.4,110.1.1 9,102.5.2,102.5.3,102.5.4,102.5.5,102.5.6,102.5.7,102.5.8,102.5.9,102.5.17,102.5.26, 102.5.27,102.5.33,102.6.1,102.6.2,102.6.3.1,102.6.5,102.6.6,102.6.7,102.6.8, 102.6.9,102.6.10,102.6.11,102.6.18,102.6.12,102.6.12.1, 102.6.13, 102.6.14,102.6.15,102.6.16,204.5.1

Demonstrator: Phase 2 Participant Driver

(Source: NYCDOT)

Figure 5 – Sample MAP Message Configuration for ORD of SPDCOMP Application at the Aqueduct

Facilitator: TransCore employee **Observer: USDOT AOR and Reviewers representatives** **Observer Experience:** **Observers ride in participant vehicle equipped with an ASD on which the software is installed and commissioned. Vehicle begins at the starting point and travels inbounds towards the beginning edge of the RSU. The observers note that when the ASD is in range of the RSU; at this point the ASD receives the speed limit information. The observers note that when the driver is driving above the speed limit threshold that no alert message is received.** **One demonstration runs:** • **Run 1: Vehicle is driven above the [SpeedLimitVar] and exceeds the [OverSpeedLimitVar]** **Expectation:** • **Run 1, above speed limit and above the overspeed parameter:** ○ **Roadway speed limit sign (if present) matches the ASD detection speed limit** ○ **No speed warning is issued** ○ **Margin to be specified *SpeedMargin1*** ○ **Margin to be specified *SpeedMargin2***	

3.2.2.4 Use Case 1 Demonstration 1(b) Actions

Note that it is recommended that SpeedMargin1 be set to 5 MPH to minimize the human error in maintaining the speed of the vehicle. Each test run can be repeated at different SpeedMargin1 variables.

SpeedMargin2 is set to a value which must trigger an alert above the high threshold.

Table 40 – UC1D1(b) Actions

No.	Actions	Expected Result	Pass/Fail/Comments
Run 1			
5	VEH-1 drives from starting point towards start cone	No warning issued to driver	Pass ___ Fail ___ Comments:
6	VEH-1 reaches start cone driving at *[SpeedMargin1] below* [SpeedLimitVar]	No warning issued to driver	Pass ___ Fail ___ Comments:
7	VEH-1 drives *[SpeedMargin2]* above the over speed parameter through the RSU range	No warning issued to driver	Pass ___ Fail ___ Comments:
8	VEH-1 reaches stop cone	No warning issued to driver	Pass ___ Fail ___ Comments:

3.2.2.5 Use Case 2 Demonstration 1 Scene

The demonstrations and steps listed below are subject to adjustment due to local conditions (e.g., weather, the presence of pedestrians and other vehicles).

Table 41 – UC2D1 Scene

Use Case 2: Traffic Manager Functionality **Demonstration 1: Speed compliance/Work Zone operation using the Speed Compliance application** **Purpose: Demonstrate over speed warnings for work and school zones that are statically located. This proves that when a vehicle's speed exceeds the over speed parameter and the configured time-of-day and day-of-week parameters are set to the day of testing then a warning message is issued to the driver** **Variables:** • **RSU Range = [RSURangeVar]** • **Speed Limit = [SpeedLimitVar] = 15 mph** • **Time of Day schedule = [TODScheduleVar]** • **Day of Week schedule = [DOWScheduleVar]** • **Over speed Limit parameter = [OverSpeedLimitVar] = 0 mph** • **Speed Margin 1 = [SpeedMargin1] = -5 mph** • **Speed Margin 2 = [SpeedMargin2] = +5 mph** • **Vehicle 1 driver = VEH-1** **Pre-Conditions:** • **Identify work or school zone** • **Define a speed limit for the roadway segment. For example, [SpeedLimitVar] = 25MPH** • **Define a time-of-day and day-of-week schedule. For example, [TODScheduleVar] = 1PM and [DOWScheduleVar] = January 1, 2019** • **One of the following vehicle types are available for testing: Light Duty Vehicle ASD, Bus vehicle ASD or Commercial Vehicle ASD** **Test Cases:** **Requirements: 101.3.2,101.3.3,101.3.4,101.3.5,101.3.6,101.3.7,101.3.8,101.3.9,101.3.10,101.3.11,101.3.12,101.3.13,101.3.14,101.3.15,101.3.16,101.3.17, 203.6.4,203.6.5,203.6.6** **Demonstrator: Phase 2 Participant Driver** **Facilitator: TransCore employee** **Observer: USDOT AOR and Reviewers representatives** **Observer Experience:** **Observers ride in participant vehicle equipped with an ASD on which the software is installed and commissioned. Vehicle begins at the starting point and travels towards the RSU. The observers note that when the ASD is in range of the RSU, the ASD receives the speed limit information. The observers note that when the driver is driving below or at the speed limit that no alert**	Location: NYCDOT Vicinity of 34-02 Queens Blvd. Long Island City, Queens, NY

message is received. The observers note that when the driver is driving above the speed limit threshold, an alert message is received.
 	
Four demonstration runs:
• **Run 1: Vehicle is driven below [SpeedLimitVar]**
• **Run 2: Vehicle is driven [SpeedLimitVar]**
• **Run 3: Vehicle is driven above the [SpeedLimitVar] and exceeds the [OverSpeedLimitVar]**
• **Run 4: Vehicle is driven above the [SpeedLimitVar] and exceeds the [OverSpeedLimitVar], then reduces to the [SpeedLimitVar], then the vehicle is driven again above the [SpeedLimitVar] and exceeds the [OverSpeedLimitVar]**
 	
<u>Expectation</u>:
• **Run 1, below speed limit:**
  ○ **Roadway speed limit sign (if present) matches the ASD detection speed limit**
  ○ **No speed warning is issued**
 	
• **Run 2, at speed limit:**
  ○ **Roadway speed limit sign (if present) matches the ASD detection speed limit**
  ○ **No speed warning is issued**
 	
• **Run 3, above speed limit and above the overspeed parameter:**
  ○ **Roadway speed limit sign (if present) matches the ASD detection speed limit**
  ○ **Margin to be specified *SpeedMargin2***
  ○ **Speed warning is issued via an audible message (tones and/or words).**
  ○ **Event log created with warning trigger near real-time**
  ○ **Stored encrypted event logs are uploaded and purged from the device**
  ○ **Incident log examined to show speeds and alert and location**
 	
• **Run 4, above speed limit, above the overspeed parameter and then at the speed limit. Then above speed limit, above the overspeed parameter:**
  ○ **Roadway speed limit sign (if present) matches the ASD detection speed limit**
  ○ **Margin to be specified *SpeedMargin1***
  ○ **Margin to be specified *SpeedMargin2***
  ○ **Speed warning is issued via an audible message (tones and/or words)**
  ○ **No speed warning is issued when driving is below the speed limit**
  ○ **Speed warning is issued via an audible message (tones and/or words)**
  ○ **Event log created with warning trigger near real-time**
  ○ **Stored encrypted event logs are uploaded and purged from the device**
  ○ **Incident log examined to show speeds and alert and location**	

3.2.2.6 Use Case 2 Demonstration 1 Actions

Table 42 – UC2D1 Actions

No.	Actions	Expected Result	Pass/Fail/Comments
Run 1			
1	VEH-1 drives from starting point towards start cone		
2	VEH-1 reaches start cone driving at **[SpeedMargin1]** below **[SpeedLimitVar]**	No warning issued to driver	Pass ___ Fail ___ Comments:
3	VEH-1 drives at **[SpeedMargin1]** below **[SpeedLimitVar]** through the RSU range	No warning issued to driver	Pass ___ Fail ___ Comments:
4	VEH-1 reaches stop cone	No warning issued to driver	Pass ___ Fail ___ Comments:
Run 2			
5	VEH-1 drives from starting point towards start cone		
6	VEH-1 reaches start cone driving at **[SpeedMargin1]** below **[SpeedLimitVar]**	No warning issued to driver	Pass ___ Fail ___ Comments:
7	VEH-1 drives at **[SpeedLimitVar]** through the RSU range	No warning issued to driver	Pass ___ Fail ___ Comments:
8	VEH-1 reaches stop cone	No warning issued to driver	Pass ___ Fail ___ Comments:
Run 3			
13	VEH-1 drives from starting point towards start cone		
14	VEH-1 reaches start cone driving at **[SpeedMargin1]** below **[SpeedLimitVar]**	No warning issued to driver	Pass ___ Fail ___ Comments:
15	VEH-1 drives **[SpeedMargin2]** above the over speed parameter through the RSU range	Speed limit warning issued to the driver	Pass ___ Fail ___ Comments:
16	VEH-1 reaches stop cone	Speed limit warning issued to the driver	Pass ___ Fail ___ Comments:
Run 4			

No.	Actions	Expected Result	Pass/Fail/Comments
21	VEH-1 drives from starting point towards start cone		
22	VEH-1 reaches start cone driving at **[SpeedMargin1]** below **[SpeedLimitVar]**	No warning issued to driver	Pass ___ Fail ___ Comments:
23	VEH-1 drives **[SpeedMargin2]** above the over speed parameter for 200 feet through the RSU range	Speed limit warning issued to the driver	Pass ___ Fail ___ Comments:
24	VEH-1 drives **[SpeedLimitVar]** for 200 feet through the RSU range	No warning issued to driver	Pass ___ Fail ___ Comments:
25	VEH-1 drives **[SpeedMargin2]** above the over speed parameter through the rest of the RSU range	Speed limit warning issued to the driver	Pass ___ Fail ___ Comments:
26	VEH-1 reaches stop cone	Speed limit warning issued to the driver	Pass ___ Fail ___ Comments:

3.2.2.7 Use Case 2 Demonstration 2 Scene - NOT DEMONSTRATED 8/19

The demonstrations and steps listed below are subject to adjustment due to local conditions (e.g., weather, the presence of pedestrians and other vehicles). Figure 6 shows the sample MAP message configuration that was developed for demonstrating the Speed Compliance/Work Zone (SPDCOMPWZ) for static zones at the Aqueduct. However, this application was demonstrated around NYCDOT at 47th Ave. @ 34th and 35th St. in Long Island City, Queens, NY.

Table 43 – UC2D2 Scene

Use Case 2: Traffic Manager Functionality

Demonstration 2: Speed compliance/Work Zone operation using the Speed Compliance application

Purpose: Demonstrate over speed warnings for work and school zones that are statically located. This proves that when a vehicle's speed exceeds the over speed parameter and the configured time-of-day and day-of-week parameters are not set to the day of testing then no warning message is issued to the driver

Variables:

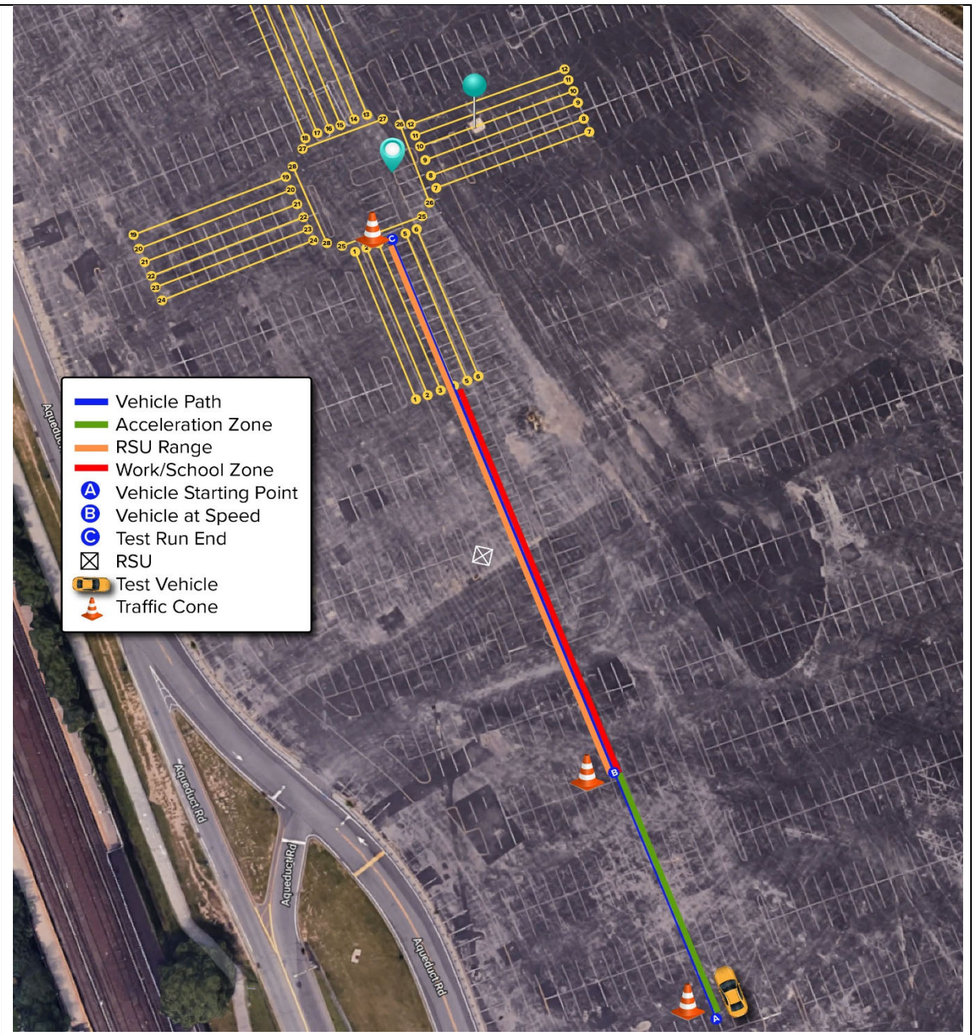
- **RSU Range = [RSURangeVar]**
- **Speed Limit = [SpeedLimitVar] = 15 mph**
- **Time of Day schedule = [TODScheduleVar]**
- **Day of Week schedule = [DOWScheduleVar]**
- **Over speed Limit parameter = [OverSpeedLimitVar] = 0 mph**
- **Speed Margin 1 = [SpeedMargin1] = -5 mph**
- **Speed Margin 2 = [SpeedMargin2] = +5 mph**
- **Speed Margin 3 = [SpeedMargin3] = -3 mph**
- **Vehicle 1 driver = VEH-1**

Pre-Conditions:

- **Identify work or school zone**
- **Set the RSU range. For example, [RSURangeVar] = 300 ft distance**
- **Mark the vehicle starting point**
- **Place start cone at the beginning edge of RSU range**
- **Place stop cone at the end of RSU range**
- **Define a speed limit for the roadway segment. For example, [SpeedLimitVar] = 25MPH**
- **Define a time-of-day and day-of-week schedule. For example, [TODScheduleVar] = 1PM and [DOWScheduleVar] = January 1, 2019**
- **Define the "over speed" parameter. For example, [OverSpeedLimitVar] = 10MPH**
- **One of the following vehicle types are available for testing: Light Duty Vehicle ASD, Bus vehicle ASD or Commercial Vehicle ASD**
- **A decryption tool is available that is not the event log processing center**

Test Cases:

Requirements:
101.3.2,101.3.3,101.3.4,101.3.5,101.3.6,101.3.7,101.3.8,101.3.9,101.3.10,101.3.11,101.3.12,101.3.13,101.3.14,101.3.15,101.3.16,101.3.17, 203.6.4,203.6.5,203.6.6



(Source: NYCDOT)

Figure 6 – Sample MAP Message Configuration for ORD of SPDCOMPWZ Application for Static Zones at the Aqueduct

Demonstrator: Phase 2 Participant Driver **Facilitator: TransCore employee** **Observer: USDOT AOR and Reviewers representatives** **Observer Experience:** **Observers ride in participant vehicle equipped with an ASD on which the software is installed and commissioned. Vehicle begins at the starting point and travels inbounds towards the beginning edge of the RSU. The observers note that when the ASD is in range of the RSU; at this point the ASD receives the speed limit information. The observers note that when the driver is driving above the speed limit threshold that no alert message is received.** **Two demonstration runs:** • **Run 1: Vehicle is driven above the [SpeedLimitVar] but less than the [OverSpeedLimitVar]** • **Run 2: Vehicle is driven above the [SpeedLimitVar] and exceeds the [OverSpeedLimitVar]** **Expectation:** • **Run 1, above the speed limit and below overspeed parameter:** ○ **Roadway speed limit sign matches the ASD detection speed limit** ○ **No speed warning is issued** ○ **Margin to be specified *SpeedMargin1*** ○ **Margin to be specified *SpeedMargin3*** ○ **No encrypted event logs created** • **Run 2, above speed limit and above the overspeed parameter:** ○ **Roadway speed limit sign matches the ASD detection speed limit** ○ **No speed warning is issued** ○ **Margin to be specified *SpeedMargin1*** ○ **Margin to be specified *SpeedMargin2*** ○ **No encrypted event logs created**	

3.2.2.8 Use Case 2 Demonstration 2 Actions

Note that it is recommended that SpeedMargin1 be set to 5 MPH to minimize the human error in maintaining the speed of the vehicle. Each test run can be repeated at different SpeedMargin1 variables.

SpeedMargin3 is set to a value which will test the variability of the detection and should be set to avoid false alerts.

SpeedMargin2 is set to a value which must trigger an alert above the high threshold.

Table 44 – UC2D2 Actions

No.	Actions	Expected Result	Pass/Fail/Comments
Run 1			
1	VEH-1 drives from starting point towards start cone		
2	VEH-1 reaches start cone driving at **[SpeedMargin1]** below **[SpeedLimitVar]**	No warning issued to driver	Pass ___ Fail ___ Comments:
3	VEH-1 drives **[SpeedMargin3]** below the over speed parameter through the RSU range	No warning issued to driver	Pass ___ Fail ___ Comments:
4	VEH-1 reaches stop cone	No warning issued to driver	Pass ___ Fail ___ Comments:
Run 2			
6	VEH-1 drives from starting point towards start cone		
7	VEH-1 reaches start cone driving at **[SpeedMargin1]** below **[SpeedLimitVar]**	No warning issued to driver	Pass ___ Fail ___ Comments:
8	VEH-1 drives **[SpeedMargin2]** above the over speed parameter through the RSU range	No warning issued to driver	Pass ___ Fail ___ Comments:
9	VEH-1 reaches stop cone	No warning issued to driver	Pass ___ Fail ___ Comments:

3.2.2.9 Use Case 2 Demonstration 3 Scene – NOT DEMONSTRATED 8/19

The demonstrations and steps listed below are subject to adjustment due to local conditions (e.g., weather, the presence of pedestrians and other vehicles). Figure 7 shows the sample MAP message configuration that was developed for demonstrating the Speed Compliance/Work Zone (SPDCOMPWZ) for dynamic zones at the Aqueduct. However, this application was not demonstrated during the ORD.

Table 45 – UC2D3 Scene

Use Case 2: Traffic Manager Functionality

Demonstration 3: Speed compliance/Work Zone operation using the TIM DSRC message application

Purpose: Demonstrate over speed warnings for work zone areas that are dynamically located.

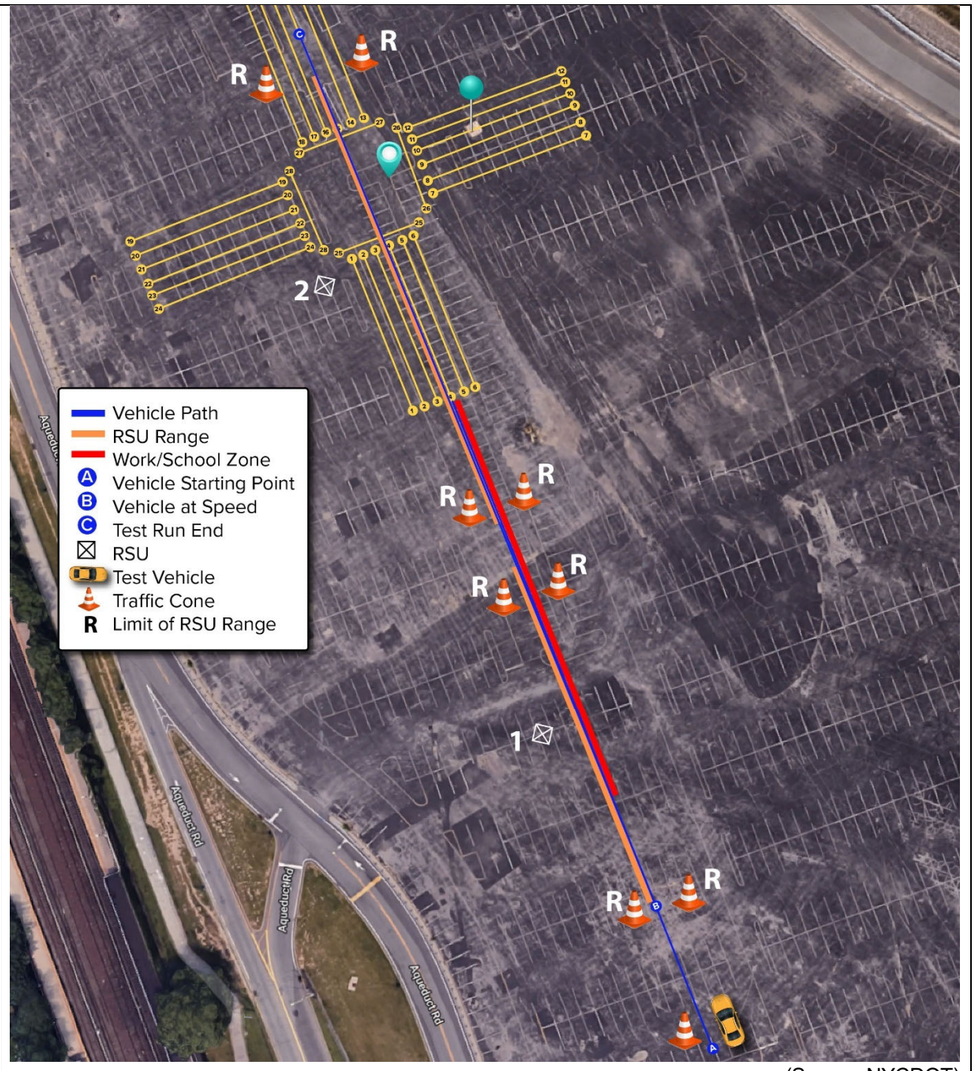
Variables:

- **RSU Range = [RSU1RangeVar]**
- **Speed Limit = [SpeedLimitVar] = 15 mph**
- **Time of Day schedule = [TODScheduleVar]**
- **Day of Week schedule = [DOWScheduleVar]**
- **Over speed Limit parameter = [OverSpeedLimitVar]**
- **Speed Margin 1 = [SpeedMargin1] = -5 mph**
- **Speed Margin 2 = [SpeedMargin2] = +5 mph**
- **Speed Margin 3 = [SpeedMargin3] = -3 mph**
- **Vehicle 1 driver = VEH-1**
- **Warning Time-Outs = [WarningTimeOutVar]**

Pre-Conditions:

- **Identify work zone**
- **Set the range for RSU1 and RSU2 to be very close in distance along the roadway segment**
- **Set each RSU range. For example, [RSURangeVar] = 300 ft distance**
- **Mark the vehicle starting point**
- **Two RSU are available for testing: RSU1 is the known as the barrier truck and RSU 2 is known as the lead vehicle:**
  - **Place start cone at the beginning edge of RSU1 range**
  - **Place stop cone at the end of RSU1 range**
  - **Place start cone at the beginning edge of RSU2 range**
  - **Place stop cone at the end of RSU2 range**
- **Define a speed limit for the roadway segment. For example, [SpeedLimitVar] = 25MPH**
- **Define a time-of-day and day-of-week schedule. For example, [TODScheduleVar] = 1PM and [DOWScheduleVar] = January 1, 2019**
- **Define the "over speed" parameter. For example, [OverSpeedLimitVar] = 10MPH**
- **Define the warning time-out/end time values. For example, [WarningTimeOutVar] = 2 hours**
- **One of the following vehicle types are available for testing: Light Duty Vehicle ASD, Bus vehicle ASD or Commercial Vehicle ASD**
- **A decryption tool is available that is not the event log processing center**

Test Cases:



(Source: NYCDOT)

Figure 7 – Sample MAP Message Configuration for ORD of SPDCOMPWZ Application for Dynamic Zones at the Aqueduct

Requirements:
101.3.2,101.3.3,101.3.4,101.3.5,101.3.6,101.3.7,101.3.8,101.3.9,101.3.10,101.3.11,101.3.12,101.3.13,101.3.14,101.3.15,101.3.16,101.3.17, 203.6.4,203.6.5,203.6.6
 	
Demonstrator: Phase 2 Participant Driver
 	
Facilitator: TransCore employee
 	
Observer: USDOT AOR and Reviewers representatives
 	
Observer Experience:
 	
Observers ride in participant vehicle equipped with an ASD on which the software is installed and commissioned. Vehicle begins at the starting point and travels inbounds towards the beginning edge of the RSU installed on a barrier truck at the entry point. The observers note that when the ASD is in range of the RSU installed on a barrier truck or a lead vehicle that it notifies the driver that the speed limit is active and the geographic limit of the speed zone. Otherwise no alert is received.
 	
