Connected Vehicle Pilot Deployment Program Phase 2

Operational Readiness Plan – WYDOT CV Pilot

www.its.dot.gov/index.htm
Final Report — March 16, 2018

Update — July 30, 2018

FHWA-JPO-17-472

U.S. Department of Transportation

Produced by DTFH6116H00027

U.S. Department of Transportation

Notice

Technical Report Documentation Page

1. Report No. FHWA-JPO-17-472	**2. Government Accession No.**	**3. Recipient's Catalog No.**
4. Title and Subtitle Connected Vehicle Pilot Deployment Program Phase 2, Operational Readiness Plan – WYDOT CV Pilot		**5. Report Date** Final 3/16/2018 Update 07/30/2018 **6. Performing Organization Code**
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9. Performing Organization Name and Address Wyoming DOT, 5300 Bishop Boulevard, Cheyenne, WY 82009 ICF International, 1725 Eye St NW, Washington DC, 20006 Trihydro Corporation, 1252 Commerce Drive, Laramie, WY 82070 Vital Assurance, 175 S. Third St., Suite 200, Columbus, OH 43215		**10. Work Unit No. (TRAIS)** **11. Contract or Grant No.** DTFH6116H00027
12. Sponsoring Agency Name and Address U.S Department of Transportation 1200 New Jersey Ave, SE Washington, DC 20590		**13. Type of Report and Period Covered** Operational Readiness Plan, 09/01/2016 to 3/16/2018 14. Sponsoring Agency Code

15. Supplementary Notes
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16. Abstract

The Wyoming Department of Transportation's (WYDOT) Connected Vehicle (CV) Pilot Deployment Program is intended to develop a suite of applications that utilize vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communication technology to reduce the impact of adverse weather on truck travel in the I-80 corridor. These applications support a flexible range of services from advisories, roadside alerts, parking notifications and dynamic travel guidance. Information from these applications are made available directly to the equipped fleets or through data connections to fleet management centers (who will then communicate it to their trucks using their own systems). The pilot will be conducted in three Phases. Phase 1 includes the planning for the CV pilot including the concept of operations development. Phase 2 is the design, development, and testing phase. Phase 3 includes a real-world demonstration of the applications developed as part of this pilot.

This Phase 2 document presents the Operational Readiness Plan which outlines the plan and checklist by which the WYDOT Team will monitor and report the readiness of the WYDOT CV Pilot for full deployment and implementation. This document describes the plans by which the WYDOT CV Pilot Team will verify and demonstrate to USDOT and other stakeholders that the WYDOT Connected Vehicle Pilot Deployment (CVPD) meets performance requirements, is operational, and will be reliable, available, maintainable, and safe. This revised version is an update to an earlier version of the report, reflecting more thoroughly fleshed out concepts and insights gained by the site during and at the end of Phase 2.

17. Key Words Connected Vehicle Technology, I-80 Corridor, Road Weather, Truck Safety, System Architecture	**18. Distribution Statement** This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161		
19. Security Classif. (of this report) None	**20. Security Classif. (of this page)** None	**21. No. of Pages** 100	**22. Price** NA

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

Acknowledgements

The Operational Readiness Plan development team would like to thank USDOT and Noblis for their technical assistance throughout the development of this document.

Table of Contents

1 Introduction 1
1.1 Project Scope 1
1.2 Purpose of the Operational Readiness Plan 2
1.3 Document Overview 2
1.4 Document Organization 3
2 References 4
3 Operational Readiness Schedule and Checklist Approach 5
4 End-to-end System Development Integration Readiness 8
5 End-to-end System Operational Readiness Testing 14
5.1 Test Plan Overview 14
5.2 Test Locations 15
5.3 Test Procedure and Test Case Descriptions 15
5.4 End-to-end System Operational Readiness Testing Schedule and Checklist 37
6 Acquisition, Installation, and Production Deployment Readiness 42
7 Operational Readiness Demonstration 52
7.1 Readiness Demonstration Agenda 52
7.2 Readiness Demonstration Event 53
7.3 Demonstration Test Cases 53
8 Performance Measurement and Evaluation Support Readiness 56
8.1 Performance Measures and Evaluation Support Schedule and Checklist 56
9 Planning & Design Readiness 59
10 Operations and Maintenance Procedures Readiness 62
10.1 Plans for the Forthcoming Comprehensive Maintenance and Operations Plan 65
11 Training and IRB Readiness 66
11.1 Training Materials and Staff Training 66
11.2 Training Materials Readiness 66
11.3 Staff Training Readiness 67
11.4 IRB Readiness 71
12 Institutional, Staff, and Financial Readiness 73
13 Safety, Security and Privacy Readiness 78
13.1 Safety Readiness 78
13.1.1 Safety Management Stakeholder Roles and Responsibilities 78