Nine demonstration runs:
 	
Small work zone (entirely within the RF range of one RSU) – one RSU device installed at the entry point of the work zone area. Start and end cones used for RSU 1.
 	
Large work zone (size exceeds RF range of one RSU)– Two RSU devices installed in the work zone area. One is installed at the entry point of the work zone and the other is installed at the end of the work zone. Start and end cones used for RSU 1 and RSU 2.
 	
• **Run 1: Vehicle is driven below [SpeedLimitVar] and [WarningTimeOutVar] has not expired in small work zone**
• **Run 2: Vehicle is driven [SpeedLimitVar] and [WarningTimeOutVar] has expired in small work zone**
• **Run 3: Vehicle is driven above the [SpeedLimitVar] but less than the [OverSpeedLimitVar] and [WarningTimeOutVar] has not expired in small work zone**
• **Run 4: Vehicle is driven above the [SpeedLimitVar] and exceeds the [OverSpeedLimitVar] and [WarningTimeOutVar] has expired in small work zone**
• **Run 5: Vehicle is driven below [SpeedLimitVar] and [WarningTimeOutVar] has not expired in large work zone**
• **Run 6: Vehicle is driven [SpeedLimitVar] and [WarningTimeOutVar] has expired in large work zone**
• **Run 7: Vehicle is driven above the [SpeedLimitVar] but less than the [OverSpeedLimitVar] and [WarningTimeOutVar] has not expired in large work zone**
• **Run 8: Vehicle is driven above the [SpeedLimitVar] and exceeds the [OverSpeedLimitVar] and [WarningTimeOutVar] has expired in large work zone**
• **Run 9: Vehicle is driven above the [SpeedLimitVar] and exceeds the [OverSpeedLimitVar] and [WarningTimeOutVar] has not expired in large work zone and the system fails**
 	
Expectation:
• **Run 1, Small work zone: below speed limit and warning time-out parameter has not expired:**
  ○ **Driver receives speed zone warning and the geographic limit of the speed zone**
  ○ **Margin to be specified *SpeedMargin1***
 	
• **Run 2, Small work zone: at speed limit and warning time-out parameter has expired:**
  ○ **Driver receives speed zone warning and the geographic limit of the speed zone**	

• **Run 3, Small work zone: above the speed limit, below overspeed parameter and warning time-out parameter has not expired:**
  ○ **Driver receives speed zone warning and the geographic limit of the speed zone**
  ○ **Margin to be specified *SpeedMargin1***
  ○ **Margin to be specified *SpeedMargin3***
•
• **Run 4, Small work zone: above speed limit, above the overspeed parameter and warning time-out parameter has expired:**
  ○ **Driver receives speed zone warning and the geographic limit of the speed zone**
  ○ **Margin to be specified *SpeedMargin1***
  ○ **Margin to be specified *SpeedMargin2***
•
• **Run 5, Large work zone: below speed limit and warning time-out parameter has not expired:**
  ○ **Driver receives speed zone warning and the geographic limit of the speed zone**
  ○ **Margin to be specified *SpeedMargin1***
•
• **Run 6, Large work zone: at speed limit and warning time-out parameter has expired:**
  ○ **Driver receives speed zone warning and the geographic limit of the speed zone**
•
• **Run 7, Large work zone: above the speed limit, below overspeed parameter and warning time-out parameter has not expired:**
  ○ **Driver receives speed zone warning and the geographic limit of the speed zone**
  ○ **Margin to be specified *SpeedMargin1***
  ○ **Margin to be specified *SpeedMargin3***
•
• **Run 8, Large work zone: above speed limit, above the overspeed parameter and warning time-out parameter has expired:**
  ○ **Driver receives speed zone warning and the geographic limit of the speed zone**
  ○ **Margin to be specified *SpeedMargin1***
  ○ **Margin to be specified *SpeedMargin2***
•
• **Run 9, Large work zone: above speed limit, above the overspeed parameter, warning time-out parameter has not expired and system fails:**
  ○ **Driver receives speed zone warning and the geographic limit of the speed zone**
  ○ **Margin to be specified *SpeedMargin1***
  ○ **Margin to be specified *SpeedMargin2***
  ○ **No warning issued to driver when system fails**	

3.2.2.10 Use Case 2 Demonstration 3 Actions

Note that it is recommended that SpeedMargin1 be set to 5 MPH to minimize the human error in maintaining the speed of the vehicle. Each test run can be repeated at different SpeedMargin1 variables.

SpeedMargin3 is set to a value which will test the variability of the detection and should be set to avoid false alerts.

SpeedMargin2 is set to a value which must trigger an alert above the high threshold.

Table 46 – UC2D3 Actions

No.	Actions	Expected Result	Pass/Fail/Comments
Run 1			
1	VEH-1 drives from starting point towards start cone at RSU1		
2	VEH-1 reaches start cone at RSU1 driving at **[SpeedMargin1]** below **[SpeedLimitVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
3	VEH-1 drives at **[SpeedMargin1]** below **[SpeedLimitVar]** through the RSU range while the warning end time is below **[WarningTimeoutVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
4	VEH-1 reaches stop cone at RSU1 and the warning end time is below **[WarningTimeoutVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
5	VEH-1 drives pass the stop cone at RSU1	No warning issued to driver	Pass ___ Fail ___ Comments:
Run 2			
6	VEH-1 drives from starting point towards start cone at RSU1		
7	VEH-1 reaches start cone at RSU1 driving at **[SpeedMargin1]** below **[SpeedLimitVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
8	VEH-1 drives at **[SpeedLimitVar]** through the RSU range while the warning end time is below **[WarningTimeoutVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
9	VEH-1 reaches stop cone at RSU1 and the warning end time is above **[WarningTimeoutVar]**	No warning issued to driver	Pass ___ Fail ___ Comments:
10	VEH-1 drives pass the stop cone at RSU1	No warning issued to driver	Pass ___ Fail ___ Comments:

No.	Actions	Expected Result	Pass/Fail/Comments
Run 3			
11	VEH-1 drives from starting point towards start cone at RSU1	No warning issued to driver	Pass ___ Fail ___ Comments:
12	VEH-1 reaches start cone at RSU1 driving at **[SpeedMargin1]** below **[SpeedLimitVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
13	VEH-1 drives **[SpeedMargin3]** below the over speed parameter through the RSU range and the warning end time is above **[WarningTimeoutVar]** before reaching the stop cone	No warning issued to driver	Pass ___ Fail ___ Comments:
14	VEH-1 reaches stop cone at RSU1 and the warning end time is above **[WarningTimeoutVar]**	No warning issued to driver	Pass ___ Fail ___ Comments:
15	VEH-1 drives pass the stop cone at RSU1	No warning issued to driver	Pass ___ Fail ___ Comments:
Run 4			
16	VEH-1 drives from starting point towards start cone at RSU1		
17	VEH-1 reaches start cone at RSU1 driving at **[SpeedMargin1]** below **[SpeedLimitVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
18	VEH-1 drives **[SpeedMargin2]** above the over speed parameter through the RSU range while the warning end time is below **[WarningTimeoutVar]** before reaching the stop cone	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
19	VEH-1 reaches stop cone at RSU1 and the warning end time is below **[WarningTimeoutVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
20	VEH-1 drives pass the stop cone at RSU1	No warning issued to driver	Pass ___ Fail ___ Comments:
Run 5			
21	VEH-1 drives from starting point towards start cone at RSU1		

No.	Actions	Expected Result	Pass/Fail/Comments
22	VEH-1 reaches start cone at RSU1 driving at **[SpeedMargin1]** below **[SpeedLimitVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
23	VEH-1 drives at **[SpeedMargin1]** below **[SpeedLimitVar]** through the RSU range while the warning end time is below **[WarningTimeoutVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
24	VEH-1 reaches stop cone at RSU1 and the warning end time is below **[WarningTimeoutVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
25	VEH-1 drives from stop cone of RSU 1 towards start cone at RSU2	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
26	VEH-1 reaches start cone at RSU2 driving at **[SpeedMargin1]** below **[SpeedLimitVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
27	VEH-1 drives at **[SpeedMargin1]** below **[SpeedLimitVar]** through the RSU2 range while the warning end time is below **[WarningTimeoutVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
28	VEH-1 reaches stop cone at RSU2 and the warning end time is below **[WarningTimeoutVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
29	VEH-1 drives pass the stop cone at RSU2	No warning issued to driver	Pass ___ Fail ___ Comments:
Run 6			
30	Repeat steps 21 through 24 above	Test steps pass	Pass ___ Fail ___ Comments:
31	VEH-1 drives from stop cone at RSU1 towards start cone at RSU2	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
32	VEH-1 reaches start cone at RSU2 driving at **[SpeedMargin1]** below **[SpeedLimitVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
33	VEH-1 drives at **[SpeedLimitVar]** through the RSU2 range while the warning end time is below **[WarningTimeoutVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:

No.	Actions	Expected Result	Pass/Fail/Comments
34	VEH-1 reaches stop cone at RSU2 and the warning end time is above **[WarningTimeoutVar]**	No warning issued to driver	Pass ___ Fail ___ Comments:
35	VEH-1 drives pass the stop cone at RSU2	No warning issued to driver	Pass ___ Fail ___ Comments:
Run 7			
36	Repeat steps 21 through 24 above	Test steps pass	Pass ___ Fail ___ Comments:
37	VEH-1 drives from stop cone at RSU1 towards start cone at RSU2	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
38	VEH-1 reaches start cone at RSU2 driving at **[SpeedMargin1]** below **[SpeedLimitVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
39	VEH-1 drives **[SpeedMargin3]** below the over speed parameter through the RSU2 range and the warning end time is above **[WarningTimeoutVar]** before reaching the stop cone	No warning issued to driver	Pass ___ Fail ___ Comments:
40	VEH-1 reaches stop cone at RSU2 and the warning end time is above **[WarningTimeoutVar]**	No warning issued to driver	Pass ___ Fail ___ Comments:
41	VEH-1 drives pass the stop cone at RSU2	No warning issued to driver	Pass ___ Fail ___ Comments:
Run 8			
42	Repeat steps 21 through 24 above	Test steps pass	Pass ___ Fail ___ Comments:
43	VEH-1 drives from stop cone at RSU1 towards start cone at RSU2	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
44	VEH-1 reaches start cone at RSU2 driving at **[SpeedMargin1]** below **[SpeedLimitVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:

No.	Actions	Expected Result	Pass/Fail/Comments
45	VEH-1 drives **[SpeedMargin2]** above the over speed parameter through the RSU2 range while the warning end time is below **[WarningTimeoutVar]** before reaching the stop cone	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
46	VEH-1 reaches stop cone at RSU2 and the warning end time is below **[WarningTimeoutVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
47	VEH-1 drives pass the stop cone at RSU2	No warning issued to driver	Pass ___ Fail ___ Comments:
Run 9			
48	Repeat steps 21 through 24 above	Test steps pass	Pass ___ Fail ___ Comments:
49	VEH-1 drives from stop cone at RSU1 towards start cone at RSU2	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
50	Trigger a system failure between the ASD in VEH-1 and RSU2	System failure detected	Pass ___ Fail ___ Comments
51	VEH-1 drives **[SpeedMargin2]** above the over speed parameter through the RSU2 range while the warning end time is below **[WarningTimeoutVar]** before reaching the stop cone	No warning issued to driver	Pass ___ Fail ___ Comments:

3.2.2.11 Use Case 3 Demonstration 1 Scene

The demonstrations and steps listed below are subject to adjustment due to local conditions (e.g., weather, the presence of pedestrians and other vehicles).

Table 47 – UC3D1 Scene

Use Case 3: Traffic Manager Functionality **Demonstration 1: Curve Speed compliance using the TIM message application** **Purpose: Demonstrate the curve speed functionality** Variables: • **RSU Range = [RSU1RangeVar]** • **Curve Speed Limit = [CurveSpeedLimitVar] = 15 mph** • **Excessive Curve Speed Threshold = [CurveOverSpeedLimitVar] = 25 mph** • **Speed Margin 1 = [SpeedMargin1] = -5 mph** • **Speed Margin 2 = [SpeedMargin2] = +5 mph** • **Vehicle 1 driver = VEH-1** • **Warning Time-Outs = [WarningTimeOutVar]** Pre-Conditions: • **Define a curve speed limit for the roadway segment. For example, [CurveSpeedLimitVar] = 15 MPH** • **Define the excessive curve speed threshold. For example, [CurveOverSpeedLimitVar] = 25 MPH** • **One of the following vehicle types are available for testing: Light Duty Vehicle ASD, Bus vehicle ASD or Commercial Vehicle ASD** • **A decryption tool is available that is not the event log processing center** **Test Cases:** **Requirements: 101.2.3,101.2.5,101.2.6,101.2.7,101.2.8,101.2.9,101.2.10,101.2.11,101.2.12,101.2.14,101.2.15,101.2.16** **Demonstrator: Phase 2 Participant Driver** **Facilitator: TransCore employee** **Observer: USDOT AOR and Reviewers representatives** **Observer Experience:** **Observers ride in participant vehicle equipped with an ASD on which the intelligent software is installed and commissioned. Vehicle travels inbounds towards roadway/testing vicinity with an RSU installed with curve parameters. The observers note that when the ASD approaches an RSU installed in the area where there is a curve speed warning that it notifies the driver with a curve speed warning.** **Five demonstration runs:** • **Run 1: Vehicle is driven below [CurveSpeedLimitVar]** • **Run 2: Vehicle is driven above the [CurveSpeedLimitVar] and exceeds the [CurveOverSpeedLimitVar]**	Location: NYCDOT Vicinity of 34-02 Queens Blvd. Long Island City, Queens, NY

Expectation: • **Run 1, below curve speed limit:** ○ **No speed warning is issued** ○ **Margin to be specified SpeedMargin1** • **Run 2, above curve speed limit and above the curve overspeed parameter:** ○ **Margin to be specified SpeedMargin1** ○ **Margin to be specified SpeedMargin2** ○ **Curve speed warning is issued via an audible message (tones and/or words).** ○ **Event log created with warning trigger near real-time** ○ **Stored encrypted event logs are uploaded and purged from the device** ○ **Incident log examined to show speeds and alert and location**	

3.2.2.12 Use Case 3 Demonstration 1 Actions

Table 48 – UC3D1 Actions

No.	Actions	Expected Result	Pass/Fail/Comments
Run 1			
1	VEH-1 drives from starting point towards start cone		
2	VEH-1 reaches start cone driving at **[SpeedMargin1]** below **[CurveSpeedLimitVar]**	No warning issued to driver	
3	VEH-1 drives at **[SpeedMargin1]** below **[CurveSpeedLimitVar]** through the RSU range	No warning issued to driver	Pass ___ Fail ___ Comments:
4	VEH-1 reaches stop cone	No warning issued to driver	Pass ___ Fail ___ Comments:
Run 2			
13	VEH-1 drives from starting point towards start cone		
14	VEH-1 reaches start cone driving at **[SpeedMargin1]** below **[CurveSpeedLimitVar]**	No warning issued to driver	Pass ___ Fail ___ Comments:
15	VEH-1 drives **[SpeedMargin2]** above the over speed parameter through the RSU range	Speed limit warning issued to the driver	Pass ___ Fail ___ Comments:
16	VEH-1 reaches stop cone	Speed limit warning issued to the driver	Pass ___ Fail ___ Comments:

3.2.2.13 Use Case 4 Demonstration 1 Scene

The demonstrations and steps listed below are subject to adjustment due to local conditions (e.g., weather, the presence of pedestrians and other vehicles).

Table 49 – UC4D1 Scene

Use Case 4: Traffic Manager Functionality **Demonstration 1: Oversize Vehicle Compliance (OVC) application** **Purpose: Demonstrate the oversize vehicle compliance functionality.** **Variables:** • **RSU Range = [RSURangeVar]** • **Roadway Restriction Height 1= [RdwyRestrHght1]** • **Roadway Restriction Height 2= [RdwyRestrHght2]** • **Advisory Distance Threshold = [AdvisoryDistanceVar]** • **Warning Distance Threshold = [WarningDistanceVar]** • **Vehicle 1 driver = VEH-1** **Pre-Conditions:** • **Place cone at [AdvisoryDistanceVar]** • **Place cone at [WarningDistanceVar]** • **Place cone out of range of RSU to serve as destination for "alternate route"** • **Define roadway restriction height 1 for the test segment (simulated bridge/tunnel). For example [RdwyRestrHght1] = 20 ft.** • **Define roadway restriction height 2 for the test segment (simulated bridge/tunnel). For example [RdwyRestrHght2] = 16 ft.** • **Define the vehicle height in the OVC application associated with the ASD as less than [RdwyRestrHght1] and greater than [RdwyRestrHght2].** • **One of the following vehicle types are available for testing: commercial vehicle or light duty vehicle.** • **A decryption tool is available that is not the event log processing center** **Test Cases: Danlaw TP_OVC_HIL_01, Danlaw TP_OVC_HIL_02, Danlaw TP_OVC_HIL_10, Danlaw TP_OVC_HIL_13** **Requirements: 103.1.1,103.1.2,103.2.1,103.3.1,103.3.2,103.3.3,203.6.7** **Demonstrator: Phase 2 Participant Driver** **Facilitator: TransCore employee** **Observer: USDOT AOR and Reviewers representatives** **Observer Experience:** **Observers ride in participant vehicle equipped with an ASD on which the intelligent software is installed and commissioned. Vehicle travels inbound toward RSU that includes roadway restriction height. The observers note that when the ASD approaches RSUs installed in the area that appropriate height restriction warnings are issued to the driver.** **Four demonstration runs:** • **Run 1: Vehicle's pre-configured height is less than the roadway restriction height.** • **Run 2: Vehicle's pre-configured height is greater than the roadway restriction height; driver heeds advisory alert and takes alternate route.**	Location: NYCDOT Vicinity of 34-02 Queens Blvd. Long Island City, Queens, NY

• **Run 3: Vehicle's pre-configured height is greater than the roadway restriction height; driver heeds advisory alert and stops.**
• **Run 4: Vehicles pre-configured height is greater than the roadway restriction height; driver ignores advisory alert.**
 	
<u>Expectation</u>:
• **Run 1:**
  ○ **Roadway height restriction to be defined as [RdwyRestrHght1]**
  ○ **OVC detects that the vehicle height is less than [RdwyRestrHght1]**
  ○ **No warnings are issued to the driver**
• **Run 2:**
  ○ **Roadway height restriction to be defined as [RdwyRestrHght2]**
  ○ **OVC detects that the vehicle height is more than [RdwyRestrHght2]**
  ○ **Advisory is issued to the driver of the impending low height obstacle via an audible message (tones and/or words).**
  ○ **Driver takes an alternate route**
  ○ **Event log created with warning trigger**
  ○ **Encrypted event log is not decrypted by a tool that is not the event log processing center**
  ○ **Encrypted event log is decrypted by the event log processing center**
  ○ **Stored encrypted event logs are uploaded and purged from the device**
• **Run 3:**
  ○ **Roadway height restriction to be defined as [RdwyRestrHght2]**
  ○ **OVC detects that the vehicle height is more than [RdwyRestrHght2]**
  ○ **Advisory is issued to the driver of the impending low height obstacle via an audible message (tones and/or words).**
  ○ **Driver stops**
  ○ **Event log created with warning trigger**
  ○ **Encrypted event log is not decrypted by a tool that is not the event log processing center**
  ○ **Encrypted event log is decrypted by the event log processing center**
  ○ **Stored encrypted event logs are uploaded and purged from the device**
• **Run 4:**
  ○ **Roadway height restriction to be defined as [RdwyRestrHght2]**
  ○ **OVC detects that the vehicle height is more than [RdwyRestrHght2]**
  ○ **Advisory is issued to the driver of the impending low height obstacle via an audible message (tones and/or words).**
  ○ **Driver ignores the warning of the impending low height obstacle**
  ○ **Driver continues along the route**
  ○ **Warning is issued to the driver of an impending collision via an audible message (tones and/or words)**
  ○ **Event log created with warning trigger near real-time**
  ○ **Encrypted event log is not decrypted by a tool that is not the event log processing center**
  ○ **Encrypted event log is decrypted by the event log processing center**
  ○ **Stored encrypted event logs are uploaded and purged from the device**	

3.2.2.14 Use Case 4 Demonstration 1 Actions

Table 50 – UC4D1 Actions

No.	Actions	Expected Result	Pass/Fail/Comments
Run 1			
1	VEH-1 drives from starting point towards start cone for RSU with **[RdwyRestrHght1**]		

No.	Actions	Expected Result	Pass/Fail/Comments
2	VEH-1 reaches advisory cone for RSU with **[RdwyRestrHght1]**	No warning issued to driver	Pass ___ Fail ___ Comments:
3	VEH-1 reaches warning cone for RSU with **[RdwyRestrHght1]**	No warning issued to driver	Pass ___ Fail ___ Comments:
4	VEH-1 reaches stop cone for RSU with **[RdwyRestrHght1]**	No warning issued to driver	Pass ___ Fail ___ Comments:
Run 2			
5	VEH-1 drives from starting point towards start cone for RSU with **[RdwyRestrHght2**]		
6	VEH-1 reaches advisory cone for RSU with **[RdwyRestrHght2]**	A warning is issued to the driver of the impending low height obstacle	Pass ___ Fail ___ Comments:
7	VEH-1 driver finds an alternate route (leaves course and drives away from RSU).	No more warning issued to driver	Pass ___ Fail ___ Comments:
8	Park VEH-1 and check the event logs for the ASD performance monitoring application	An encrypted event log is created for the warning trigger issued during the test run.	Pass ___ Fail ___ Comments:
Run 3			
9	VEH-1 drives from starting point towards start cone for RSU with **[RdwyRestrHght2**]		
10	VEH-1 reaches advisory cone for RSU with **[RdwyRestrHght2]**	A warning is issued to the driver of the impending low height obstacle	Pass ___ Fail ___ Comments:
11	VEH-1 driver pulls off the roadway and stop for >5 seconds.	No more warning issued to driver	Pass ___ Fail ___ Comments:
Run 4			
12	VEH-1 drives from starting point towards start cone for RSU with **[RdwyRestrHght2**]		
13	VEH-1 reaches advisory cone for RSU with **[RdwyRestrHght2]**	A warning is issued to the driver of the impending low height obstacle	Pass ___ Fail ___ Comments:
14	VEH-1 driver ignores the alert of an impending low height obstacle and continues to drive along the same route	A warning is issued to the driver of the impending low height obstacle .	Pass ___ Fail ___ Comments:
15	VEH-1 reaches warning cone for RSU with **[RdwyRestrHght2]**	A warning is issued to the driver of the impending collision .	Pass ___ Fail ___ Comments:

3.2.2.15 Use Case 5 Demonstration 1

The demonstrations and steps listed below are subject to adjustment due to local conditions (e.g., weather, the presence of pedestrians and other vehicles).

Table 51 – UC5D1 Scene

Use Case 5: Traffic Manager Functionality
 	
Demonstration 1: Emergency Communications and Evacuation Information using the TIM messages
 	
Purpose: Demonstrate how TIM messages containing information from NYCDOT Office of Emergency Response (OER) is transmitted to vehicles in the affected area and equipped with an ASD unit.
 	
Variables:
• **RSU Range = [RSURangeVar]**
 	
Pre-Condition:
• **TIM message transmitted to RSU**
• **RSU is configured to receive emergency-related information**
• **The following vehicle type is available for testing: Light Vehicle ASD**
• **A decryption tool is available that is not the event log processing center**
 	
Test Cases: Danlaw TP_EVAC_HIL_01, Danlaw TP_EVAC_HIL_06, Danlaw TP_EVAC_HIL_10
 	
Requirements: 105.1.1,105.1.1.1, 204.4.4
 	
Demonstrator: Phase 2 Participant Driver
 	
Facilitator: TransCore employee
 	
Observer: USDOT AOR and Reviewers representatives
 	
Observer Experience:
 	
Observers ride in participant vehicle equipped with an ASD on which the intelligent software is installed and commissioned. Vehicle travels within range of an RSU. The observers note that when the RSU receives the emergency-related information, it broadcasts the TIM messages to the ASD, which alerts the driver of the emergency-related information via audio message.
 	
Three demonstration runs:
• **Run 1: Vehicle operates outside range of RSU representing affected area and does not receive alert.**
• **Run 2: TIM alert message is sent to the ASD of the vehicle traveling within range of the RSU representing affected area. Driver leaves the affected area.**
• **Run 3: TIM alert message is sent to the ASD of the vehicle traveling within range of the RSU representing affected area. Driver remains in the affected area.**
 	
Expectation:
• **Run 1:**
  ○ **Application is installed on the ASD and commissioned**
  ○ **Vehicle is operated outside range of RSU**
	Locations: NYCDOT
	Westbound Queens Blvd. at 34th St.
	Long Island City, Queens, NY
	
	6th Ave. between 55th St. and 56th St.
	Manhattan

○ **No alerts are issued to the driver** • **Run 2:** ○ **Application is installed on the ASD and commissioned** ○ **RSU receives emergency related information and broadcast the TIM messages to the ASDs in the vehicles in the areas of interest** ○ **ASD alerts driver on the emergency-related information via audio message.** ○ **Driver leaves the affected area** ○ **ASD collects the BSMs before and after the alert and records the event** ○ **Stored encrypted event logs are uploaded and purged from the device** • **Run 3:** ○ **Application is installed on the ASD and commissioned** ○ **RSU receives emergency related information and broadcast the TIM messages to the ASDs in the vehicles in the areas of interest** ○ **ASD alerts driver on the emergency-related information via audio message.** ○ **Driver ignores the alert and continues in the affected geographical area** ○ **ASD collects the BSMs before and after the alert and records the event** ○ **Stored encrypted event logs are uploaded and purged from the device**	

3.2.2.16 Use Case 5 Demonstration 1 Actions

Table 52 – UC5D1 Actions

No.	Actions	Expected Result	Pass/Fail/Comments
Run 1			
1	VEH-1 approaches but does not enter range of RSU	No warning issued to driver	Pass ___ Fail ___ Comments:
Run 2			
2	VEH-1 approaches cone representing RSU range		
3	VEH-1 reaches cone representing RSU range	The ASD alerts the driver on the emergency-related information via audio message	Pass ___ Fail ___ Comments:
4	The driver of VEH-1 turns off the affected geographical area, finds an alternate route but is still inside the RSU zone	The ASD alerts the driver on the emergency-related information via audio message	Pass ___ Fail ___ Comments:
5	The driver of VEH-1 reaches the cone representing “outside affected area.”	No more warning issued to driver	Pass ___ Fail ___ Comments:
6	Driver parks VEH-1	The vehicle is parked	Pass ___ Fail ___ Comments:
7	Check the events logged in the ASD	Records of BSMs before and after the alert are created	Pass ___ Fail ___

No.	Actions	Expected Result	Pass/Fail/Comments
			Comments:
8	VEH-1 passes through the testing vicinity of the same RSU that advertises that it can upload the event logs	The stored encrypted event logs are uploaded and purged from the device	Pass ___ Fail ___ Comments:
Run 3			
9	VEH-1 approaches the cone representing RSU range		
10	VEH-1 reaches cone representing RSU range	The ASD alerts the driver on the emergency-related information via audio message	Pass ___ Fail ___ Comments:
11	The driver of VEH-1 ignores the warning and continues in the geographical area but is still inside the RSU zone	The ASD alerts the driver on the emergency-related information via audio message	Pass ___ Fail ___ Comments:
12	The driver of VEH-1 ignores the warning and continues in the geographical area but is not inside the RSU zone	No more warning issued to driver	Pass ___ Fail ___ Comments:
13	Driver parks VEH-1	The vehicle is parked	Pass ___ Fail ___ Comments:
14	Check the events logged in the ASD	Records of BSMs before and after the alert are created	Pass ___ Fail ___ Comments:
15	VEH-1 passes through the testing vicinity of the same RSU that advertises that it can upload the event logs	The stored encrypted event logs are uploaded and purged from the device	Pass ___ Fail ___ Comments:

3.2.2.17 Use Case 6 Demonstration 1 Scene – NOT DEMONSTRATED 8/19

Figure 8 shows the sample MAP message configuration that was developed for demonstrating the vehicle trip initiation use case. at the Aqueduct. However, this application was not demonstrated during the ORD.

Table 53 – UC6D1 Scene

Use Case 6: Roadway User Functionality

Demonstration 1: Vehicle Trip Initiation

Purpose: Demonstrate that when the vehicle operator starts the ASD-equipped vehicle, the ASD will send a notification response to the driver, confirming that it is turned on and that CV applications are ready for operation.

Variables:

Pre-Condition:

- **Test vehicle equipped with an ASD unit**
- **One of the following vehicle types is available for testing: Light Duty Vehicle ASD, Bus vehicle ASD or Commercial Vehicle ASD**
- **RSU is placed at a designated entry point for the vehicle fleet terminal or parking point location**
- **RSU is placed at a designated exit point for the vehicle fleet terminal or parking point location**

Test Cases:

Requirements: 202.4.3

Demonstrator: Phase 2 Participant Driver

Facilitator: TransCore employee

Observer: USDOT AOR and Reviewers representatives

Observer Experience:

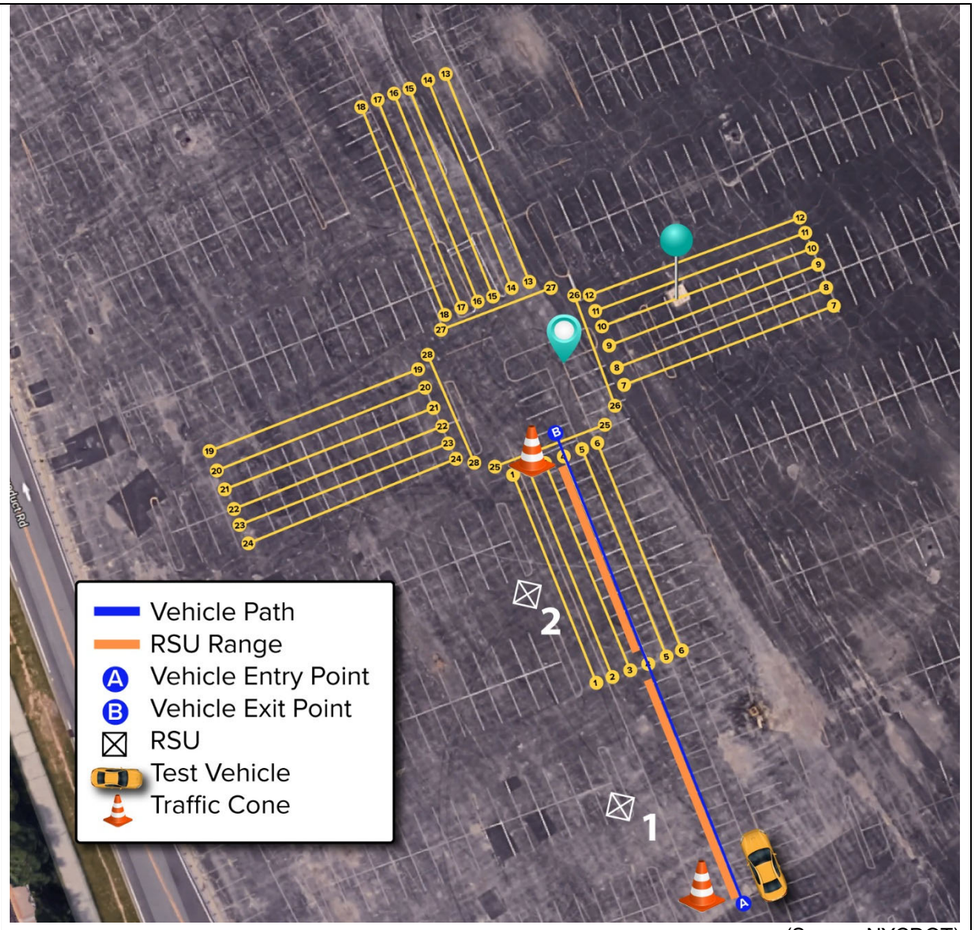
Observers sit in participant vehicle equipped with an ASD on which the software is installed and commissioned. The vehicle operator turns on the ignition for the ASD-equipped vehicle that is placed at a designated entry and exit point for the vehicle fleet terminal or parking point location. The observers note that the ASD sends a notification to the driver to indicate that the device is turned on and that the connected vehicle applications are ready for operation.

One demonstration run:

- **Run 1: RSU is placed at a designated entry and exit point for the vehicle fleet terminal or parking point location. ASD-equipped vehicle starts, and confirmation is sent that the device is turned on and ready for operation.**

Expectation:

- **Run 1:**
  - **ASD-equipped vehicle starts**
  - **Driver is notified to confirm that the device is turned on and ready for operation**
  - **ASD logs the start-up event**
  - **Driver resumes his or her normal operation**



(Source: NYCDOT)

Figure 8 – Sample MAP Message Configuration for ORD of the Use Case on Vehicle Trip Initiation

3.2.2.18 Use Case 6 Demonstration 1 Actions

Table 54 – UC6D1 Actions

No.	Actions	Expected Result	Pass/Fail/Comments
Run 1			
1	Drive VEH-1 equipped with an ASD to the [EntryPointRSU]	VEH -1 is at the entry point of the vehicle fleet terminal	
2	Driver turns on the ignition for VEH-1 at [EntryPointRSU]	Vehicle's VIN and VIN registered in the ASD match Driver is notified (via a speaker's voice audio prompt) that the ASD is turned on and that the connected vehicle applications are ready for operation	Pass ___ Fail ___ Comments:
3	Check the ASD logs	ASD logs the start-up event	Pass ___ Fail ___ Comments:
4	Driver of VEH-1 exits the [ExitPointRSU]	ASD uploads its System Status Log (SSL) with all events during the last 24-hour period, the ASD's serial number The driver gets a confirmation that the ASD has not been moved to another vehicle.	Pass ___ Fail ___ Comments:
5	Driver of VEH-1 resumes normal operation by driving a few hundred feet from [ExitPointRSU]	No warning issued to driver	Pass ___ Fail ___ Comments:

3.2.2.19 Use Case 6 Demonstration 2 Scene – NOT DEMONSTRATED 8/19

Table 55 – UC6D2 Scene

Use Case 6: Roadway User Functionality **Demonstration 2: Vehicle Trip Initiation** **Purpose: Demonstrate that when the vehicle operator starts the ASD-equipped vehicle, the ASD will send a notification to the driver that the system is not ready for operation if any faults have been detected.** **Variables:** • **Entry Point RSU = [EntryPointRSU]** • **Exit Point RSU = [ExitPointRSU]** • **Vehicle 1 driver = VEH-1** • **Vehicle 2 driver = VEH-2** **Pre-Conditions:** • **Two ASD-equipped vehicles are available for testing** • **Use the ASD application to configure multiple ASD-equipped vehicles with the same VIN. For example, VEH-1 = 1HCM82633A004352, VEH-2 = 1HCM82633A004352** • **One of the following vehicle types is available for testing: Light Duty Vehicle ASD, Bus vehicle ASD or Commercial Vehicle ASD** • **RSU is placed at a designated entry point for the vehicle fleet terminal or parking point location** • **RSU is placed at a designated exit point for the vehicle fleet terminal or parking point location** • **Determine a way to trigger a communication or device failure in the ASD** **Test Cases:** **Requirements: 202.4.3** **Demonstrator: Phase 2 Participant Driver** **Facilitator: TransCore employee** **Observer: USDOT AOR and Reviewers representatives** **Observer Experience:** **Observers sit in participant vehicle equipped with an ASD on which the software is installed and commissioned. The vehicle uses a VIN that is used by another vehicle. The vehicle operator turns on the ignition for the ASD-equipped vehicle that is placed at a designated entry for the vehicle fleet terminal or parking point location. The observers note that the ASD sends a notification to the driver, that the ASD has a failure and is not ready for operation.** **Two demonstration runs:** • **Run 1: RSU is placed at a designated entry and exit point for the vehicle fleet terminal or parking point location. ASD-equipped vehicle starts, and a failure is detected (device failure) that the device is not ready for operation.** • **Run 2: RSU is placed at a designated entry and exit point for the vehicle fleet terminal or parking point location. ASD-equipped vehicle starts, and a failure is detected (identical VINs detected) that the device is not ready for operation.**	

Expectation:
• **Run 1:**
  ○ **ASD-equipped vehicle starts**
  ○ **Driver is notified that a fault is detected and that the device is not ready for operation**
  ○ **ASD logs the start-up event and the fault (communication/device failure)**
  ○ **Driver notifies the fleet owner**
  ○ **Fleet owner notifies NYCDOT**
  ○ **NYCDOT ASD Operations Manager coordinates and arranges diagnostics and repairs of the ASD**
  ○ **NYCDOT maintenance personnel visits the fleet terminal and performs the repairs as needed**
  ○ **Driver resumes normal operation**
• **Run 2:**
  ○ **ASD-equipped vehicle starts**
  ○ **Driver is notified that a fault is detected and that the device is not ready for operation**
  ○ **ASD logs the start-up event and the fault (identical VIN)**
  ○ **Driver notifies the fleet owner**
  ○ **Fleet owner notifies NYCDOT**
  ○ **NYCDOT ASD Operations Manager coordinates and arranges diagnostics and repairs of the ASD**
  ○ **NYCDOT maintenance personnel visits the fleet terminal and performs the repairs as needed**
  ○ **Driver resumes normal operation**	

3.2.2.20 Use Case 6 Demonstration 2 Actions

Table 56 – UC6D2 Actions

No.	Actions	Expected Result	Pass/Fail/Comments
Run 1			
1	Drive VEH-1 equipped with an ASD to the [EntryPointRSU]	VEH -1 is at the entry point of the vehicle fleet terminal	
2	Trigger an action to cause a communication or device failure in the ASD while the car's ignition is not turned on	Failure operation done	Pass ___ Fail ___ Comments:
3	Driver turns on the ignition for VEH-1 equipped with an ASD that is located at the [EntryPointRSU]	Driver is notified (via a speaker's voice audio prompt) that the ASD failed to initiate and is not ready for operation.	Pass ___ Fail ___ Comments:
4	Check the ASD logs	ASD logs the start-up event and the fault	Pass ___ Fail ___ Comments:
5	Driver records the fault using the defect notification card	Defect notification card dropped off in box for the fleet owner	Pass ___ Fail ___ Comments:
6	Fleet owner notifies NYCDOT of the ASD failure.	NYCDOT ASD Operations Manager coordinates and arranges diagnostics and repair activities with the NYCDOT maintenance personnel and the fleet owner. NYCDOT maintenance personnel visits the fleet garage and performs the repairs as needed.	Pass ___ Fail ___ Comments:

No.	Actions	Expected Result	Pass/Fail/Comments
7	Driver of VEH-1 resumes normal operation	No warning issued to driver	Pass ___ Fail ___ Comments:
Run 2			
8	Drive VEH-2 equipped with an ASD to the [EntryPointRSU]	VEH -2 is at the entry point of the vehicle fleet terminal	
9	Driver turns on the ignition for VEH-2 equipped with an ASD (that has the same VIN as VEH-1that is located at the [EntryPointRSU]	ASD detects identical VINs Driver is notified (via a speaker's voice audio prompt) that the ASD failed to initiate and is not ready for operation	Pass ___ Fail ___ Comments:
10	Check the ASD logs	ASD logs the start-up event and the fault	Pass ___ Fail ___ Comments:
11	Driver records the fault using the defect notification card	Defect notification card dropped off in box for the fleet owner	Pass ___ Fail ___ Comments:
12	Fleet owner notifies NYCDOT of the ASD failure.	NYCDOT ASD Operations Manager coordinates and arranges diagnostics and repair activities with the NYCDOT maintenance personnel and the fleet owner. NYCDOT maintenance personnel visits the fleet garage and performs the repairs as needed.	Pass ___ Fail ___ Comments:
13	Driver of VEH-2 resumes normal operation	No warning issued to driver	Pass ___ Fail ___ Comments:

3.2.2.21 Use Case 7 Demonstration 1 Scene – NOT DEMONSTRATED 8/19

Figure 9 shows the sample MAP message configuration that was developed for demonstrating the vehicle trip initiation use case. at the Aqueduct. However, this application was not demonstrated during the ORD.

Table 57 – UC7D1 Scene

Use Case 7: Roadway User Functionality

Demonstration 1: Driver Reporting Suspected ASD Failure

Purpose: Demonstrate that when the vehicle operator detects that the ASD is no longer sending the audio alerts during normal operation, the operator will notify the fleet owner; then the fleet owner notifies NYCDOT maintenance personnel.

Variables:

- **RSU1 Range = [RSU1RangeVar]**
- **RSU2 Range = [RSU2RangeVar]**
- **Speed Limit = [SpeedLimitVar] = 25 mph**
- **Time of Day schedule = [TODScheduleVar]**
- **Day of Week schedule = [DOWScheduleVar]**
- **Over speed Limit parameter = [OverSpeedLimitVar] = 0 mph**
- **Speed Margin 1 = [SpeedMargin1] = -5 mph**
- **Speed Margin 2 = [SpeedMargin2] = +5 mph**
- **Warning Time-Outs = [WarningTimeOutVar]**
- **RSU Relative Distance = [RSURelDis]**
- Vehicle 1 driver = VEH-1

Pre-Condition:

- **Test drivers has identified a way to trigger a communication or device failure to the ASD unit**
- **Set the range for RSU1 and RSU2 to be very close in distance along the roadway segment**
- **Set each RSU range. For example, [RSU1RangeVar] = 300 ft distance and [RSU2RangeVar] = 300 ft distance**
- **Mark the vehicle starting point**
- **Two RSU are available for testing: RSU1 is the known as the barrier truck and RSU 2 is known as the lead vehicle:**
- **Place start cone at the beginning edge of RSU1 range**
- **Place stop cone at the end of RSU1 range**
- **Place start cone at the beginning edge of RSU2 range**
- **Place stop cone at the end of RSU2 range**
- **Define a speed limit for the roadway segment. For example, [SpeedLimitVar] = 25MPH**
- **Define a time-of-day and day-of-week schedule. For example, [TODScheduleVar] = 1PM and [DOWScheduleVar] = January 1, 2019**
- **Define the "over speed" parameter. For example, [OverSpeedLimitVar] = 10MPH**
- **Define the warning time-out/end time values. For example, [WarningTimeOutVar] = 2 hours**
- **One of the following vehicle types are available for testing: Light Duty Vehicle ASD, Bus vehicle ASD or Commercial Vehicle ASD**

Test Cases:

(Source: NYCDOT)

Figure 9 – Sample MAP Message Configuration for ORD of the Use Case on Driver Reporting Suspected ASD Failure

Requirements: 402.1.1,402.1.2,402.1.3,402.1.4 **Demonstrator: Phase 2 Participant Driver** **Facilitator: TransCore employee** **Observer: USDOT AOR and Reviewers representatives** **Observer Experience:** **Observers ride in participant vehicle equipped with an ASD on which the software is installed and commissioned. Vehicle begins at the starting point and travels inbounds towards the beginning edge of the RSU installed. The observers note that when the ASD passes an RSU, that a notification is sent to the driver. The observers note that when the ASD passes other RSU units, that no notification is sent to the driver when a failure is detected with the ASD.** **One demonstration run:** • **Run 1: Multiple RSU devices are placed on the roadway/testing vicinity. ASD-equipped vehicle travels towards the RSU units and driver is not notified of alerts when passing all the RSU units.** **Expectation:** **Run 1:** • **Roadway speed limit sign matches the ASD detection speed limit** ○ **Speed warning is issued via an audible message (tones and/or words).** ○ **Event log created with warning trigger** ○ **Stored encrypted event logs are uploaded and purged from the device** ○ **Driver receives no notification when passing other RSU units** ○ **Driver notifies the fleet owner** ○ **Fleet owner notifies NYCDOT CV equipment maintenance personnel**	

3.2.2.22 Use Case 7 Demonstration 1 Actions

Table 58 – UC7D1 Actions

No.	Actions	Expected Result	Pass/Fail/Comments
1	VEH-1 drives from starting point towards start cone at RSU1	No warning issued to driver	Pass ___ Fail ___ Comments:
2	VEH-1 reaches start cone at RSU1 driving at **[SpeedMargin1]** below **[SpeedLimitVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
3	VEH-1 drives at **[SpeedMargin1]** below **[SpeedLimitVar]** through the RSU range while the warning end time is below **[WarningTimeoutVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
4	VEH-1 reaches stop cone at RSU1 and the warning end time is below **[WarningTimeoutVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
5	Trigger an ASD communication failure	ASD failure triggered	Pass ___ Fail ___ Comments:

No.	Actions	Expected Result	Pass/Fail/Comments
6	VEH-1 drives from stop cone of RSU 1 towards start cone at RSU2 at **[SpeedMargin1]** above **[SpeedLimitVar]**	No warning issued to driver Driver finds that the ASD is no longer sending the alerts.	Pass ___ Fail ___ Comments:
7	Driver records the fault using the defect notification card	Defect notification card dropped off in box for the fleet owner	Pass ___ Fail ___ Comments:
8	Fleet owner notifies NYCDOT CV equipment maintenance personnel of the ASD failure.	NYCDOT CV equipment maintenance personnel diagnoses the problem	Pass ___ Fail ___ Comments:

3.2.2.23 Use Case 8 Demonstration 1 Scene NOT DEMONSTRATED 8/19

The demonstrations and steps listed below are subject to adjustment due to local conditions (e.g., weather, the presence of pedestrians and other vehicles). shows the sample MAP message configuration that was developed for demonstrating the Pedestrian in Signalized Intersection Warning (PEDINXWALK) application at the Aqueduct. However, this application was demonstrated around NYCDOT at 47th Ave. @ 34th St. in Long Island City, Queens, NY. The demonstration involved having the pedestrian crossing the street perpendicular to test vehicle's travel path.

Table 59 – UC8D1 Scene

Use Case 8: Roadway User Functionality

Demonstration 1: Pedestrian in Signalized Intersection Warning

Purpose: Demonstrate that functionality of the application for warning the vehicles when pedestrians are crossing the road at signalized intersections.

Variables:

- **RSU Range = [RSURangeVar]**
- **Speed Limit = [SpeedLimitVar] = 25 mph**
- **Time of Day schedule = [TODScheduleVar]**
- **Day of Week schedule = [DOWScheduleVar]**
- **Over speed Limit parameter = [OverSpeedLimitVar] = 0 mph**
- **Speed Margin 1 = [SpeedMargin1] = -5 mph**
- **Speed Margin 2 = [SpeedMargin2] = + 5 mph**
- **Vehicle 1 driver = VEH-1**
- **Pedestrian 1 Operator = PED - 1**

Pre-Conditions:

- **The pedestrian detection information application is used by the signalized intersection that has the RSU**
- **One of the following vehicle types is available for testing: Light Duty Vehicle ASD, Bus vehicle ASD or Commercial Vehicle ASD**
- **Set the RSU range. For example, [RSURangeVar] = 300 ft distance**
- **Mark the vehicle starting point**
- **Place start cone at the beginning edge of RSU range**
- **Place stop cone at the end of RSU range**
- **Define a speed limit for the roadway segment. For example, [SpeedLimitVar] = 25MPH**
- **Define a time-of-day and day-of-week schedule. For example, [TODScheduleVar] = 1PM and [DOWScheduleVar] = January 1, 2019**
- **Define the "over speed" parameter. For example, [OverSpeedLimitVar] = 10MPH**
- **One of the following vehicle types are available for testing: Light Duty Vehicle ASD, Bus vehicle ASD or Commercial Vehicle ASD**
- **Mark the pedestrian starting point**
- **Mark the pedestrian crossworld point**

Test Cases: Danlaw TP_PEDINXWALK_HIL_01

Requirements: 104.1.2,104.1.3,104.1.5,104.1.7,104.1.8,104.1.10,104.1.12,104.2.3,104.2.4,104.2.7,104.3.1,104.3.2,104.3.3, 104.3.8,104.3.9,104.4.6,104.4.8,104.4.10,104.4.11, 104.5.1,104.5.2,104.5.3,104.5.4,104.5.6,104.5.8,

(Source: NYCDOT)

Figure 10 – Sample MAP Message Configuration for ORD of PEDINXWALK Application at the Aqueduct

104.5.9,104.5.10,104.5.11,104.5.13,104.5.14,104.5.16 104.5.18,104.6.2,104.6.3,104.6.3.1,104.6.4,104.6.11 104.8.4,104.8.6,104.8.9,104.8.10,104.9.4,505.1.6,505.2.1,505.2.1.1,505.2.1.2,505.2.1.3,505.2.1.4,505.2.2 **Demonstrator: Phase 2 Participant Driver, unequipped pedestrian** **Facilitator: TransCore employee** **Observer: USDOT AOR and Reviewers representatives** **Observer Experience:** **Observers ride in participant vehicle equipped with an ASD on which the software is installed and commissioned. Vehicle begins at the starting point and travels inbound towards the beginning edge of the RSU and pedestrian detection information application. The observers note that the pedestrian phase begins at the signal, and the pedestrian crosses the street. The observers also note that when the driver approaches the installed RSU that the ASD alerts the driver that a pedestrian is crossing.** **One demonstration run:** • **Run 1: ASD-equipped vehicle travels towards the installed RSU. Pedestrian crosses the street when pedestrian phase begins and driver receives notification of pedestrian in crosswalk** **Expectation:** • **Run 1:** ○ **The pedestrian approaches the crosswalk and is detected by the traffic control system** ○ **The RSU receives the pedestrian detection information** ○ **The pedestrian crosses the street** ○ **Driver approaches the signalized intersection** ○ **Driver receives a notification that a pedestrian is in the crosswalk** ○ **Driver waits until pedestrian is served and signal changes from red to green**	

3.2.2.24 Use Case 8 Demonstration 1 Actions

Table 60 – UC8D1 Actions

No.	Actions	Expected Result	Pass/Fail/Comments
1	VEH-1 is at the starting point	No alert sent to driver	Pass ___ Fail ___ Comments:
2	Pedestrian is at the starting point	Traffic Controller Active Screen does not display WALK CALL service request for that crosswalk	Pass ___ Fail ___ Comments:
3	Pedestrian approaches the beginning edge of the RSU range but not yet at the specific crosswalk point where he or she can be detected	Traffic Controller Active Screen does not display WALK CALL service request for that crosswalk	Pass ___ Fail ___ Comments:
4	Pedestrian arrives at the specific crosswalk point at the RSU	Traffic Controller Active Screen displays WALK CALL service request for that crosswalk	Pass ___ Fail ___ Comments:
5	Pedestrian phase begins at the signal	The pedestrian starts to cross the street	
6	Driver approaches the RSU and is in the notification zone	ASD alerts the driver that pedestrian is crossing.	Pass ___ Fail ___ Comments:
7	Driver waits until the pedestrian phase is served and the signal for the vehicle's approach turns from red to green	Drivers crosses through the intersection	

3.2.2.25 Use Case 9 Demonstration 1 Scene – NOT DEMONSTRATED 8/19

Figure 11 shows the sample MAP message configuration that was developed for demonstrating the Mobile Accessible Pedestrian Signal System (PED-SIG) application. at the Aqueduct. However, this application was not demonstrated during the ORD.

Table 61 – UC9D1 Scene

Use Case 9: Roadway User Functionality

Demonstration 1: Mobile Accessible Pedestrian Signal System

Purpose: To demonstrate the ability to support PED-SIG on a crosswalk

Variables:

- **RSU Range = [RSURangeVar]**
- **Pedestrian 1 Operator = PED - 1**

Pre-Conditions:

- **The user is located near an instrumented crosswalk in the testing area.**
- **Pedestrian actor's mobile device uses geographic data from Google maps and 4G/LTE communications.**
- **Mobile device is able to orient the pedestrian with respect to the street crossing of interest.**
- **Communication baseline confirmed including security certificates for authentication and privileges to make crossing requests.**
- **SPAT message baseline set using 5.9 DSRC.**
- **Set the RSU range. For example, [RSURangeVar] = 300 ft distance**
- **Place start cone at the beginning edge of RSU range**
- **Place stop cone at the end of RSU range**
- **Mark the pedestrian starting point**
- **Mark the pedestrian crosswalk point**

Assumptions:

- **The pedestrian is not deaf or hard of hearing.**
- **The pedestrian needs audible information regarding the signal display.**
- **The pedestrian needs help in orienting themselves to the crosswalk.**
- **The mobile application will notify the pedestrian when to start the crossing**

Test Cases:

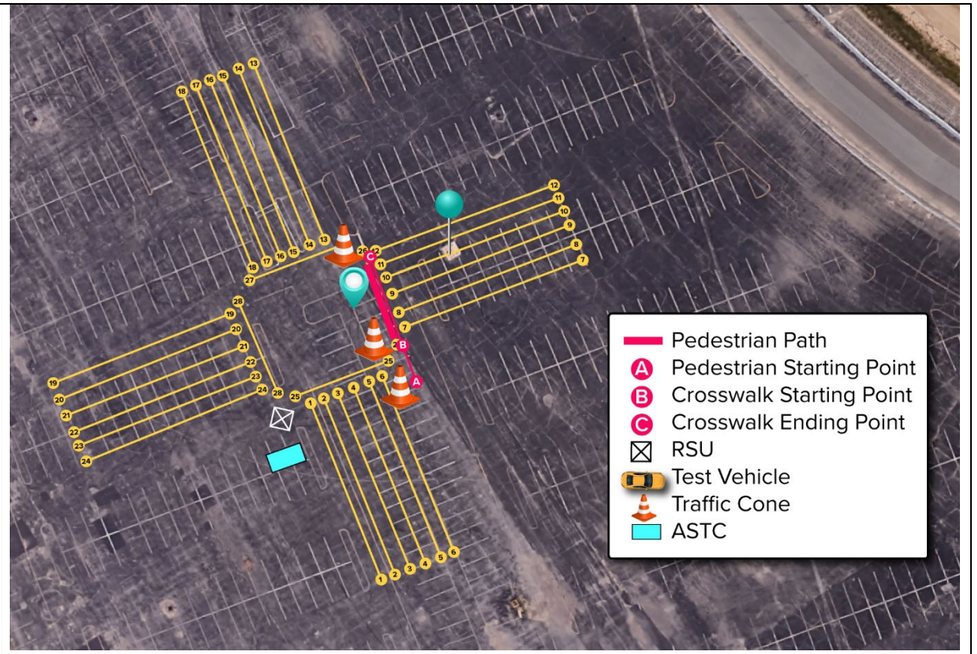
Requirements: 104.1.2,104.1.3,104.1.5,104.1.7,104.1.8,104.1.10,104.1.12,104.2.3,104.2.4,104.2.7,104.3.1,104.3.2,104.3.3, 104.3.8,104.3.9,104.4.6,104.4.8,104.4.10,104.4.11, 104.5.1,104.5.2,104.5.3,104.5.4,104.5.6,104.5.8, 104.5.9,104.5.10,104.5.11,104.5.13,104.5.14,104.5.16 104.5.18,104.6.2,104.6.3,104.6.3.1,104.6.4,104.6.11 104.8.4,104.8.6,104.8.9,104.8.10,104.9.4,505.1.6,505.2.1,505.2.1.1,505.2.1.2,505.2.1.3,505.2.1.4,505.2.2, 104.10.1,104.10.2,104.10.3

Demonstrators: Phase 2 Participant Driver, pedestrian with mobile device

Facilitator: TransCore employee

Observer: USDOT AOR and Reviewers representatives

Observer Experience:



(Source: NYCDOT)

Figure 11 – Sample MAP Message Configuration for ORD of PED-SIG Application at the Aqueduct

Observers will watch the participant launch the PED-SIG app on a smart phone and place pedestrian calls on a crosswalk **One demonstration run:** • **Run 1: Observers will watch as the participant equipped with the PED-SIG app arrives at the specific crosswalk and places pedestrian calls on a crosswalk** **<u>Expectation</u>:** • **Run 1:** ○ **Pedestrian call is detected by the traffic control system** ○ **Traffic signal responds with a pedestrian phase for the crosswalk** ○ **PID communicates audible walk indicators to the pedestrian** ○ **Pedestrian crosses street successfully**	

3.2.2.26 Use Case 9 Demonstration 1 Actions

Table 62 – UC9D1 Actions

No.	Actions	Expected Result	Pass/Fail/Comments
1	Pedestrian is at the starting point	Traffic Controller Active Screen does not display WALK CALL service request for that crosswalk	Pass ___ Fail ___ Comments:
2	Visually-impaired pedestrian approaches the beginning edge of the RSU range but not yet at the specific crosswalk point where he or she can be detected	Traffic Controller Active Screen does not display WLK service request for that crosswalk	Pass ___ Fail ___ Comments:
3	Visually-impaired pedestrian arrives at the beginning edge of the RSU range and waits to cross the street	Pedestrian is at the beginning edge of the RSU range	
4	Position pedestrian facing North/South lanes	Traffic Controller Active Screen displays WALK CALL service request for that crosswalk	Pass ___ Fail ___ Comments:
5	Pedestrian phase begins at the signal	The PID communicates audible walk indicators to the pedestrian.	Pass ___ Fail ___ Comments:
6	Pedestrian is guided to the crosswalk and starts to cross the street.	Pedestrian is crossing the street	
7	Wait for the pedestrian clearance interval to start	The PID communicates the audible flashing don't walk (FDW) indicator to the visually-impaired pedestrian.	Pass ___ Fail ___ Comments:
8	Pedestrian completes the crossing maneuver	Pedestrian is not in the crosswalk Traffic signal turns from red to green	Pass ___ Fail ___ Comments:
9	Check the PID Statistics	PID acknowledges confirmation of the completed crossing action. PID records statistics.	Pass ___ Fail ___ Comments:

3.2.2.27 Use Case 9 Demonstration 2 Scene – NOT DEMONSTRATED 8/19

Table 63 – UC9D2 Scene

Use Case 9: Roadway User Functionality **Demonstration 2: Mobile Accessible Pedestrian Signal System** **Purpose: To demonstrate the ability to support PED-SIG on a crosswalk when the security certificate does not indicate permission to make a request** **Variables:** • **RSU Range = [RSURangeVar]** • Pedestrian 1 Operator = PED – 1 **Pre-Conditions:** • **The user is located near an instrumented crosswalk in the NYC geographic area.** • **Actor's mobile device uses geographic data from Google maps and 4G/LTE communications.** • **Mobile device is able to orient the pedestrian with respect to the street crossing of interest.** • **Communication baseline confirmed including security certificates for authentication and privileges to make crossing requests.** • **SPAT message baseline set using 5.9 DSRC.** • **Security certificate of the mobile device application is not configured with privileges** • **Set the RSU range. For example, [RSURangeVar] = 300 ft distance** • **Place start cone at the beginning edge of RSU range** • **Place stop cone at the end of RSU range** • **Mark the pedestrian starting point** • **Mark the pedestrian crosswalk point** **Assumptions:** • **The pedestrian is not deaf or hard of hearing.** • **The pedestrian needs audible information regarding the signal display.** • **The pedestrian needs help in orienting themselves to the crosswalk.** **Test Cases:** **Requirements: 04.1.2,104.1.3,104.1.5,104.1.7,104.1.8,104.1.10,104.1.12,104.2.3,104.2.4,104.2.7,104.3.1,104.3.2,104.3.3, 104.3.8,104.3.9,104.4.6,104.4.8,104.4.10,104.4.11, 104.5.1,104.5.2,104.5.3,104.5.4,104.5.6,104.5.8, 104.5.9,104.5.10,104.5.11,104.5.13,104.5.14,104.5.16 104.5.18,104.6.2,104.6.3,104.6.3.1,104.6.4,104.6.11 104.8.4,104.8.6,104.8.9,104.8.10,104.9.4, 104.10.1,104.10.2,104.10.3** **Demonstrators: Phase 2 Participant Driver, pedestrian with mobile device** **Facilitator: TransCore employee** **Observer: USDOT AOR and Reviewers representatives** **Observer Experience:** **Observers will watch as the participant equipped with the PED-SIG app arrives at the specific crosswalk and places pedestrian calls on a crosswalk**	

One demonstration run:
• **Run 1: Pedestrian launches the PED-SIG app on a smart phone and places a pedestrian call while at the signalized intersection.**
 	
<u>Expectation</u>:
• **Run 1:**
  ○ **Pedestrian call is not detected by the traffic control system**
  ○ **Mobile App indicates that it is unable to provide service based on insufficient privileges**
  ○ **Pedestrian finds alternate method to cross at intersection**	

3.2.2.28 Use Case 9 Demonstration 2 Actions

Table 64 – UC9D2 Actions

No.	Actions	Expected Result	Pass/Fail/Comments
1	Pedestrian is at the starting point	Traffic Controller Active Screen does not display WALK CALL service request for that crosswalk	Pass ___ Fail ___ Comments:
2	Visually-impaired pedestrian approaches the beginning edge of the RSU but not yet at the specific crosswalk point where he or she can be detected	Traffic Controller Active Screen does not display WLK service request for that crosswalk	Pass ___ Fail ___ Comments:
3	Visually-impaired pedestrian arrives at the beginning edge of the RSU and waits to cross the street	Pedestrian is at the beginning edge of the RSU	Pass ___ Fail ___ Comments:
4	Position pedestrian facing North/South lanes	Pedestrian is positioned to the correct lanes	Pass ___ Fail ___ Comments:
5	Place a pedestrian call on the crosswalk using the PED-SIG- app	Mobile App indicates that it is unable to provide service based on insufficient privileges	Pass ___ Fail ___ Comments:
6	Pedestrian looks for alternative method to cross at intersection.	Traffic Controller Active Screen does not display WLK service request for that crosswalk	Pass ___ Fail ___ Comments:

3.2.2.29 Use Case 10 Demonstration 1 Scene

The demonstrations and steps listed below are subject to adjustment due to local conditions (e.g., weather, the presence of pedestrians and other vehicles). Figure 12 shows the MAP message configuration for demonstrating the IMA application at the Aqueduct.

Table 65 – UC10D1 Scene

Use Case 10: Roadway User Functionality

Demonstration 1: Intersection Movement Assist (IMA) Host Vehicle Stopped application

Purpose: Demonstrate that the ASD produces an IMA warning message to the driver of the Host Vehicle when receiving BSMs from other connected ASD with the Host Vehicle stopped at an intersection, and then starts slowly moving as the Remote Vehicle traverses the intersection.

Variables:

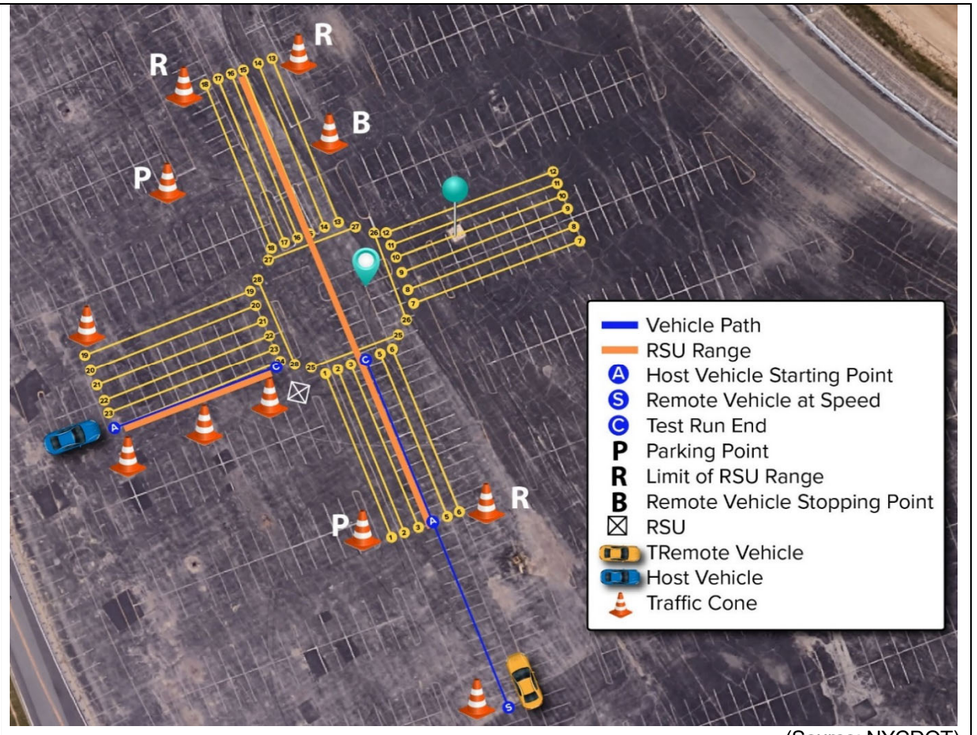
RSU Range = [RSURangeVar]
Speed Limit = [SpeedLimitVar] = 25 mph
Over speed Limit parameter = [OverSpeedLimitVar] = 0 mph
Speed Margin 1 = [SpeedMargin1]
Remote Vehicle driver = VEH-1
Host Vehicle driver = VEH-2
First Location Point = [LocationA]
Host Vehicle Stopping Point = [LocationC]
Remote Vehicle Stopping Point = [LocationB]
Remote Vehicle Intersection Proximity Detection Point = [RemoteVehDetPoint]
Acceleration Speed Limit = [AccelerationSpeedLimitVar]

Pre-Conditions:

Two vehicles with ASDs
Each test vehicle has a driver, technician, note taker
Set the RSU range. For example, [RSURangeVar] = 300 ft distance
Mark the vehicle starting point
Mark the intersection
Mark [LocationA], the host and remote vehicle first location point
Mark [LocationB], the remote vehicle intended stopping point after passing the intersection
Mark [LocationC], the host vehicle stopping point near the intersection
Place start cone at the beginning edge of RSU range
Place stop cone at the end of RSU range
Mark the vehicle fleet terminal /parking point in the RSU vicinity so that ASD data can be uploaded
MAP Messages have been generated for each RSU location
Infrastructure and vehicle installations and configurations are correct
Place a flag or cone at a point to detect the Remote Vehicle close proximity to the intersection. For example, [RemoteVehDetPoint]= 25 FT
Define an acceleration speed limit for the roadway segment. For example, [AccerelationSpeedLimitVar] = 35MPH
Define a speed limit for the roadway segment. For example, [SpeedLimitVar] = 35MPH
Define a time-of-day and day-of-week schedule. For example, [TODShceduleVar] = 1PM and [DOWScheduleVar] = January 1, 2019
One of. the following vehicle types are available for testing: Light Duty Vehicle ASD, Bus vehicle ASD or Commercial Vehicle ASD

Test Cases:

Requirements: 102.4.1



(Source: NYCDOT)

Figure 12 – MAP Message Configuration for ORD of IMA Application at the Aqueduct

Demonstrator: Two Phase 2 Participant Drivers **Facilitator: TransCore employee** **Observer: USDOT AOR and Reviewers representatives** **Observer Experience:** **Observers ride in both participant vehicles equipped with an ASD on which the software is installed and commissioned. The observers note that the driver of the Remote Vehicle travels to the starting point and stops there. The driver of the Host Vehicle travels from the starting point to a location close to the intersection and stops there. The observers also note that the Remote Vehicle accelerates to the desired speed to trigger the alert, maintains that speed and travels along the path toward Location C. The Host Vehicle remains stopped at Location C. When the Remote Vehicle is within the defined distance of the intersection (which will be marked by flags or a cone) the Host Vehicle releases the brake and the driver confirms they have received an intersection movement assist warning. Otherwise no alert is received.** **Two demonstration runs:** **Run 1: Remote Vehicle is within the [RemoteVehDetPoint] range of the intersection** **Run 2: Host Vehicle releases brake when Remote Vehicle is less than [RemoteVehDetPoint] from the intersection** **Expectation:** **Run 1:** ○ **HMI issues IMA warning to the Host Vehicle** ○ **Warning/alert received is correct** **Run 2:** ○ **No IMA warning issued to Host Driver**	

3.2.2.30 Use Case 10 Demonstration 1 Actions

Table 66 – UC10D1 Actions

No.	Actions	Expected Result	Pass/Fail/Partial/Comments
Run 1			
1.	VEH-1 drives from starting point towards [LocationA]		
2.	VEH-1 reaches [LocationA] driving at [SpeedMargin1] below [AccelerationSpeedLimitVar] and stops	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
3.	VEH-2 drives from starting point towards [LocationC]	No warning issued to driver	Pass ___Fail ___ Partial ___ Comments:
4.	VEH-2 reaches [LocationC] driving at [SpeedMargin1] below [AccelerationSpeedLimitVar] and stops (applying the brake but not putting the vehicle in park)	No warning issued to driver	Pass ___ Fail ___ Partial ___

No.	Actions	Expected Result	Pass/Fail/Partial/Comments
			Comments:
5.	VEH-1 drives from [LocationA] at [SpeedMargin1] to maintain the [AccelerationSpeedLimitVar] towards [LocationB]	No warning issued to driver VEH-2 remains stopped at Location C	Pass ___ Fail ___ Partial ___ Comments:
6.	VEH-1 drives at [SpeedMargin1] below [AccelerationSpeedLimitVar] towards intersection but is less than [RemoteVehDetPoint]	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
7.	VEH-1 reaches within [RemoteVehDetPoint] of the intersection	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
8.	VEH-2 releases brake	The VEH-2 driver receives an intersection movement assist warning.	Pass ___ Fail ___ Partial ___ Comments:
9.	Host Vehicle driver manually records the IMA warnings they received (e.g. – audio only, audio and visual, etc.)		
10.	VEH-1 reaches [LocationB]	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
11.	VEH-1 reaches stop cone	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
12.	VEH-2 reaches stop cone	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
13.	Check the IMA warnings received	Proper IMA warnings received	Pass ___ Fail ___ Partial ___ Comments:
Run 2			
14.	VEH-1 drives from starting point towards [LocationA]		
15.	VEH-1 reaches [Location A] driving at [SpeedMargin1] below [AccelerationSpeedLimitVar] and stops	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
16.	VEH-2 drives from starting point towards [LocationC]	No warning issued to driver	Pass ___Fail ___ Partial ___ Comments:
17.	VEH-2 reaches [LocationC] driving at [SpeedMargin1] below [AccelerationSpeedLimitVar] and stops	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:

No.	Actions	Expected Result	Pass/Fail/Partial/Comments
18.	VEH-1 drives from [LocationA] at [SpeedMargin1] to maintain the [AccelerationSpeedLimitVar] towards [LocationC]	No warning issued to driver VEH-2 remains stopped at Location C	Pass ___ Fail ___ Partial ___ Comments:
19.	VEH-1 drives at [SpeedMargin1] below [AccelerationSpeedLimitVar] towards intersection but is less than [RemoteVehDetPoint]	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
20.	VEH-1 reaches within [RemoteVehDetPoint] of the intersection	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
21.	VEH-2 holds the brake	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
22.	VEH-1 reaches [LocationB]	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
23.	VEH-1 reaches stop cone	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
24.	VEH-2 releases the brake	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
25.	VEH-2 reaches stop cone	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:

3.2.2.31 Use Case 11 Demonstration 1 Scene

The demonstrations and steps listed below are subject to adjustment due to local conditions (e.g., weather, the presence of pedestrians and other vehicles). Figure 13 shows the sample MAP message configuration that was developed for demonstrating the Forward Collision Warning (FCW) application at the Aqueduct.This application was demonstrated at the Aqueduct and along 55th St and 56th St between 5th Ave and 6th Ave in Manhattan, NY.

Table 67 – UC11D1 Scene

Use Case 11: Roadway User Functionality

Demonstration 1: FCW Moving Remote Vehicle and Electronic Emergency Brake Light (EEBL) application

Purpose: Demonstrate that the ASD devices can produce an EEBL warning message to the driver when receiving BSMs from other Remote Vehicle connected ASD and also produces FCW warning as they get within FCW range of the Remote Vehicle

Variables:

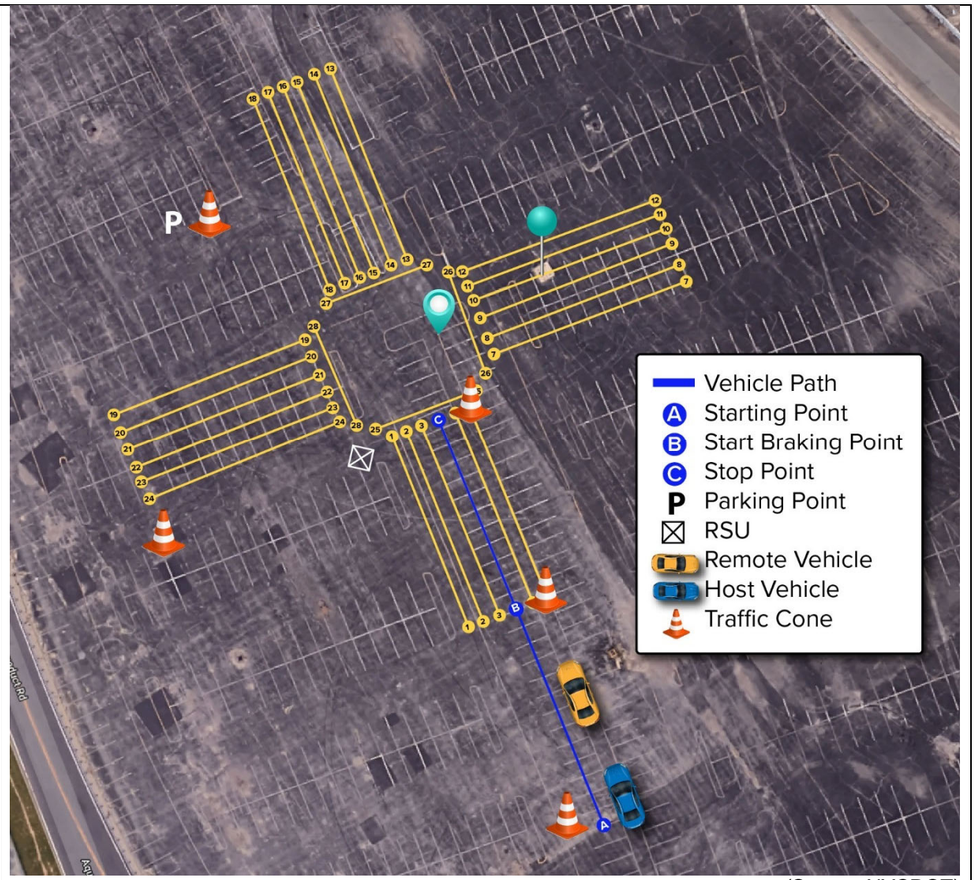
RSU Range = [RSURangeVar]
Speed Limit = [SpeedLimitVar] = 25 mph
Over speed Limit parameter = [OverSpeedLimitVar] = 0 mph
Speed Margin 1 = [SpeedMargin1]
Remote Vehicle driver = VEH-1
Host Vehicle driver = VEH-2
First Location Point = [LocationA]
Host Vehicle Stopping Point = [LocationC]
Remote Vehicle Position Ahead of Host Vehicle= [RemoteVehPostAheadHostVeh]
Distance Between Host and Remote Vehicle = [DistanceBetwVehicles]
Acceleration Speed Limit = [AccelerationSpeedLimitVar] = 25 mph

Pre-Conditions:

Two vehicles with different OBUs
Each test vehicle has a driver, technician, note taker and IE
Set the RSU range. For example, [RSURangeVar] = 300 ft distance
Mark the vehicle starting point
Place start cone at the beginning edge of RSU range
Place stop cone at the end of RSU range
Place a cone at the Start Braking point
Place a cone at the Stop Braking point (where vehicle comes to a complete stop)
Place a flag or cone at the point where the Remote Vehicle needs to position itself in front of the Host Vehicle. For example, [RemoteVehPostAheadHostVeh]= 150 FT
Define the distance to maintain between the Host Vehicle and the Remote Vehicle when accelerating. For example, [DistanceBetwVehicles]= 150 FT
Define an acceleration speed limit for the roadway segment. For example, [AccerelationSpeedLimitVar] = 35MPH
Define a speed limit for the roadway segment. For example, [SpeedLimitVar] = 35MPH
Define a time-of-day and day-of-week schedule. For example, [TODShceduleVar] = 1PM and [DOWScheduleVar] = January 1, 2019
Define the "over speed" parameter. For example, [OverSpeedLimitVar] = 10MPH
One of the following vehicle types are available for testing: Light Duty Vehicle ASD, Bus vehicle ASD or Commercial Vehicle ASD
Verify no connected vehicle devices are broadcasting messages conformant with the SAE J2735 2009 standard.

Test Cases:

Requirements: 102.1.1; 102.2.1



(Source: NYCDOT)

Figure 13 –MAP Message Configuration for ORD of FCW Application at the Aqueduct

Demonstrator: Two Phase 2 Participant Drivers **Facilitator: TransCore employee** **Observer: USDOT AOR and Reviewers representatives** **Observer Experience:** **Observers ride in both participant vehicles equipped with an ASD on which the software is installed and commissioned. The observers note that the driver of the Host Vehicle travels from the starting point and stops at Location A. The driver of the Remote Vehicle will position itself at a defined distance in front of the Host Vehicle (this position will be marked). Both the Host and Remote Vehicles accelerate to the desired speed to trigger the alert and maintains a defined distance between each other. The observers note that at the Start Braking Point the Remote Vehicle will start braking and come to a complete stop (the Start and Stop Braking Points will be marked). The Host Vehicle driver confirms that they received the electronic emergency brake light warning and/or forward collision warning. As the Host Vehicle continues forward, the Host Vehicle driver confirms that they receive a forward collision warning after receiving the electronic emergency brake light warning. Otherwise no warning message is received.** **Four demonstration runs:** **Run 1: Remote Vehicle starts braking while Host Vehicle maintains [AccelerationSpeedLimitVar] and [DistanceBetwVehicles] between both vehicles** **Run 2: Remote Vehicle starts braking while Host Vehicle maintains [AccelerationSpeedLimitVar] and distance is more than [DistanceBetwVehicles] between both vehicles** **Run 3: Remote Vehicle starts braking while Host Vehicle maintains [AccelerationSpeedLimitVar] and distance is less than [DistanceBetwVehicles] between both vehicles** **Expectations:** **Run 1:** **HMI issues electronic emergency brake light warning and/or forward collision warning to the driver of the Host Vehicle** **Host Vehicle driver confirms a forward collision warning after receiving the electronic emergency brake light warning** **Warnings/alerts received are correct** **Run 2:** **No electronic emergency brake light warning issued to the driver of the Host Vehicle** **No forward collision warning issued to the driver of the Host Vehicle** **Run 3:** **No electronic emergency brake light warning issued to the driver of the Host Vehicle** **No forward collision warning issued to the driver of the Host Vehicle**	

3.2.2.32 Use Case 11 Demonstration 1 Actions

Note that it is recommended that SpeedMargin1 be set to 5 MPH to minimize the human error in maintaining the speed of the vehicle. Each test run can be repeated at different SpeedMargin1 variables.

Table 68 – UC11D1 Actions

No.	Actions	Expected Result	Pass/Fail/Partial/Comments
Run 1			
1.	VEH-2 drives from starting point towards [LocationA]		

No.	Actions	Expected Result	Pass/Fail/Partial/Comments
2.	VEH-2 reaches [LocationA] driving at [SpeedMargin1] below [AccelerationSpeedLimitVar] and stops	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
3.	VEH-1 drives from starting point towards [RemoteVehPostAheadHostVeh]	No warning issued to driver	Pass ___Fail ___ Partial ___ Comments:
4.	VEH-1 reaches [RemoteVehPostAheadHostVeh] driving at [SpeedMargin1] below [AccelerationSpeedLimitVar] and stops	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
5.	VEH-1 and VEH-2 accelerate below the [AccelerationSpeedLimitVar] and maintain a distance that is more than the [DistanceBetwVehicles]	No warning issued to any of the drivers	Pass ___ Fail ___ Partial ___ Comments:
6.	VEH-1 and VEH-2 accelerate above the [AccelerationSpeedLimitVar] and maintain a distance that is more than the [DistanceBetwVehicles]	No warning issued to any of the drivers	Pass ___ Fail ___ Partial ___ Comments:
7.	VEH-1 and VEH-2 accelerate to the defined [AccelerationSpeedLimitVar] and maintain a distance that is the defined [DistanceBetwVehicles]	No warning issued to any of the drivers	Pass ___ Fail ___ Partial ___ Comments:
8.	VEH-1 accelerates to the Start Braking Point and come to a complete stop at the Stop Braking Point	No warning issued to any of the drivers	Pass ___ Fail ___ Partial ___ Comments:
9.	VEH-2 continues to drive forward to maintain [DistanceBetwVehicles]	The VEH-2 driver receives an electronic emergency brake light warning and/or forward collision warning	Pass ___ Fail ___ Partial ___ Comments:
10.	VEH-2 is still driving within [DistanceBetwVehicles]	The VEH-2 driver receives a forward collision warning after receiving the electronic emergency brake light warning	Pass ___ Fail ___ Partial ___ Comments:
11.	VEH-2 stops behind VEH-1	No warning issued to any of the drivers	
12.	VEH-1 releases brake	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
13.	VEH-1 reaches stop cone	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
14.	VEH-2 reaches stop cone	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
15.	Host Vehicle driver manually records the emergency brake light warnings they received (e.g. – audio only, audio and visual, etc.)	EEBL warnings are recorded	Pass ___ Fail ___ Partial ___ Comments:

No.	Actions	Expected Result	Pass/Fail/Partial/Comments
16.	Host Vehicle driver manually records the forward collision warnings they received (e.g. – audio only, audio and visual, etc.)	FCW alerts are recorded	Pass ___ Fail ___ Partial ___ Comments:
Run 2			
17.	VEH-2 drives from starting point towards [LocationA]		
18.	VEH-2 reaches [LocationA] driving at [SpeedMargin1] below [AccelerationSpeedLimitVar] and stops	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
19.	VEH-1 drives from starting point towards [RemoteVehPostAheadHostVeh]		
20.	VEH-1 reaches [RemoteVehPostAheadHostVeh] driving at [SpeedMargin1] below [AccelerationSpeedLimitVar] and stops	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
21.	VEH-1 and VEH-2 accelerate below the [AccelerationSpeedLimitVar] and maintain a distance that is more than the [DistanceBetwVehicles]	No warning issued to any of the drivers	Pass ___ Fail ___ Partial ___ Comments:
22.	VEH-1 and VEH-2 accelerate above the [AccelerationSpeedLimitVar] and maintain a distance that is more than the [DistanceBetwVehicles]	No warning issued to any of the drivers	Pass ___ Fail ___ Partial ___ Comments:
23.	VEH-1 and VEH-2 accelerate to the defined [AccelerationSpeedLimitVar] and the distance between vehicles is more than the defined [DistanceBetwVehicles]	No warning issued to any of the drivers	Pass ___ Fail ___ Partial ___ Comments:
24.	VEH-1 accelerates to the Start Braking Point and come to a complete stop at the Stop Braking Point	No warning issued to any of the drivers	Pass ___ Fail ___ Partial ___ Comments:
25.	VEH-2 continues to drive forward to maintain [DistanceBetwVehicles]	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
26.	VEH-2 is still driving within [DistanceBetwVehicles]	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
27.	VEH-2 stops behind VEH-1	No warning issued to any of the drivers	Pass ___ Fail ___ Partial ___ Comments:
28.	VEH-1 releases brake	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
29.	VEH-1 reaches stop cone	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:

No.	Actions	Expected Result	Pass/Fail/Partial/Comments
30.	VEH-2 reaches stop cone	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
Run 3			
31.	VEH-2 drives from starting point towards [LocationA]		
32.	VEH-2 reaches [LocationA] driving at [SpeedMargin1] below [AccelerationSpeedLimitVar] and stops	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
33.	VEH-1 drives from starting point towards [RemoteVehPostAheadHostVeh]	No warning issued to driver	Pass ___Fail ___ Partial ___ Comments:
34.	VEH-1 reaches [RemoteVehPostAheadHostVeh] driving at [SpeedMargin1] below [AccelerationSpeedLimitVar] and stops	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
35.	VEH-1 and VEH-2 accelerate below the [AccelerationSpeedLimitVar] and maintain a distance that is more than the [DistanceBetwVehicles]	No warning issued to any of the drivers	Pass ___ Fail ___ Partial ___ Comments:
36.	VEH-1 and VEH-2 accelerate above the [AccelerationSpeedLimitVar] and maintain a distance that is more than the [DistanceBetwVehicles]	No warning issued to any of the drivers	Pass ___ Fail ___ Partial ___ Comments:
37.	VEH-1 and VEH-2 accelerate to a speed that is less than the defined [AccelerationSpeedLimitVar] and the distance between vehicles is less than the defined [DistanceBetwVehicles]	No warning issued to any of the drivers	Pass ___ Fail ___ Partial ___ Comments:
38.	VEH-1 accelerates to the Start Braking Point and come to a complete stop at the Stop Braking Point	No warning issued to any of the drivers	Pass ___ Fail ___ Partial ___ Comments:
39.	VEH-2 continues to drive forward to maintain [DistanceBetwVehicles]	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
40.	VEH-2 is still driving within [DistanceBetwVehicles]	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
41.	VEH-2 stops behind VEH-1	No warning issued to any of the drivers	Pass ___ Fail ___ Partial ___ Comments:
42.	VEH-1 releases brake	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:

No.	Actions	Expected Result	Pass/Fail/Partial/Comments
43.	VEH-1 reaches stop cone	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
44.	VEH-2 reaches stop cone	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
Run 4			
45.	VEH-2 drives from starting point towards [LocationA]		
46.	VEH-2 reaches [LocationA] driving at [SpeedMargin1] below [AccelerationSpeedLimitVar] and stops	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
47.	VEH-1 drives from starting point towards [RemoteVehPostAheadHostVeh]	No warning issued to driver	Pass ___Fail ___ Partial ___ Comments:
48.	VEH-1 reaches [RemoteVehPostAheadHostVeh] driving at [SpeedMargin1] below [AccelerationSpeedLimitVar] and stops	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
49.	VEH-1 and VEH-2 accelerate below the [AccelerationSpeedLimitVar] and maintain a distance that is more than the [DistanceBetwVehicles]	No warning issued to any of the drivers	Pass ___ Fail ___ Partial ___ Comments:
50.	VEH-1 and VEH-2 accelerate above the [AccelerationSpeedLimitVar] and maintain a distance that is more than the [DistanceBetwVehicles]	No warning issued to any of the drivers	Pass ___ Fail ___ Partial ___ Comments:
51.	VEH-1 and VEH-2 accelerate to the defined [AccelerationSpeedLimitVar] and maintain a distance that is the defined [DistanceBetwVehicles]	No warning issued to any of the drivers	Pass ___ Fail ___ Partial ___ Comments:
52.	VEH-1 accelerates to the Start Braking Point and come to a complete stop at the Stop Braking Point	No warning issued to any of the drivers	Pass ___ Fail ___ Partial ___ Comments:
53.	VEH-2 continues to drive forward to maintain [DistanceBetwVehicles]	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
54.	VEH-2 is still driving within [DistanceBetwVehicles]	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
55.	VEH-2 stops behind VEH-1	No warning issued to any of the drivers	Pass ___ Fail ___ Partial ___ Comments:

No.	Actions	Expected Result	Pass/Fail/Partial/Comments
56.	VEH-1 releases brake	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
57.	VEH-1 reaches stop cone	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
58.	VEH-2 reaches stop cone	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:

3.2.2.33 Use Case 12 Demonstration 1 Scene

The demonstrations and steps listed below are subject to adjustment due to local conditions (e.g., weather, the presence of pedestrians and other vehicles).

Table 69 – UC12D1 Scene

Use Case 12: Roadway User Functionality **Demonstration 1: Forward Collision Warning with a Stationary Remote Vehicle in Adjacent Lane application** **Purpose: Demonstrate that no false Forward Collision Warning message is generated in the Host Vehicle which is driven towards the Remote Vehicle which is stopped in the adjacent lane.** **Variables:** **Speed Limit = [SpeedLimitVar] = 25 mph** **Over speed Limit parameter = [OverSpeedLimitVar] = 0 mph** **Speed Margin 1 = [SpeedMargin1]** **Remote Vehicle driver = VEH-1** **Host Vehicle driver = VEH-2** **First Location Point = [LocationA]** **Host Vehicle Stopping Point = [LocationC]** **Remote Vehicle Stopping Point = [LocationB]** **Remote Vehicle Intersection Proximity Detection Point = [RemoteVehDetPoint]** **Pre-Conditions:** **Two vehicles with ASDs** **Each test vehicle has a driver, technician, note taker** **Infrastructure and vehicle installations and configurations are correct** **Installation procedures should be well documented and precise, and installations should be inspected to ensure they are correct. For example, GPS performance may be affected by GPS antenna placement. The location of the GPS system needs to be calibrated based on antenna position to provide vehicle location in compliance with J2945/1** **Define an acceleration speed limit for the roadway segment. For example, [AccerelationSpeedLimitVar] = 35MPH** **Define a speed limit for the roadway segment. For example, [SpeedLimitVar] = 35MPH** **One of the following vehicle types are available for testing: Light Duty Vehicle ASD, Bus vehicle ASD or Commercial Vehicle ASD** **Test Cases:** **Requirements: 102.1.1; 102.2.1** **Demonstrator: Two Phase 2 Participant Drivers** **Facilitator: TransCore employee** **Observer: USDOT AOR and Reviewers representatives** **Observer Experience:** **Observers ride in both participant vehicles equipped with an ASD on which the software is installed and commissioned. The driver of the Remote Vehicle will stop in a right lane adjacent to the normal roadway. The driver of Remote Vehicle will apply the brake but will not put the vehicle in park. The observers note that the Host Vehicle accelerates to the desired speed to trigger**	Location: Eastbound Queens Blvd.

the alert and maintains that speed travelling along the path toward the remote vehicle. The driver of the Host Vehicle passes the Remote Vehicle, and the observers note that the driver does not receive Forward Collision Warning. **One demonstration run:** **Run 1: Host Vehicle drives below, at, or above the [SpeedLimitVar] while travelling along the test route and passes the Remote Vehicle.** **<u>Expectation</u>:** **Run 1:** **No Forward Collision Warning issued to the driver of the Host Vehicle**	

3.2.2.34 Use Case 12 Demonstration 1 Actions

Table 70 – UC12D1 Actions

No.	Actions	Expected Result	Pass/Fail/Partial/Comments
Run 1			
1.	VEH-1 drives from starting point and stops in right lane adjacent to normal roadway, applying the brake but not putting the vehicle in Park.		
2.	VEH-2 drives below, at, or above [SpeedLimitVar] and passes VEH-1	No Forward Collision Warning iissued to any of the driver of the Host Vehicle	Pass ___ Fail ___ Partial ___ Comments:

3.2.2.35 Use Case 13 Demonstration 1 Scene

The demonstrations and steps listed below are subject to adjustment due to local conditions (e.g., weather, the presence of pedestrians and other vehicles).

Table 71 – UC13D1 Scene

Use Case 13: Roadway User Functionality **Demonstration 1: Forward Collision Warning with a Stationary Vehicle in the Same Lane application** **Purpose: Demonstrate that the ASD devices can produce an FCW warning message to the driver when receiving BSMs from other Remote Vehicle connected ASD which was stopped in the same lane as the approaching vehicle. In this test, a Host Vehicle (the one expected to receive the Foreword Collision Warning) was driven at speed towards a Remote Vehicle, which is positioned in the same lane but at a stop.** **Variables**: • **Speed Limit = [SpeedLimitVar] = 25 mph** • **Over speed Limit parameter = [OverSpeedLimitVar] = 0 mph** • **Speed Margin 1 = [SpeedMargin1]** • **Remote Vehicle driver = VEH-1** • **Host Vehicle driver = VEH-2** • **Acceleration Speed Limit = [AccelerationSpeedLimitVar]** • **Distance Between Host and Remote Vehicle = [DistanceBetwVehicles]** **Pre-Conditions**: • **Two vehicles with ASDs** • **Each test vehicle has a driver, technician, note taker** • **Mark the Host Vehicle Detection Point. This is dependent on the value set for [DistanceBetwVehicles]** • **Define the distance to maintain between the Host Vehicle and the Remote Vehicle when accelerating in order to trigger a warning. For example, [DistanceBetwVehicles]= 150 FT** • **Define an acceleration speed limit for the roadway segment. For example, [AccerelationSpeedLimitVar] = 35MPH** • **Define a speed limit for the roadway segment. For example, [SpeedLimitVar] = 35MPH** • **Define the "over speed" parameter. For example, [OverSpeedLimitVar] = 10MPH** • **One of the following vehicle types are available for testing: Light Duty Vehicle ASD, Bus vehicle ASD or Commercial Vehicle ASD** **Test Cases:** **Requirements: 102.1.1; 102.2.1** **Demonstrator: Two Phase 2 Participant Drivers** **Facilitator: TransCore employee** **Observer: USDOT AOR and Reviewers representatives** **Observer Experience:** **Observers ride in both participant vehicles equipped with an ASD on which the software is installed and commissioned. The observers note that the driver of the Remote Vehicle travels from the starting point and stops in the lane.The observers note that the Host Vehicle accelerates to the desired speed distance from the Remote Vehicle to trigger the alert and maintains that speed travelling along the path. The observers note that when the Host Vehicle is within the defined distance of the Remote Vehicle it receives a forward collision warning.**	Location: Eastbound Queens Blvd.

Three demonstration runs: **Run 1: Host Vehicle accelerates and maintains the defined [SpeedLimitVar] and is within the defined range of [DistanceBetwVehicles] between both vehicles** **Run 2: Host Vehicle accelerates but is below the defined [SpeedLimitVar] and is within the defined range of [DistanceBetwVehicles] between both vehicles** **Run 3: Host Vehicle accelerates and is above the defined [SpeedLimitVar] and is within the defined range of [DistanceBetwVehicles] between both vehicles** **Expectation:** **Run 1:** **ASD issues a forward collision warning to the driver of the Host Vehicle** **Warning/alert received is correct** **Run 2:** **No forward collision warning issued to the driver of the Host Vehicle** **Run 3:** **ASD issues a forward collision warning to the driver of the Host Vehicle** **Warning/alert received is correct**	

3.2.2.36 Use Case 13 Demonstration 1 Actions

Table 72 – UC13D1 Actions

No.	Actions	Expected Result	Pass/Fail/Partial/Comments
Run 1			
1.	VEH-1 drives in from starting point and stops in the lane and applies brake, but does not put vehicle in Park.		
2.	VEH-2 drives at [SpeedLimitVar] toward VEH-1	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
3.	VEH-2 reaches [DistanceBetwVehicles] from VEH-1	Forward collision warning issued to driver of VEH-2	Pass ___Fail ___ Partial ___ Comments:
4.	VEH-2 stops or drives around VEH-1	No warning issued to any of the drivers	Pass ___ Fail ___ Partial ___ Comments:
Run 2			
5.	VEH-1 drives in from starting point and stops in the lane and applies brake, but does not put vehicle in Park.		
6.	VEH-2 drives below [SpeedLimitVar] toward VEH-1	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:

No.	Actions	Expected Result	Pass/Fail/Partial/Comments
7.	VEH-2 reaches [DistanceBetwVehicles] from VEH-1	No warning issued to driver	Pass ___Fail ___ Partial ___ Comments:
8.	VEH-2 stops or drives around VEH-1	No warning issued to driver	Pass ___Fail ___ Partial ___ Comments:
Run 3			
9.	VEH-1 drives in from starting point and stops in the lane and applies brake, but does not put vehicle in Park.		
10.	VEH-2 drives above [SpeedLimitVar] toward VEH-1	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:
11.	VEH-2 reaches [DistanceBetwVehicles] from VEH-1	Forward collision warning issued to driver of VEH-2	Pass ___Fail ___ Partial ___ Comments:
12.	VEH-2 stops or drives around VEH-1	No warning issued to driver	Pass ___ Fail ___ Partial ___ Comments:

3.2.2.37 Use Case 14 Demonstration 1 Scene

The demonstrations and steps listed below are subject to adjustment due to local conditions (e.g., weather, the presence of pedestrians and other vehicles).

Table 73 – UC14D1 Scene

Use Case 14: Roadway User Functionality **Demonstration 1: Blind Spot Warning (BSW)/Lane Change Warning (LCW) application** **Purpose: Demonstrate that the ASD devices can produce a BSW/LCW message to the driver when receiving BSMs from Remote Vehicle connected ASD which is approaching in an adjacent lane to the host vehicle. In this test, a Remote Vehicle is driven at speed towards the Host Vehicle (the one expected to receive the BSW message), also driven at speed, in the adjacent lane.** **Variables:** **Speed Limit = [SpeedLimitVar] = 25 mph** **Host Vehicle Speed = [HVSpeed] = 20 mph** **Speed Margin 1 = [SpeedMargin1]** **Remote Vehicle driver = VEH-1** **Host Vehicle driver = VEH-2** **Pre-Conditions:** **Two vehicles with ASDs** **Each test vehicle has a driver, technician, note taker** **Vehicle installations and configurations are correct** **Define a speed for the Host Vehicle, which will be slower than [SpeedLimitVar], to allow Remote Vehicle to pass Host Vehicle** **The following vehicle types are available for testing: Light Duty Vehicle ASD** **Test Cases:** **Requirements: 102.3.1; 102.4.1** **Demonstrator: Two Phase 2 Participant Drivers** **Facilitator: TransCore employee** **Observer: USDOT AOR and Reviewers representatives** **Observer Experience:** **Observers ride in both participant vehicles equipped with an ASD on which the software is installed and commissioned. The observers note that the driver of the Host Vehicle travels at the desired speed. The driver of the Remote Vehicle travels at the speed limit and enters the Host Vehicle's blind spot. The observers note that the Host Vehicle receives a blind spot warning when the Remote Vehicle moves into its blind spot. When the Host Vehicle driver activates the turn signal, indicating a lane change in the direction of the Remote Vehicle, the Host Vehicle receives a lane change warning** **Demonstration runs:** **Run 1: Vehicles traveling in same direction, remote vehicle in the lane to right of host vehicle** **Run 2: Vehicles traveling in same direction, remote vehicle in the lane to left of host vehicle** **Expectation:** **Run 1:** **ASD issues blind spot and lane change warnings to the driver of the Host Vehicle**	Locations: Eastbound Queens Blvd. 57th St. Manhattan

Warning/alert received is correct **Run 2:** **ASD issues a blind spot and lane change warnings to the driver of the Host Vehicle** **Warning/alert received is correct**	

3.2.2.38 Use Case 14 Demonstration 1 Actions

Table 74 – UC14D1 Actions

No.	Actions	Expected Result	Pass/Fail/Partial/Comments
Run 1			
1.	VEH-2 departs starting point in second right lane		
2.	VEH-1 departs starting point in right lane		
3.	VEH-1 moves into VEH-2 blind spot	BSW application is triggered and alert received in VEH-2	Pass ___Fail ___ Partial ___ Comments:
4.	VEH-1 stays in VEH-2 blind spot	BSW application is triggered and alert received in VEH-2	Pass ___Fail ___ Partial ___ Comments:
5.	VEH-2 turns on right turn signal	LCW application is triggered and alert received in VEH-2	Pass ___Fail ___ Partial ___ Comments:
6.	Vehicles continue to stopping point		
Run 2			
7.	VEH-2 departs starting point in right lane		
8.	VEH-1 departs starting point in second right lane		
9.	VEH-1 moves into VEH-2 blind spot	BSW application is triggered and alert received in VEH-2	Pass ___Fail ___ Partial ___ Comments:

No.	Actions	Expected Result	Pass/Fail/Partial/Comments
Run 1			
10.	VEH-1 stays in VEH-2 blind spot	BSW application is triggered and alert received in VEH-2	Pass ___Fail ___ Partial ___ Comments:
11.	VEH-2 turns on left turn signal	LCW application is triggered and alert received in VEH-2	Pass ___Fail ___ Partial ___ Comments:
12.	Vehicles continue to stopping point		

3.2.2.39 Use Case 14 Demonstration 2 Scene

The demonstrations and steps listed below are subject to adjustment due to local conditions (e.g., weather, the presence of pedestrians and other vehicles). Figure 14 shows the sample MAP message configuration that was developed for demonstrating the Blind Spot Warning (BSW) application at the Aqueduct.This application was demonstrated at the Aqueduct Racetrak Parking Lot in South Ozone Park, Queens, NY.

Table 75 – UC14D2 Scene

Use Case 14: Roadway User Functionality

Demonstration 1: Blind Spot Warning (BSW) application

Purpose: Demonstrate that the ASD devices do not produce a BSW message to the driver when receiving BSMs from other Remote Vehicle connected ASD which passes the Host Vehicle moving in the opposite direction. In this test, a Remote Vehicle is driven at speed past the Host Vehicle (the one expected to receive the BSW message), also driven at speed, in the adjacent lane but moving in the opposite direction.

Variables:
Speed Limit = [SpeedLimitVar] = 25 mph
Remote Vehicle driver = VEH-1
Host Vehicle driver = VEH-2
Host Vehicle Start Point = [LocationA]
Host Vehicle Stop Point = [LocationB]
Remote Vehicle Start Point 2 = [LocationC]
Remote Vehicle Stop Point = [LocationD]

Pre-Conditions:
Two vehicles with ASDs
Each test vehicle has a driver, technician, note taker
Mark the vehicle starting point
Mark the intersection
Mark [LocationA], the host vehicle start point
Mark [LocationB], the host vehicle stop point
Mark [LocationC], the remote vehicle start point
Mark [LocationD], the remote vehicle stop point
Vehicle installations and configurations are correct
Define a speed limit for the roadway segment, which will be both host and remote vehicle speeds. For example, [SpeedLimitVar] = 35MPH

Test Cases:

Requirements: 102.3.1

Demonstrator: Two Phase 2 Participant Drivers

Facilitator: TransCore employee

Observer: USDOT AOR and Reviewers representatives

Observer Experience:
Observers ride in both participant vehicles equipped with an ASD on which the software is installed and commissioned. The observers note that the driver of the Host Vehicle travels from the starting point A and accelerates to the desired speed. The driver of the Remote Vehicle travels from starting point C, accelerates to the desired speed, and passes the Host Vehicle traveling in the opposite direction. The observers note that the Host Vehicle does not receive a blind spot warning when the Remote Vehicle moves into its blind spot after passing.

(Source: NYCDOT)

Figure 14 – MAP Message Configuration for ORD of BSW Application at the Aqueduct

Demonstration runs: **Run 1: Vehicles traveling in opposite directions** **<u>Expectation</u>:** **No blind spot warning is issued to the driver of the Host Vehicle.**	

3.2.2.40 Use Case 14 Demonstration 2 Actions

Table 76 – UC14D2 Actions

No.	Actions	Expected Result	Pass/Fail/Partial/Comments
1.	[VEH-1] departs Locaton C toward Location D, reaching [SpeedLimitVar] before passing [VEH-2]		
2.	[VEH-2] departs Location A toward Location B, reaching [SpeedLimitVar] before passing [VEH-1]		
3.	[VEH-1] and [VEH-2] approach each other from opposite directions, traveling at [SpeedLimitVar].		Pass ___Fail ___ Partial ___ Comments:
4.	[VEH-1] enters [VEH-2] blind spot, traveling in opposite direction.	No BSW alert issued in [VEH-1].	Pass ___Fail ___ Partial ___ Comments:
5.	[VEH-2] enters [VEH-] blind spot, traveling in opposite direction.	No BSW alert issued in [VEH-2].	Pass ___Fail ___ Partial ___ Comments:
6.	[VEH-1] stops at Location D		
7.	[VEH-2] stops at Location B		

3.2.2.41 Use Case 15 Demonstration 1 Scene – NOT DEMONSTRATED 8/19

The demonstrations and steps listed below are subject to adjustment due to local conditions (e.g., weather, the presence of pedestrians and other vehicles).

Table 77 – UC15D1 Scene

Use Case 15: Roadway User Functionality
 	
Demonstration 1: Vehicle Turning Right in Front of Bus Warning (VTRW) application
 	
Purpose: Demonstrate that the ASD device on a transit vehicle (bus) departing a bus stop produces a VTRW message to the driver when receiving BSMs from other remote vehicle connected ASD indicating a potential conflict with the remote vehicle: RV passing bus as bus departs stop; RV passing with the intent to turn right in front of or change lanes in front of bus (based on heading and position); RV turning right in front of bus (based on heading and position).
 	
Variables:
 	
Pre-Conditions:
• **Remote vehicle driver = VEH-1**
• **Transit vehicle (bus) driver = VEH-2**
• **Remote vehicle starting point = [LocationA]**
• **Remote vehicle first lane change point = [LocationB]**
• **Transit vehicle bus stop point = [LocationC]**
• **Remote vehicle second lane change/turn point = [LocationD]**
 	
Test Cases:
 	
Requirements: 102.5.2, 102.5.3, 102.5.4, 102.5.5, 102.5.6, 102.5.7, 102.5.8, 102.5.9, 102.5.17
 	
Demonstrator: Two Phase 2 Participant Drivers
 	
Facilitator: TransCore employee
 	
Observer: USDOT AOR and Reviewers representatives
 	
Observer Experience:
Observers ride in both participant vehicles equipped with an ASD on which the software is installed and commissioned. As the bus prepares to leave the stop and enter the lane (transmission in gear, brake released), remote vehicle changes lanes to pass bus on the left or moves to turn right in front of the bus.
 	
Demonstration runs:
Run 1: Remote vehicle passes bus on the left.
 	
Run 2: Remote vehicle passes bus on the left and then changes lanes to right in front of the bus.
 	
Run 3: Remote vehicle in lane to left of the bus moves to turn right in front of the bus.
 	
Run 4: Remote vehicle changes lanes to pass bus on the left and turn right in front of the bus; bus is not in gear. No warning/alert is received on bus ASD.
 	
Expectation:
• **Run 1:**
  ○ **Bus placed in gear and brake released**
  ○ **Remote vehicle immediately behind bus changes lanes to pass bus on the left**
  ○ **Warning/alert is received on bus ASD**
	Figure to be added later

• **Run 2:**
  ○ **Bus placed in gear and brake released**
  ○ **Remote vehicle immediately behind bus changes lanes to pass bus on the left**
  ○ **Remote vehicle again changes lanes to move to right in front of the bus**
  ○ **Warning/alert is received on bus ASD**
• **Run 3:**
  ○ **Bus placed in gear and brake released**
  ○ **Remote vehicle in lane to left of bus moves to turn right in front of the bus**
  ○ **Warning/alert is received on bus ASD**
• **Run 4:**
  ○ **Bus not in gear**
  ○ **Remote vehicle immediately behind bus changes lanes to pass bus on the left**
  ○ **Remote vehicle again changes lanes to move to right in front of the bus**
  ○ **No warning/alert is received on bus ASD**	

3.2.2.42 Use Case 15 Demonstration 1 Actions

Note that it is recommended that SpeedMargin1 be set to 5 MPH to minimize the human error in maintaining the speed of the vehicle. Each test run can be repeated at different SpeedMargin1 variables.

Table 78 – UC15D1 Actions

No.	Actions	Expected Result	Pass/Fail/Partial/Comments
Run 1			
1.			Pass ___Fail ___ Partial ___ Comments:
2.			Pass ___Fail ___ Partial ___ Comments:
3.			Pass ___Fail ___ Partial ___ Comments:
4.			Pass ___Fail ___ Partial ___ Comments:
5.			Pass ___Fail ___ Partial ___ Comments:
6.			Pass ___Fail ___ Partial ___ Comments:
7.			Pass ___Fail ___ Partial ___ Comments:

No.	Actions	Expected Result	Pass/Fail/Partial/Comments
8.			Pass ___Fail ___ Partial ___ Comments:
Run 2			
9.			Pass ___Fail ___ Partial ___ Comments:
10.			Pass ___Fail ___ Partial ___ Comments:
11.			Pass ___Fail ___ Partial ___ Comments:
12.			Pass ___Fail ___ Partial ___ Comments:
Run 3			
13.			Pass ___Fail ___ Partial ___ Comments:
14.			Pass ___Fail ___ Partial ___ Comments:
15.			Pass ___Fail ___ Partial ___ Comments:
16.			Pass ___Fail ___ Partial ___ Comments:
Run 4			
17.			Pass ___Fail ___ Partial ___ Comments:
18.			Pass ___Fail ___ Partial ___ Comments:
19.			Pass ___Fail ___ Partial ___ Comments:

No.	Actions	Expected Result	Pass/Fail/Partial/Comments
20.			Pass ___Fail ___ Partial ___ Comments:
21.			Pass ___Fail ___ Partial ___ Comments:
22.			Pass ___Fail ___ Partial ___ Comments:

3.2.2.43 Use Case 16 Demonstration 1 Scene

Table 79 – UC16D1 Scene

Use Case 16: System Manager Functionality **Demonstration 1: ASD Firmware Update and Application Configuration Download** **<u>Purpose</u>: To demonstrate the ability to determine the ASD's firmware version and perform over-the-air (OTA) firmware updates as needed. To demonstrate the ability to upload or download the configuration parameters of V2I and V2V applications to the ASD.** **<u>Variables</u>:** • **Old ASD Firmware = [OldASDFirmwareVar]** • **New ASD Firmware = [NewASDFirmwareVar]** • **RSU Range = [RSURangeVar]** • **Speed Limit = [SpeedLimitVar] = 25 mph** • **Time of Day schedule = [TODScheduleVar]** • **Day of Week schedule = [DOWScheduleVar]** • **Over speed Limit parameter = [OverSpeedLimitVar] = 0 mph** • **Speed Margin 1 = [SpeedMargin1] = -5 mph** • **Speed Margin 2 = [SpeedMargin2] = +5 mph** • **Vehicle 1 driver = VEH-1** **<u>Pre-Conditions</u>:** • **Participant driver in a with old ASD firmware** • **NYCDOT CV equipment maintenance personnel who is familiar with the installation and configuration of the ASD application** • **The RSU broadcasts WAVE Service Advertisement (WSA), indicating that it is prepared to transmit the firmware update parameters to the vehicle** • **Mark the fleet terminal or parking point location where ASD firmware update is performed** • **Older and newer versions of the ASD firmware are available. For example, [OldASDFirmwareVar] = 3.1 and [NewASDFirmwareVar] = 3.2** • **Set the RSU range. For example, [RSURangeVar] = 300 ft distance** • **Mark the vehicle starting point** • **Place start cone at the beginning edge of RSU range** • **Place stop cone at the end of RSU range** • **Mark the fleet terminal or parking point location where ASD configurations are performed** • **Define a speed limit for the roadway segment. For example, [SpeedLimitVar] = 25MPH** • **Define a time-of-day and day-of-week schedule. For example, [TODScheduleVar] = 1PM and [DOWScheduleVar] = January 1, 2019** • **Define the "over speed" parameter. For example, [OverSpeedLimitVar] = 10MPH** • **One of the following vehicle types are available for testing: Light Duty Vehicle ASD, Bus vehicle ASD or Commercial Vehicle ASD** **<u>Test Cases</u>:**	Location: NYCDOT Lab 34-02 Queens Blvd. Long Island City, Queens, NY

Requirements: 403.1.1,403.1.1.1,403.1.1.2,403.2.1,403.2.2,403.3.1,403.4.1,403.4.2
 	
Demonstrators: Phase 2 Participant Driver, NYCDOT CV equipment maintenance personnel
 	
Facilitator: TransCore employee
 	
Observer: USDOT AOR and Reviewers representatives
 	
Observer Experience:
 	
Observers will watch as the ASD configuration tool is used to perform a firmware update on an ASD that was commissioned. Observers will watch as the ASD configuration tool is used to upload, download and modify ASD parameters.
 	
Two demonstration runs:
• **Run 1: System Manager launches the ASD tool, installs the ASD Firmware Update application and then a firmware update is performed on the system**
• **Run 2: System Manager launches the ASD CV application configuration tool and the vehicle configuration parameters are downloaded**
 	
Expectation:
• **Run 1:**
  ○ **Firmware Update application is successfully installed on the ASD and commissioned**
  ○ **ASD firmware downloads successfully and is verified**
  ○ **ASD firmware update is performed**
  ○ **ASD firmware update is successful**
• **Run 2:**
  ○ **Vehicle configuration parameters are downloaded to the ASD**
  ○ **ASD is validated for operation**
  ○ **ASD is commissioned for operation**	

3.2.2.44 Use Case 16 Demonstration 1 Actions

Table 80 – UC16D1 Actions

No.	Actions	Expected Result	Pass/Fail/Comments
Run 1			
1	Drive VEH-1 to its fleet terminal or parking point location where ASD firmware update service is advertised and park it.	VEH-1 is at the location for ASD firmware update service	Pass ___ Fail ___ Comments:
2	VEH-1 drives from starting point towards start cone	No warning issued to driver	Pass ___ Fail ___ Comments:
3	VEH-1 reaches start cone driving at [SpeedMargin1] below [SpeedLimitVar]	No warning issued to driver	Pass ___ Fail ___ Comments:
4	VEH-1 drives [SpeedMargin2] above the over speed parameter through the RSU range	Speed limit warning issued to the driver	Pass ___ Fail ___

No.	Actions	Expected Result	Pass/Fail/Comments
			Comments:
5	VEH-1 reaches stop cone	Speed limit warning issued to the driver	Pass ___ Fail ___ Comments:
6	Drive VEH-1 to its fleet terminal or parking point location where ASD Firmware Update services is advertised	Vehicle is at the location for ASD Firmware Update services	Pass ___ Fail ___ Comments:
7	Check for an indication that RSU is downloading the new firmware package for the ASD	ASD shows that it is downloading the new firmware version from the RSU ASD checks that the downloaded firmware package passes verification tests	Pass ___ Fail ___ Comments:
8	Wait for the ASD to complete the installation of the firmware update	ASD successfully installs the new firmware	Pass ___ Fail ___ Comments:
9	Driver exits the parking point location for ASD Firmware Update services	Driver is not in the area for ASD Firmware Update services	Pass ___ Fail ___ Comments:
10	VEH-1 drives from starting point towards start cone	No warning issued to driver	Pass ___ Fail ___ Comments:
11	VEH-1 reaches start cone driving at [SpeedMargin1] below [SpeedLimitVar]	No warning issued to driver	Pass ___ Fail ___ Comments:
12	VEH-1 drives [SpeedMargin2] above the over speed parameter through the RSU range	Speed limit warning issued to the driver	Pass ___ Fail ___ Comments:
13	VEH-1 reaches stop cone	Speed limit warning issued to the driver	Pass ___ Fail ___ Comments:
14	Drive VEH-1 to its fleet terminal or parking point location where ASD Firmware Update services is advertised	Vehicle is at the location for ASD Firmware Update services	Pass ___ Fail ___ Comments:
15	Check for an indication that RSU is downloading a new firmware package for the ASD	No indication is provided that a new firmware version is being downloaded from the RSU	Pass ___ Fail ___ Comments:
Run 2			
16	Drive VEH-1 to its fleet barn terminal or parking point location after operating normal operations	VEH-1 is at the fleet terminal or parking point location	Pass ___ Fail ___ Comments:
17	NYCDOT CV equipment maintenance personnel locates the ASD tool connected to the parked vehicle	Manager has access to the device	Pass ___ Fail ___ Comments:
18	NYCDOT CV equipment maintenance personnel turns on the ASD CV Configuration tool	Tool is ready for operation	Pass ___ Fail ___

No.	Actions	Expected Result	Pass/Fail/Comments
			Comments:
19	Download the vehicle configuration parameters	Download operation succeeds	Pass ___ Fail ___ Comments:
20	Check the CV application configuration parameters	Parameters are valid and ASD is commissioned for operation	Pass ___ Fail ___ Comments:

3.2.2.45 Use Case 17 Demonstration 1 Scene

Table 81 – UC177D1 Scene

Use Case 17: System Manager Functionality **Demonstration *1:* RSU RF Monitoring** **<u>Purpose</u>: To demonstrate how to monitor the RSU RF.** **<u>Variables</u>:** • **RSU1 Range = [RSU1RangeVar]** • **RSU2 Range = [RSU2RangeVar]** • **Speed Limit = [SpeedLimitVar] = 25 mph** • **Time of Day schedule = [TODScheduleVar]** • **Day of Week schedule = [DOWScheduleVar]** • **Over speed Limit parameter = [OverSpeedLimitVar] = 0 mph** • **Speed Margin 1 = [SpeedMargin1] = -5 mph** • **Speed Margin 2 = [SpeedMargin2] = +5 mph** • **Vehicle 1 driver = VEH-1** • **RSU RF Collection Duration = [RSURFCollectionDur]** • **Warning Time-Outs = [WarningTimeOutVar]** **<u>Pre-Conditions</u>:** • **Test drivers has identified a way to trigger a communication or device failure to the ASD unit** • **Enable the system for the collection of RSU RF monitoring information to transmits it to the TMC back office for analysis. For example, [RSURFCollectionDur] = 5 minutes** • **Both the RSU and ASD clocks are synchronized to within 10 ms and use the same time reference** • **NYCDOT CV equipment maintenance personnel who is familiar with the installation and configuration of the ASD application** • **Pen and paper are needed to record data** • **ASD has no ASD event log data** • **Set the range for RSU1 and RSU2 to be very close in distance along the roadway segment** • **Set each RSU range. For example, [RSU1RangeVar] = 300 ft distance and [RSU2RangeVar] = 400 ft distance** • **Mark the vehicle starting point** • **Mark the vehicle fleet terminal /parking point in the RSU vicinity so that ASD data can be uploaded** • **Two RSU are available for testing: RSU1 is the known as the barrier truck and RSU 2 is known as the lead vehicle:** • **Place start cone at the beginning edge of RSU1 range** • **Place stop cone at the end of RSU1 range** • **Place start cone at the beginning edge of RSU2 range** • **Place stop cone at the end of RSU2 range** • **Define a speed limit for the roadway segment. For example, [SpeedLimitVar] = 25MPH** • **Define a time-of-day and day-of-week schedule. For example, [TODScheduleVar] = 1PM and [DOWScheduleVar] = January 1, 2019** • **Define the "over speed" parameter. For example, [OverSpeedLimitVar] = 10MPH** • **Define the warning time-out/end time values. For example, [WarningTimeOutVar] = 2 hours** • **One of the following vehicle types are available for testing: Light Duty Vehicle ASD, Bus vehicle ASD or Commercial Vehicle ASD**	Location: NYCDOT Lab 34-02 Queens Blvd. Long Island City, Queens, NY

Test Cases: **Requirements: 405.1.7,405.1.8,405.1.9,405.1.10, 405.1.12,405.2.1,405.2.2,405.2.3,405.2.4,405.2.5,405.2.6,405.2.7,405.2.8,501.1.1** **Demonstrators: Phase 2 Participant Driver, Activity Recorder (to record events)** **Facilitator: TransCore employee** **Observer: USDOT AOR and Reviewers representatives** **Observer Experience:** **Observers will drive in participant's vehicle in an area where multiple RSUs are installed and checks the data that the RSU logs for the vehicle.** **One demonstration run:** • **Run 1: Driver operates a CV-equipped vehicle in testing area and checks the RSU logs for the data it logs for the vehicle** **Expectation:** • **Run 1:** ○ **RSU RF Monitoring application is successfully installed on the ASD and commissioned** ○ **RSU logs data for each BSM** ○ **RSU determines the first message received from the ASD** ○ **RSU determines the last message received from the ASD** ○ **RSU logs the last entry for the same vehicle**	

3.2.2.46 Use Case 17 Demonstration 1 Actions

Table 82 – UC17D1 Actions

No.	Actions	Expected Result	Pass/Fail/Comments
1	Install the RSU RF Monitoring application on the ASD and configure it for for VEH-1.	RSU RF Monitoring application is installed and the ASD is configured for the specific vehicle	Pass ___ Fail ___ Comments:
2	From steps 3 through 12 do the following: Recorder will record the time and activity (vehicle's location, time stamp, heading, and speed) when driver received notifications	None	None
3	VEH-1 drives from starting point towards start cone at RSU1	No warning issued to driver	Pass ___ Fail ___ Comments:
4	VEH-1 reaches start cone at RSU1 driving at **[SpeedMargin1]** below **[SpeedLimitVar]**	No warning issued to driver	Pass ___ Fail ___ Comments:
5	VEH-1 drives at **[SpeedMargin1]** below **[SpeedLimitVar]** through the RSU range while the warning end time is below **[WarningTimeoutVar]**	No warning issued to driver	Pass ___ Fail ___ Comments:
6			

No.	Actions	Expected Result	Pass/Fail/Comments
	VEH-1 reaches stop cone at RSU1 and stops	No warning issued to driver	Pass ___ Fail ___ Comments:
7	VEH-1 drives from stop cone of RSU 1 towards start cone at RSU2	No warning issued to driver	Pass ___ Fail ___ Comments:
8	Trigger an ASD communication failure	ASD failure triggered	Pass ___ Fail ___ Comments:
9	VEH-1 reaches start cone at RSU2 driving at **[SpeedMargin1]** below **[SpeedLimitVar]**	No warning issued to driver	Pass ___ Fail ___ Comments:
10	VEH-1 drives at **[SpeedMargin1]** below **[SpeedLimitVar]** through the RSU2 range while the warning end time is below **[WarningTimeoutVar]**	No warning issued to driver	Pass ___ Fail ___ Comments:
11	VEH-1 drives past the stop cone at RSU2	No warning issued to driver	Pass ___ Fail ___ Comments:
12	Recorder stops recording data	Recording has stopped Information on vehicle location and time and driver's action are recorded	Pass ___ Fail ___ Comments:
13	Drive VEH-1 back to a fleet terminal or parking point location which advertises that it can upload ASD logs	ASD transmits the event log data to the RSU	Pass ___ Fail ___ Comments:
14	Move the NYCDOT CV equipment maintenance personnel and observers to the TMC back office system	All observers and CV personnel are at the TMC back office system	Pass ___ Fail ___ Comments:
15	Check the RSU logs for the BSM data logged	Each BSM logged, includes vehicle ID, location, time stamp, heading, and speed, and the available RF signal levels. BSM logged data matches the recorded data	Pass ___ Fail ___ Comments:
16	Check the RSU logs for the first message received from the ASD	First message is recorded First message matches the one recorded	Pass ___ Fail ___ Comments:
17	Check the RSU logs for the last message received from the ASD	Last message is recorded Last message matches the one recorded	Pass ___ Fail ___ Comments:
18	Wait for [RSURFCollectionDur] to end	No more RSU data is collected	Pass ___ Fail ___ Comments:
19	Wait for the RSU logged entries to be sent to the TMC Check the RSU database	RSU database is purged	Pass ___ Fail ___ Comments:

3.2.2.47 Use Case 18 Demonstration 1 Scene – NOT DEMONSTRATED 8/19

Table 83 – UC18D1 Scene

Use Case 18: System Manager Functionality **Demonstration 1: ASD RF Monitoring** **<u>Purpose</u>: To demonstrate how to monitor the ASD RF support application which is used to detect the presence or absence of ASDs in the NYC CVPD. It also demonstrates what happens during the RSU data collection by the ASD.** **<u>Variables</u>:** • **RSU1 Range = [RSU1RangeVar]** • **RSU2 Range = [RSU2RangeVar]** • **Speed Limit = [SpeedLimitVar] = 25 mph** • **Time of Day schedule = [TODScheduleVar]** • **Day of Week schedule = [DOWScheduleVar]** • **Over speed Limit parameter = [OverSpeedLimitVar] = 0 mph** • **Speed Margin 1 = [SpeedMargin1] = -5 mph** • **Speed Margin 2 = [SpeedMargin2] = +5 mph** • **Vehicle 1 driver = VEH-1** • **RSU RF Collection Duration = [RSURFCollectionDur]** • **Warning Time-Outs = [WarningTimeOutVar]** **<u>Pre-Conditions</u>:** • **Enable the system for the collection of RSU RF monitoring information to transmits it to the TMC back office for analysis. For example, [RSURFCollectionDur] = 5 minutes** • **Both the RSU and ASD clocks are synchronized to within 10 ms and use the same time reference** • **NYCDOT CV equipment maintenance personnel who is familiar with the installation and configuration of the ASD application** • **Pen and paper are needed to record data** • **ASD has no ASD event log data** • **Set the range for RSU1 and RSU2 to be very close in distance along the roadway segment** • **Set each RSU range. For example, [RSU1RangeVar] = 300 ft distance and [RSU2RangeVar] = 400 ft distance** • **Mark the vehicle starting point** • **Mark the vehicle fleet terminal /parking point in the RSU vicinity so that ASD data can be uploaded** • **Two RSU are available for testing: RSU1 is the known as the barrier truck and RSU 2 is known as the lead vehicle:** • **Place start cone at the beginning edge of RSU1 range** • **Place stop cone at the end of RSU1 range** • **Place start cone at the beginning edge of RSU2 range** • **Place stop cone at the end of RSU2 range** • **Define a speed limit for the roadway segment. For example, [SpeedLimitVar] = 25MPH** • **Define a time-of-day and day-of-week schedule. For example, [TODScheduleVar] = 1PM and [DOWScheduleVar] = January 1, 2019** • **Define the "over speed" parameter. For example, [OverSpeedLimitVar] = 10MPH** • **Define the warning time-out/end time values. For example, [WarningTimeOutVar] = 2 hours**	

• **One of the following vehicle types are available for testing: Light Duty Vehicle ASD, Bus vehicle ASD or Commercial Vehicle ASD** **Test Cases:** **Requirements: 405.1.7,405.1.8,405.1.9,405.1.10, 405.1.12,405.2.1,405.2.2,405.2.3,405.2.4,405.2.5,405.2.6,405.2.7,405.2.8,501.1.1,501.2.1.4,501.2.1.5,501.2.1.6,501.2.1.7501.2.2,501.3.1,501.3.4,501.3.2,501.3.3** **Demonstrators: Phase 2 Participant Driver, Activity Recorder (to record events)** **Facilitator: TransCore employee** **Observer: USDOT AOR and Reviewers representatives** **Observer Experience:** **Observers will drive in participant's vehicle in an area where multiple RSUs are installed and checks how the RSU data is collected by the ASD.** **One demonstration run:** **Run 1: Driver operates a CV-equipped vehicle in testing area and checks the ASD logs for the RSU data that is collected** **Expectation:** • **Run 1:** ○ **ASD RF Monitoring application is successfully installed on the ASD and commissioned** ○ **ASD logs RSU data via each BSM** ○ **ASD determines the first message received from the RSU** ○ **ASD determines the last message received from the RSU** ○ **RSU logs the first and last entries for the each RSU**	

3.2.2.48 Use Case 18 Demonstration 1 Actions

Table 84 – UC18D1 Actions

No.	Actions	Expected Result	Pass/Fail/Comments
1	Install the ASD RF Monitoring application on the ASD and configure it for VEH-1.	ASD RF Monitoring application is installed and the ASD is configured for the specific vehicle	Pass ___ Fail ___ Comments:
2	From steps 3 through 12 do the following: Recorder will record the time and activity (vehicle's location, time stamp, heading, and speed) when driver received notifications	None	None
3	VEH-1 drives from starting point towards start cone at RSU1	No warning issued to driver	Pass ___ Fail ___ Comments:
4	VEH-1 reaches start cone at RSU1 driving at **[SpeedMargin1]** below **[SpeedLimitVar]**	No warning issued to driver	Pass ___ Fail ___ Comments:
5			

No.	Actions	Expected Result	Pass/Fail/Comments
	VEH-1 drives at **[SpeedMargin1]** below **[SpeedLimitVar]** through the RSU range while the warning end time is below **[WarningTimeoutVar]**	No warning issued to driver	Pass ___ Fail ___ Comments:
6	VEH-1 reaches stop cone at RSU1 and stops	No warning issued to driver	Pass ___ Fail ___ Comments:
7	VEH-1 drives from stop cone of RSU 1 towards start cone at RSU2	No warning issued to driver	Pass ___ Fail ___ Comments:
8	VEH-1 reaches start cone at RSU2 driving at **[SpeedMargin1]** below **[SpeedLimitVar]**	No warning issued to driver	Pass ___ Fail ___ Comments:
9	VEH-1 drives at **[SpeedMargin1]** below **[SpeedLimitVar]** through the RSU2 range while the warning end time is below **[WarningTimeoutVar]**	No warning issued to driver	Pass ___ Fail ___ Comments:
10	VEH-1 drives pass the stop cone at RSU2	No warning issued to driver	Pass ___ Fail ___ Comments:
11	Recorder stops recording data	Recording has stopped Information on vehicle location and time and driver's action are recorded	Pass ___ Fail ___ Comments:
12	Drive VEH-1 back to a fleet terminal or parking point location which advertises that it can upload ASD logs	ASD transmits the event log data to the RSU	Pass ___ Fail ___ Comments:
13	Move the NYCDOT CV equipment maintenance personnel and observers to the TMC back office system	All observers and CV personnel are at the TMC back office system	Pass ___ Fail ___ Comments:
14	Check the ASD logs for the BSM data logged	For each RSU that the ASD hears from: A BSM event is logged. Each BSM logged event, includes RSU ID and power level information, vehicle's location, time stamp, heading, and speed BSM logged data matches the recorded data	Pass ___ Fail ___ Comments:
15	Check the ASD logs for the first message received from the RSU	For each RSU that the ASD hears from: First message is recorded First message matches the one recorded	Pass ___ Fail ___ Comments:
16	Check the ASD logs for the last message received from the RSU	For each RSU that the ASD hears from: Last message is recorded Last message matches the one recorded	Pass ___ Fail ___ Comments:
17	Wait for [RSURFCollectionDur] to end	No more RSU data is collected	Pass ___ Fail ___

No.	Actions	Expected Result	Pass/Fail/Comments
			Comments:
18	Wait for log upload from ASD to RSU	RSU acknowledges receipt of upload and processes the RF log entries	Pass ___ Fail ___ Comments:
19	Check the ASD for RF log entries	RF log entries are purged	Pass ___ Fail ___ Comments:

3.2.2.49 Use Case 18 Demonstration 2 Scene – NOT DEMONSTRATED 8/19

Table 85 – UC18D2 Scene

Use Case 18: System Manager Functionality **Demonstration 2: ASD RF Monitoring** **<u>Purpose</u>: To demonstrate how to monitor the ASD RF support application which is used to detect the presence or absence of other ASDs in the NYC CVPD.** **<u>Variables</u>:** • **RSU1 Range = [RSU1RangeVar]** • **RSU2 Range = [RSU2RangeVar]** • **Speed Limit = [SpeedLimitVar] = 25 mph** • **Time of Day schedule = [TODScheduleVar]** • **Day of Week schedule = [DOWScheduleVar]** • **Over speed Limit parameter = [OverSpeedLimitVar] = 0 mph** • **Speed Margin 1 = [SpeedMargin1] = -5 mph** • **Speed Margin 2 = [SpeedMargin2] = +5 mph** • **Vehicle 1 driver = VEH-1** • **Vehicle 2 driver = VEH-2** • **ASD Collection Duration = [ASDCollectionDur]** • **Warning Time-Outs = [WarningTimeOutVar]** **<u>Pre-Conditions</u>:** • **Both the RSU and ASD clocks are synchronized to within 10 ms and use the same time reference** • **NYCDOT CV equipment maintenance personnel who is familiar with the installation and configuration of the ASD application** • **Pen and paper are needed to record data** • **ASD has no ASD event log data** • **Two participant drivers are available and each one equipped with an ASD** • **Define the ASD data collection in the RSU and the TMC's back office CV data processing center for a specified duration. For example, [**ASDCollectionDur**] = 5 minutes** • **Set the range for RSU1 and RSU2 to be very close in distance along the roadway segment** • **Set each RSU range. For example, [RSU1RangeVar] = 300 ft distance and [RSU2RangeVar] = 400 ft distance** • **Mark the vehicle starting point** • **Mark the vehicle fleet terminal /parking point in the RSU vicinity so that ASD data can be uploaded** • **Two RSU are available for testing: RSU1 is the known as the barrier truck and RSU 2 is known as the lead vehicle:** • **Place start cone at the beginning edge of RSU1 range** • **Place stop cone at the end of RSU1 range** • **Place start cone at the beginning edge of RSU2 range** • **Place stop cone at the end of RSU2 range** • **Define a speed limit for the roadway segment. For example, [SpeedLimitVar] = 25MPH**	

• **Define a time-of-day and day-of-week schedule. For example, [TODScheduleVar] = 1PM and [DOWScheduleVar] = January 1, 2019** • **Define the "over speed" parameter. For example, [OverSpeedLimitVar] = 10MPH** • **Define the warning time-out/end time values. For example, [WarningTimeOutVar] = 2 hours** • **One of the following vehicle types are available for testing: Light Duty Vehicle ASD, Bus vehicle ASD or Commercial Vehicle ASD** • **Two vehicles are available for testing; one parks at RSU1 while the other one carries out actions 3-11.** **Test Cases:** **Requirements: 405.1.7,405.1.8,405.1.9,405.1.10, 405.1.12,405.2.1,405.2.2,405.2.3,405.2.4,405.2.5,405.2.6,405.2.7,405.2.8,501.1.1,501.2.1.4,501.2.1.5,501.2.1.6,501.2.1.7501.2.2,501.3.1,501.3.4,501.3.2,501.3.3** **Demonstrators: Two Phase 2 Participant Drivers, Two Activity Recorders (to record events)** **Facilitator: TransCore employee** **Observer: USDOT AOR and Reviewers representatives** **Observer Experience:** **Observers will drive in participant's vehicle in an area where multiple RSUs are installed and checks how the ASD data is collected by the ASD.** **One demonstration run:** • **Run 1: Driver of VEH-1 operates a CV-equipped vehicle in testing area and checks the ASD logs for the ASD data that is collected for vehicles VEH-1 and VEH-2** **Expectation:** • **Run 1:** ○ **ASD RF Monitoring application is successfully installed on the ASD and commissioned** ○ **ASD logs ASD data via each BSM** ○ **ASD logs the first message received from the same ASD** ○ **ASD logs the last message received from the same ASD**	

3.2.2.50 Use Case 18 Demonstration 2 Actions

Table 86 – UC18D2 Actions

No.	Actions	Expected Result	Pass/Fail/Comments
1	Install the ASD RF Monitoring application on the ASD and configure it for VEH-1 and VEH-2.	ASD RF Monitoring application is installed and the ASD is configured for each specific vehicle	Pass ___ Fail ___ Comments:
2	From steps 3 through 12 do the following: Recorder will record the time and activity (vehicle's location, time stamp, heading, and speed) when driver received notifications	None	None
3	VEH-1 drives from starting point towards start cone at RSU1	No warning issued to driver	Pass ___ Fail ___ Comments:

No.	Actions	Expected Result	Pass/Fail/Comments
4	VEH-1 reaches start cone at RSU1 driving at **[SpeedMargin1]** below **[SpeedLimitVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
5	VEH-1 drives at **[SpeedMargin1]** below **[SpeedLimitVar]** through the RSU range while the warning end time is below **[WarningTimeoutVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
6	VEH-1 reaches stop cone at RSU1 and the warning end time is below **[WarningTimeoutVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
7	VEH-1 drives from stop cone of RSU 1 towards start cone at RSU2	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
8	VEH-1 reaches start cone at RSU2 driving at **[SpeedMargin1]** below **[SpeedLimitVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
9	VEH-1 drives at **[SpeedMargin1]** below **[SpeedLimitVar]** through the RSU2 range while the warning end time is below **[WarningTimeoutVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
10	VEH-1 reaches stop cone at RSU2 and the warning end time is below **[WarningTimeoutVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
11	VEH-1 drives past the stop cone at RSU2	No warning issued to driver	Pass ___ Fail ___ Comments:
12	Recorder stops recording data	Recording has stopped Information on vehicle location and time and driver's action are recorded	Pass ___ Fail ___ Comments:
13	Drive VEH-1 back to a fleet terminal or parking point location which advertises that it can upload ASD logs	ASD transmits the event log data to the RSU	Pass ___ Fail ___ Comments:
14	Repeat steps 3 through 13 for VEH-2	Test steps pass	Pass ___ Fail ___ Comments:
15	Move the NYCDOT CV equipment maintenance personnel and observers to the TMC back office system	All observers and CV personnel are at the TMC back office system	Pass ___ Fail ___ Comments:
16	For VEH-1: Check the ASD logs for the BSM data logged for both VEH-1 and VEH-2	For VEH – 1: each BSM logged event includes vehicle ID and power level information, vehicle's location, heading, speed, date and time. BSM logged data matches the recorded data For VEH – 2: each BSM logged event, includes vehicle's location, heading, speed, date and time.	Pass ___ Fail ___ Comments:

No.	Actions	Expected Result	Pass/Fail/Comments
17	Check the ASD logs for the first message received from the ASD	For each ASD that the ASD hears: First message is recorded for VEH-1 First message matches the one recorded	Pass ___ Fail ___ Comments:
18	Check the ASD logs for the last message received from the ASD	Last message is recorded for VEH-1 Last message matches the one recorded	Pass ___ Fail ___ Comments:
19	For VEH-2: Check the ASD logs for the BSM data logged for both VEH-2 and VEH-1	For VEH – 2: each BSM logged event includes vehicle ID and power level information, vehicle's location, heading, speed, date and time. BSM logged data matches the recorded data For VEH – 1: each BSM logged event, includes vehicle's location, heading, speed, date and time.	Pass ___ Fail ___ Comments:
20	Check the ASD logs for the first message received from the ASD	For each ASD that the ASD hears: First message is recorded for VEH-2 First message matches the one recorded	Pass ___ Fail ___ Comments:
21	Check the ASD logs for the last message received from the ASD	Last message is recorded for VEH-2 Last message matches the one recorded	Pass ___ Fail ___ Comments:
22	Wait for the **[ASDCollectionDur]** to end	No more ASD data is collected	Pass ___ Fail ___ Comments:
23	Wait for log upload from ASD to RSU	RSU acknowledges receipt of upload and processes the RF log entries	Pass ___ Fail ___ Comments:
24	Check the ASD for RF log entries	RF log entries are purged	Pass ___ Fail ___ Comments:

3.2.2.51 Use Case 19 Demonstration 1 Scene

Table 87 – UC19D1 Scene

Use Case 19: Independent Evaluator Functionality
 	
Demonstration 1: ASD Event Data Recording
 	
<u>Purpose</u>: To demonstrate the application's ability to log the information before and after a particular event.
 	
<u>Variables</u>:
• **RSU1 Range = [RSU1RangeVar]**
• **RSU2 Range = [RSU2RangeVar]**
• **Speed Limit = [SpeedLimitVar] = 25 mph**
• **Time of Day schedule = [TODScheduleVar]**
• **Day of Week schedule = [DOWScheduleVar]**
• **Over speed Limit parameter = [OverSpeedLimitVar] = 0 mph**
• **Speed Margin 1 = [SpeedMargin1] = -5 mph**
• **Speed Margin 2 = [SpeedMargin2] = +5 mph**
• **Vehicle 1 driver = VEH-1**
• **Warning Time-Outs = [WarningTimeOutVar]**
• Event Data to Record = [EventDataToRecord]
 	
<u>Pre-Conditions</u>:
• **NYCDOT CV equipment maintenance personnel who is familiar with the installation and configuration of the ASD application**
• **Pen and paper are needed to record event data**
• **Define in the ASD the event data that will be logged**
• **Mark the vehicle fleet terminal /parking point in the RSU vicinity so that ASD data can be uploaded**
• **Set the range for RSU1 and RSU2 to be very close in distance along the roadway segment**
• **Set each RSU range. For example, [RSU1RangeVar] = 300 ft distance, [RSU2RangeVar] = 400 ft distance**
• **Mark the vehicle starting point**
• **Two RSU are available for testing: RSU1 is the known as the barrier truck and RSU 2 is known as the lead vehicle:**
  ○ **Place start cone at the beginning edge of RSU1 range**
  ○ **Place stop cone at the end of RSU1 range**
  ○ **Place start cone at the beginning edge of RSU2 range**
  ○ **Place stop cone at the end of RSU2 range**
• **Define a speed limit for the roadway segment. For example, [SpeedLimitVar] = 25MPH**
• **Define a time-of-day and day-of-week schedule. For example, [TODScheduleVar] = 1PM and [DOWScheduleVar] = January 1, 2019**
• **Define the "over speed" parameter. For example, [OverSpeedLimitVar] = 10MPH**
• **Define the warning time-out/end time values. For example, [WarningTimeOutVar] = 2 hours**
• **One of the following vehicle types are available for testing: Light Duty Vehicle ASD, Bus vehicle ASD or Commercial Vehicle ASD**
 	
<u>Test Cases</u>:
	Location: NYCDOT Lab
	34-02 Queens Blvd.
	Long Island City, Queens, NY

Requirements: **405.1.1,405.1.2,405.1.3,405.1.4,405.1.5,405.1.6,501.3.6501.3.5,501.3.6,502.1.1502.1.2,502.1.2.1,502.1.4,502.1.5,502.1.6,502.1.7,502.1.8,502.1.12,502.1.9,502.1.10,502.2.1,502.2.2,502.2.3,502.2.4** **Demonstrators: Phase 2 Participant Driver, Activity Recorders (to record events)** **Facilitator: TransCore employee** **Observer: USDOT AOR and Reviewers representatives** **Observer Experience:** **Observers will drive in participant's vehicle in an area where multiple RSUs are installed and checks that event data is recorded for all the alerts issued to the driver.** **One demonstration run:** • **Run 1: Driver of VEH-1 operates a CV-equipped vehicle in the testing area and checks that event logs are recorded** **Expectation:** • **Run 1:** ○ **Driver is notified of alerts while performing normal operation in the testing area** ○ **ASD stores event records from all alerts** ○ **ASD transmits the event logs to the RSU**	

3.2.2.52 Use Case 19 Demonstration 1 Actions

Table 88 – UC19D1 Actions

No.	Actions	Expected Result	Pass/Fail/Comments
1	Driver of VEH-1 exits the fleet terminal to start normal day of operation	VEH-1 is not at the fleet terminal	Pass ___ Fail ___ Comments:
2	For steps 3 through 12 do the following: Recorder will record details on the vehicle's location, time and driver's action	None	None
3	VEH-1 drives from starting point towards start cone at RSU1	No warning issued to driver	Pass ___ Fail ___ Comments:
4	VEH-1 reaches start cone at RSU1 driving at **[SpeedMargin1]** below **[SpeedLimitVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
5	VEH-1 drives at **[SpeedMargin1]** below **[SpeedLimitVar]** through the RSU range while the warning end time is below **[WarningTimeoutVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
6	VEH-1 reaches stop cone at RSU1 and the warning end time is below **[WarningTimeoutVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:

No.	Actions	Expected Result	Pass/Fail/Comments
7	VEH-1 drives from stop cone of RSU 1 towards start cone at RSU2	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
8	VEH-1 reaches start cone at RSU2 driving at **[SpeedMargin1]** below **[SpeedLimitVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
9	VEH-1 drives at **[SpeedMargin1]** below **[SpeedLimitVar]** through the RSU2 range while the warning end time is below **[WarningTimeoutVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
10	VEH-1 reaches stop cone at RSU2 and the warning end time is below **[WarningTimeoutVar]**	Speed zone warning and geographic limit of the speed zone issued to driver	Pass ___ Fail ___ Comments:
11	VEH-1 drives pass the stop cone at RSU2	No warning issued to driver	Pass ___ Fail ___ Comments:
12	Recorder stops recording data	Recording has stopped Information on vehicle location and time and driver's action are recorded	Pass ___ Fail ___ Comments:
13	Drive VEH-1 back to a fleet terminal or parking point location which advertises that it can upload ASD logs	ASD transmits the event log data to the RSU	Pass ___ Fail ___ Comments:
14	Move NYCDOT CV equipment maintenance personnel and observers to the TMC back office system	All observers and CV personnel are at the TMC back office system	Pass ___ Fail ___ Comments:
15	Check the details of the ASD event records	ASD logs show event records for all alerts generated and matches the data that was recorded by the Activity Recorder The information on vehicle location, time and driver's action are recorded Details are recorded at a resolution needed for the alert type (e.g. 1/10 second or 1 second interval) for periods before and after each alert with the duration of each period defined by the needs of the alert.	Pass ___ Fail ___ Comments:

3.2.2.53 Use Case 20 Demonstration 1 Scene

Table 89 – UC20D1 Scene

Use Case 20: Independent Evaluator Functionality **Demonstration 1: ASD Event Data Upload** **Purpose: To demonstrate the application's ability to transmit the event history log generated from the BSMs in the ASDs and MAPs in the ASDs from the RSUs** **Variables:** • **RSU Range = [RSURangeVar]** • **Vehicle 1 driver = VEH-1** **Pre-Conditions:** • **Set the RSU range. For example, [RSURangeVar] = 300 ft distance** • **Mark the vehicle fleet terminal /parking point in the RSU vicinity so that ASD data can be uploaded** • **NYCDOT CV equipment maintenance personnel who is familiar with the installation and configuration of the ASD application** • **The driver has completed normal operations but has not yet returned to the fleet barn or parking location** **Test Cases:** **Requirements: 405.1.11,405.1.11.1,405.1.11.2,405.1.11.3** **Demonstrators: Phase 2 Participant Driver** **Facilitator: TransCore employee** **Observer: USDOT AOR and Reviewers representatives** **Observer Experience:** **Observers will drive in participant's vehicle in an area where multiple RSUs are installed and checks that event data that is recorded for all the alerts issued to the driver are uploaded successfully.** **One demonstration run:** • **Run 1: Driver of VEH-1 returns a CV-equipped vehicle to the fleet barn or other support location and checks that the recorded event logs are uploaded by the RSU** **Expectation:** • **Run 1:** ○ **ASD event logs are uploaded to the RSU** ○ **RSU sends uploaded data to TMC for analysis and processing**	Location: NYCDOT Lab 34-02 Queens Blvd.

3.2.2.54 Use Case 20 Demonstration 1 Actions

Table 90 – UC20D1 Actions

No.	Actions	Expected Result	Pass/Fail/Comments
1	Drive VEH-1 from starting point to the parking point location so that it can upload ASD.	Vehicle is parked at the location that uploads ASD logs	:
2	Wait for event data logs to be uploaded	RSU verifies receipt of the event log data transmission from the ASD Event data is uploaded RSU sends event data to the TMC for processing and analysis	Pass ___ Fail ___ Comments:
3	Move to the TMC back office system	Observer is at the TMC back office system	

No.	Actions	Expected Result	Pass/Fail/Comments
4	Check the RSU database	RSU purges the event log entries after they are transmitted to the TMC	Pass ___ Fail ___ Comments:

3.2.2.55 Use Case 21 Demonstration 1 Scene

Table 91 – UC21D1 Scene

Use Case 21: Independent Evaluator Functionality **Demonstration 1: Performance Measurement Data Processing** **Purpose: To demonstrate the application's ability to process the event record data collected by the ASD and collected by the Event Data Upload application** **Pre-Conditions:** • **NYCDOT TMC analyzer/evaluator who is familiar with performance measurement data processing** • **RSU has sent event data to the TMC for processing and analysis** **Test Cases:** **Requirements: 506.1.1,506.1.1.1,506.1.2,510.2.1,510.5.1,510.5.1.1,510.5.2,510.6.1,510.7.1,510.7.2, 510.7.3,510.8.1,510.8.2,510.8.3,510.9.1,510.10.1,510.10.2,510.10.3,510.10.1.1,510.10.1.2,510.10.1.3** **Demonstrators: NYCDOT TMC analyzer/evaluator** **Facilitator: TransCore employee** **Observer: USDOT AOR and Reviewers representatives** **Observer Experience:** **Observers located at TMC will check the RSU transmitted event data to ensure that it is processed completely and verified correctly** **One demonstration run:** • **Run 1: Event data transmitted to the TMC is evaluated for processing completeness and correctness** **Expectation:** • **Run 1:** ○ **Event data transmitted to TMC is stored in a temporary server** ○ **Event data is aggregated** ○ **Traceable and private data is deleted** ○ **Raw data is purged after errors are addressed and checked**	

3.2.2.56 Use Case 21 Demonstration 1 Actions

Table 92 – UC21D1 Actions

No.	Actions	Expected Result	Pass/Fail/Comments
1	NYCDOT TMC analyzer/evaluator move to the TMC back office system	Analyzer/evaluator is at the TMC back office system	
2	NYCDOT TMC analyzer/evaluator accesses the server used for temporary storage of data transmitted to the RSU	RSU data is collected and stored	Pass ___ Fail ___ Comments:

No.	Actions	Expected Result	Pass/Fail/Comments
3	Analyzer/evaluator performs a periodic batch process to examine each raw event and aggregate it into bins based on the event type, time, and location of the event.	Data is aggregated into bins based on the event type, time, and location of the event.	Pass ___ Fail ___ Comments:
4	Analyzer/evaluator re-anchors the time and location data for each recorded event	Event records are cleansed	Pass ___ Fail ___ Comments:
5	Repeat step 3 until all errors and issues are addressed	Test step passes	Pass ___ Fail ___ Comments:
6	Analyzer/evaluator checks and validates the aggregated and normalized data for any remains of PII.	No remains of PII shown	Pass ___ Fail ___ Comments:
7	Analyzer/evaluator completes the verification process	Verification process is done	Pass ___ Fail ___ Comments:
8	Analyzer/evaluator purges the raw event records.	Raw event records are deleted	Pass ___ Fail ___ Comments:
9	Analyzer/evaluator conducts a before/after performance evaluation to measure the safety benefits and the effect of deploying CV technology in NYC.	Before/after performance evaluation is done	Pass ___ Fail ___ Comments:
10	Send the aggregated and normalized data to the USDOT Secure Data Commons (SDC)	USDOT Secure Data Commons (SDC) receives the aggregated and normalized data **NOTE:** Additional performance analysis and evaluation will be conducted by the Independent Evaluators (TTI, Volpe) for USDOT.	Pass ___ Fail ___ Comments:

3.2.2.57 Use Case 22 Demonstration 1 Scene

The demonstrations and steps listed below are subject to adjustment due to local conditions (e.g., weather, the presence of pedestrians and other vehicles).

Table 93 – UC22D1 Scene

Use Case 21: Roadway User Functionality **Demonstration 1: Red Light Violation Warning** **Purpose: Demonstrate that functionality of the application for sending alert that a stop is required to avoid a red light violation, based on current speed, heading, acceleration, location and the location of stop bars.** **Variables:** • **RSU Range = [RSURangeVar]** • **Speed Limit = [SpeedLimitVar] = 25 mph** • **Vehicle 1 driver = VEH-1** **Pre-Conditions:** • **One of the following vehicle types is available for testing: Light Duty Vehicle ASD, Bus vehicle ASD or Commercial Vehicle ASD** • **The RLVW application receives MAP and SPaT data from the RSU and signal controller** • **Set the RSU range. For example, [RSURangeVar] = 300 ft distance** • **Mark the vehicle starting point** • **Mark the vehicle deceleration point** • **Place start cone at the beginning edge of RSU range** • **Define a speed limit for the roadway segment. For example, [SpeedLimitVar] = 25MPH** **Test Cases: Danlaw TP_RLVW_HIL_04, Danlaw TP_RLVW_HIL_06** **Requirements: 102.6.1; 102.6.2; 102.6.9; 102.6.10; 102.6.11; 102.6.12; 102.6.13; 102.6.14; 102.6.15; 102.6.16; 102.6.18** **Demonstrator: Phase 2 Participant Driver** **Facilitator: TransCore employee** **Observer: USDOT AOR and Reviewers representatives** **Observer Experience: Observers ride in the participant vehicle equipped with an ASD on which the software is installed and commissioned. The observers note that the driver of the Host Vehicle travels from the starting point A and accelerates to the desired speed approaching the traffic signal displaying red indication. The driver of the Host Vehicle decelerates at varying rates. An alert is received when the driver stops past the stop bar. An alert is not received when the driver stops before the stop bar.** **Two demonstration runs:** • **Run 1: Host vehicle approaches red light and does not decelerate fast enough to stop before stop bar** • **Run 2: Host vehicle approaches red light and decelerates to stop before stop bar** **Expectation:** • **Run 1:** ○ **Host vehicle approaches intersection at speed limit when light is red**	Location: NYCDOT Vicinity of 34-02 Queens Blvd. Long Island City, Queens, NY

○ **Host vehicle begins deceleration past vehicle deceleration point** ○ **Alert received** ○ **Host vehicle stops past stop bar** • **Run 2:** ○ **Host vehicle approaches intersection at speed limit when light is red** ○ **Host vehicle begins deceleration at vehicle deceleration point** ○ **No alert received**	

3.2.2.58 Use Case 22 Demonstration 1 Actions

Table 94 – UC22D1 Actions

No.	Actions	Expected Result	Pass/Fail/Comments
UC22D1Run 1:			
1	VEH-1 drives from starting point towards deceleration point	No warning issued to driver	
2	VEH-1 continues past deceleration point cone without decelerating**]**	Warning issued to driver	Pass ___ Fail ___ Comments:
3	VEH-1 begins decelerating after passing deceleration point cone	Warning issued to driver	Pass ___ Fail ___ Comments:
4	VEH-1 stops over stop bar.	Warning issued to driver	Pass ___ Fail ___ Comments:
UC22D1Run 2:			
5	VEH-1 drives from starting point towards deceleration point	No warning issued to driver	
6	VEH-1 begins decelerating at deceleration point cone	No warning issued to driver	Pass ___ Fail ___ Comments:
7	VEH-1 stops before stop bar.	No warning issued to driver	Pass ___ Fail ___ Comments:

3.2.3 Demonstration Schedule

The demonstration schedule is outlined below in Table 95 and Table 96Table 96.

Day 1 (August 20, 2019; 9:00 AM – 4:30 PM)
Locations

- **Queens**
  - **JTMC (Conference Room):** 28-11 Queens Plaza North in Long Island City, NY
  - **NYCDOT (Field):** 47th Ave/34th St, 47th Ave/35th St, and Queens Blvd/35th St in Long Island City, NY
  - **Queens Blvd (Field):** east of 35th St in Sunnyside, NY
  - **Aqueduct (Field):** Aqueduct Racetrack Parking Lot in South Ozone Park, NY
  - **NYCDOT (City Lights Conference Room):** 34-02 Queens Blvd in Long Island City, NY

Start location: Pick up at JTMC (28-11 Queens Plaza North, Long Island City, NY 11101)
End location: Drop-off at JTMC (28-11 Queens Plaza North, Long Island City, NY 11101)

Table 95 – Operational Readiness Demonstration Schedule (Day 1: August 20, 2019)

Time	Location	Use Case	Description
9:00 AM	JTMC (Conference Room)		Introduction/Overview of Day 1
9:30 AM	JTMC		Pick-up/Depart
9:40 AM	47th Ave/32nd St		Begin NYCDOT (Field) session
9:45 AM	47th Ave/34th St	UC2D1	Speed compliance static work/school zone: warning
		UC2D2	Speed compliance static work/school zone: no warning
9:50 AM	47th Ave/35th St	UC22D1	Red light violation warning (RLVW)
9:55 AM	47th Ave/35th St	UC3D1	Curve speed compliance
10:05 AM	Queens Blvd/35th St	UC4D1	Oversize vehicle compliance
10:15 AM	Queens Blvd/34th St	UC5D1	Emergency communications & evacuation information (EVAC)
10:20 AM	47th Ave/34th St	UC1D1(a)	Speed compliance: warning
		UC1D1(b)	Speed compliance: no warning
10:30 AM	Queens Blvd	UC12D1	FCW: remote vehicle stationary in adjacent lane
	Queens Blvd	UC14D1	LCW: both vehicles moving in same direction
	Queens Blvd	UC13D1	FCW: remote vehicle stationary in same lane
10:30 AM	Aqueduct		Mobilize for Aqueduct session
11:30 AM	Aqueduct	UC11D1	FCW/EEBL warning: both vehicles moving
11:40 AM	Aqueduct	UC14D2	LCW: vehicles moving opposite directions
11:50 AM	Aqueduct	UC10D1	Intersection movement assist (IMA)
12:00 PM			Return to NYCDOT
1:00 PM	NYCDOT (City Lights Conference Room)		Lunch break
2:00 PM	NYCDOT (City Lights Conference Room)		SCMS security certificate top-off (ASD)
2:15 PM	NYCDOT (City Lights Conference Room)	UC16D1	ASD firmware and config OTA download
2:30 PM	NYCDOT (City Lights Conference Room)	UC17D1	RSU RF monitoring of ASDs

3:00 PM	NYCDOT (City Lights Conference Room)	UC19D1	ASD event data recording
3:30 PM	NYCDOT (City Lights Conference Room)	UC20D1	ASD event data upload
4:00 PM	NYCDOT (City Lights Conference Room)		Adjourn
4:30 PM	JTMC		Drop-off

Day 2 (August 21, 2019; 9:30 AM – 4:30 PM)
Locations: Field

- **Manhattan (Street)**
  - 55th St (westbound only): 5th Ave – 6th Ave
  - 56th St (eastbound only): 6h Ave – 5th Ave
  - 57th St (bi-directional: eastbound and westbound): 5th Ave – 6th Ave
- **Manhattan (Avenue)**
  - 5th Ave (southbound only): 57th St – 55th St
  - 6th Ave (northbound only): 54th St – 57th St

Start location: Pick up at JTMC (28-11 Queens Plaza North, Long Island City, NY 11101)
End location: Drop off at JTMC (28-11 Queens Plaza North, Long Island City, NY 11101)

Table 96 – Operational Readiness Demonstration Schedule (Day 2: August 21, 2019)

Time	Location	Use Case	Description
9:30 AM	JTMC		Review of Day 1/Overview of Day 2
10:00 AM	JTMC		Pick-up/Depart
10:30 AM	6th Ave at 54th St	UC5D1	Emergency communications & evacuation information (EVAC)
11:00 AM	57th St between 6th and 5th Aves	UC14D1	LCW; both vehicles moving in same direction
11:30 AM	55th St between 5th and 6th Aves	UC11D1	FCW/EEBL warning: both vehicles moving
12:00 PM	55th St between 6th and 5th Aves	UC13D1	FCW; remote vehicle stationary in same lane
12:30 PM			Return to NYCDOT
1:00 PM	NYCDOT (City Lights Conference Room)		Lunch break
2:00 PM	NYCDOT (City Lights Conference Room)		Debrief
4:00 PM	NYCDOT (City Lights Conference Room)		Adjourn
4:30 PM	JTMC		Drop-off

Day 3 (August 22, 2019; 9 AM – 12 PM)

Location: Joint Traffic Management Center (JTMC) Conference Room
28-11 Queens Plaza North, Long Island City, NY 11101

Day 3 will be a continuation of overview/recap of days 1 and 2 and left open as contingency for weather delays. Also, the SCMS security certificate top-off (RSU) and additional use cases will be demonstrated

remotely from CV terminal server in the TMC.

The following use cases in Table 97 **were not demonstrated** based on discussions regarding use case priorities during the Operational Readiness Plan (ORP) Walkthrough on 6/3-6/4:

Table 97 – Postponed Use Cases

Use Case	Description
UC2D3	Speed compliance/work zone TIM message: warning
UC6D1	Vehicle trip initiation: ASD on and ready
UC6D2	Vehicle trip initiation: ASD fault(s)
UC7D1	Driver reports suspected ASD failure
UC8D1	Pedestrian in intersection
UC9D1	PedSig: valid security certificate
UC9D2	PedSig: security certificate lacks permission
UC15D1	Vehicle turning right in front warning (VTRW)
UC18D1	ASD RF monitoring of RSUs
UC18D2	ASD RF monitoring of other ASDs (who I saw today)

In addition, the following uses cases listed in Table 98 will be discussed and presented during a separate Performance Measures Data Meeting with USDOT/Noblis/Volpe/TTI from 8/22/19 at 1pm to 8/23/19 at 4pm in the JTMC Conference Room:

Table 98 – Use Cases Presented in the JTMC conference Room on 8/22/19 and 8/23/19

Use Case	Description
UC19D1	ASD event data recording
UC20D1	ASD event data upload
UC21D1	Performance measurement data processing

3.2.4 Demonstration Results

3.2.4.1 Results Document

Each demonstration action table includes a column for PASS___FAIL___PARTIAL, along with a COMMENT area for each Observer. After completion of the demonstration, the comments from all Observers are consolidated into a final version of this document, which is the Demonstration Results deliverable.

3.2.4.2 Task H Deliverable Plan

Required deliverables per Task 2-H are summarized in the Operational Readiness Report:

- Final Installation and Operational Readiness Schedule (IORS) of actual vs. plan completion dates
- Final IORS with Risk Register indicating the risks that were encountered and mitigated
- Test Results populated into the Test Procedures section extracted from the final ORP
- Operational Readiness Demonstrations results extracted from the final ORP

3.2.5 Responsibilities

The responsibilities of the project team members are outlined in Table 99.

Table 99 – Team Member Responsibilities

Name	Responsibility
Mohamad Talas	NYC Team Project Management Lead: Obtain client approval of test documents, provide test environment
Test Team	Develop test design specifications, test case specifications, test procedure specifications; review vendor test procedures; internal testing; prepare internal testing anomaly reports
Bob Rausch	Site Deployment Lead, overall operations manager
Rami Khashashina	Team safety manager, test witness
Hisham Khanzada	ASD, RSU operations manager
Kaan Ozbay	PID operations manager
David Benevelli	Systems engineering lead: Test manager: lead/direct testing operation
Samuel Sim, Letecia Tomusiak	Test operator: carries out test procedure steps
Betsy Williams	Test analyst, record test step results, prepare test reports
Keith Patton	Configuration management: Prepare testing anomaly reports, document configuration management
TBD	Client representative/team: Review and approve test documentation, test witness, confirm requirements tested and met
Development Team (vendor and NYC Team)	Develop Pilot Deployment components to be tested; test environment requirements, respond to testing anomaly reports
Change Control Board (CCB), Change Request Form (CR)	Configuration management (covered under CIP)
Jose Sauceda Ivan Nunez Wesam Daraghmeh Frank Fallacaro	Vehicle installation testing (covered under CIP)

3.2.6 Staffing and Training Needs

Drivers and other demonstration participants will require training for safe and efficient demonstrations. Drivers and in-car participants will use the driver training material, developed for the project, to familiarize themselves with the operation of and alerts from the ASD. Drivers will conduct demonstration dry-runs of select use cases. Pedestrians will be given instructions for their participation and will also participate in the dry-run of their use cases.

3.2.7 Approvals

Provide a listing of the individuals who can sign off and say the project is complete and can process to the next stage. This plan is effective as of the most recent date from the signatures provided below. All signatures indicate acceptance of the test plan.

Manager	Date	Comment
Tester	Date	Comment

4. Acronym

Table 100 below shows a list of acronyms used in this Operational Readiness Plan (ORP) document.

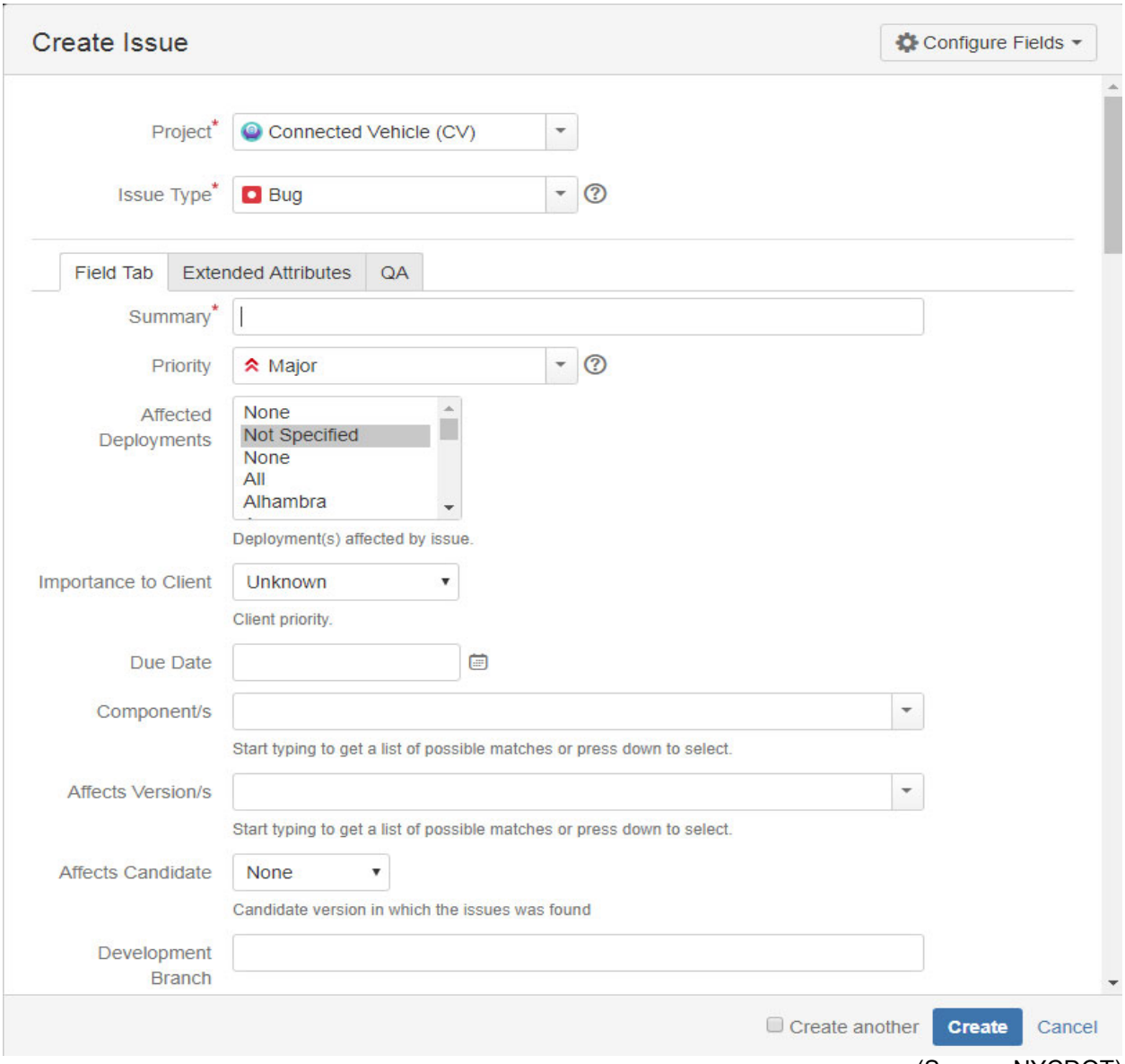
Table 100 – Acronyms

Acronym	Literal Translation
AO	Agreement Officer
AOR	Agreement Officer Representative
ASD	Aftermarket Safety Device
ASTC	Advance Solid-state Traffic Controller
ATC	Advaned Traffic Controller
AWS	Amazon Web Services
BOS	Back Office System
BSM	Basic Safety Message
BSW	Blind Spot Warning
CAN	Control Area Network
CCB	Configuration (or Change) Control Board
CIP	Comprehensive Installation Plan
CM	Configuration Management
ConOps	Concept of Operations
CV	Connected Vehicle
CVPD	Connected Vehicle Pilot Deployment
DSRC	Dedicated Short Range Communications
EEBL	Emergency Electronic Brake Lights
FCW	Forward Collision Warning
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HSM	Hardware Security Module
IE	Independent Evaluator
IEEE	Institute of Electrical and Electronics Engineers
IMA	Intersection Movement Assist
IORS	Installation and Operational Readiness Schedule
ITS	Intelligent Transportation Systems
LCW	Lane Change Warning
MAP	Map Data Message
MTA	Metropolitan Transportation Authority
NYC	New York City
NYU	New York University
ORDP	Operational Readiness Demonstration Plan

Acronym	Literal Translation
ORP	Operational Readiness Plan
ORTP	Operational Readiness Test Plan
OTA	Over the Air
PASS	Pedestrians for Accessible and Safe Streets
PED	Pedestrian
PEDINXWALK	Pedestrian in Signalized Intersection Warning
PED-SIG	Pedestrian Signal System
PID	Personal Information Device
PII	Personally Identifiable Information
PMP	Projecf Management Plan
RF	Radio Frequency
RSU	Roadside Safety Unit
SAD	System Architecture Design
SAE	Society of Automotive Engineers
SCMS	Security Credential Management System
SDC	Secure Data Common
SDD	System Design Document
SPaT	Signal Phasing and Timing
SyRS	System Requirements Specification
TIM	Traveler Information Message
TMC	Transportation Management Center
TSN	Transportation Systems Network
USDOT	United States Department of Transportation
UTC	Universal Time Coordinated
V2I	Vehicle-to-Infrastructure
V2V	Vehicle-to-Vehicle
VTRW	Vehicle Turning Right in Front of Bus Warning
WAVE	Wireless Access in Vehicular Environment
WSA	WAVE Service Advertisement
XML	Extensible Mark-up Language

Appendix A. Create Issue Form

When an incident is encountered during the testing process, a standard form has been used. The testing team used the form provided in Figure 15 below to create a bug report. This form is used to document all relevant details, including description, severity level, screenshots, and version for the newly identified bug.



(Source: NYCDOT)

Figure 15 – Create Issue Form

U.S. Department of Transportation
ITS Joint Program Office-HOIT
1200 New Jersey Avenue, SE
Washington, DC 20590

Toll-Free “Help Line” 866-367-7487
www.its.dot.gov

FHWA-JPO-17-456

U.S. Department of Transportation