13.1.2 Safety Management Schedule and Checklist 79
13.2 Security Readiness 82
13.2.1 Security Overview 82
13.2.2 Security Readiness Schedule and Checklist 82
13.3 Privacy Readiness 91
13.3.1 Privacy Readiness Schedule and Checklist 91
14 Glossary and Acronyms 94

List of Figures

Figure 4-1. WYDOT CV Pilot System Physical Architecture (Source: WYDOT)............................ 9

Figure 12-1. Public and private participants in the WYDOT CV Pilot requiring close coordination and cooperation. 73

Figure 12-2. WYDOT CV Pilot Partnership Structure... 75

Figure 13-1. Communication Security Diagram for the CV Pilot (Source: WYDOT)..................... 83

Figure 13-2. Legend for SET-IT and CVRIA Diagrams. (Source: WYDOT)................................. 84

List of Tables

Table 2-1. References. 4
Table 3-1. Summary of WYDOT CV Pilot Operational Readiness Measures (RM) and Relevant Chapter 5
Table 3-2. Operational Readiness Summary Schedule and Checklist 7
Table 4-1. End-to-end System Development and Integration Schedule and Checklist 10
Table 5-1. List of WYDOT CV Pilot Test Procedures and Test Cases by Test Plan Section 16
Table 5-2. Summary of Planned WYDOT Pilot End-to-end System Operational Readiness Test Cases 19
Table 5-3. Operational Readiness Testing Schedule and Checklist for Completion of Test Cases 37
Table 6-1. Acquisition, Installation, and Production Deployment Readiness Schedule and Checklist 43
Table 7-2. Operational Readiness Demonstration Schedule and Checklist 55
Table 8-1. Performance Measurement and Evaluation Support Readiness Schedule & Checklist 57
Table 9-1. Pilot Planning and Design Operational Readiness Schedule and Checklist 60
Table 10-1. Operations and Maintenance Procedures Readiness Schedule and Checklist 63
Table 11-1. Training Materials Readiness Checklist 68
Table 11-2. WYDOT CV Pilot Driver and Operational Staff Training Completion Status 70
Table 11-3. Other Stakeholders Training and Education 70
Table 12-1. Institutional, Staffing, and Financial Readiness Schedule and Checklist 76
Table 13-1 – Safety Management Stakeholder Roles and Responsibilities. 78
Table 13-2. Safety Readiness Schedule and Checklist 81
Table 13-3. Security Readiness Schedule and Checklist 85
Table 13-4. Privacy Readiness Schedule and Checklist 92
Table 14-1. Glossary of Terms. 94
Table 14-2. Acronym List 95

1 Introduction

1.1 Project Scope

Wyoming is one of the first wave of CV Pilot sites selected to showcase the value of and spur the adoption of CV technology in the United States. CV technology is a broad term to describe the applications and the systems that leverage dedicated short-range communications (DSRC) for vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I) and infrastructure-to-vehicle (I2V) communication to improve safety, mobility and productivity of the users of the nation's transportation system.

As one of the three selected pilots, WYDOT is focusing on improving safety and mobility by creating new ways to communicate road and travel information to commercial truck drivers and fleet managers along the 402 miles of Interstate 80 (I-80 henceforth) in the State. For the pilot project, WYDOT concluded Phase 1 (planning) in September 2016 and then initiated Phase 2 (deployment) which is scheduled to conclude in mid-2018. This will be followed by an 18-month demonstration period in the third phase.

Systems and applications developed in the pilot will enable drivers of connected vehicles to have improved awareness of potential hazards and of situations they cannot see. At a very high level, the pilot scope includes the following implementation elements:

- **Deploy about 75 roadside units (RSU)** that can receive and broadcast messages using DSRC along various sections on I-80.
- **Equip around 400 vehicles, a combination of fleet vehicles and commercial trucks, with on-board units (OBU).** Of the 400 vehicles, at least 150 are planned to be heavy trucks. All vehicles are expected to be regular users of I-80. Several types of OBUs are being procured as part of the pilot and differ based on their communication capabilities, ability to integrate with the in-vehicle network, and connectivity to ancillary devices and sensors. All OBUs will have the functionality to broadcast Basic Safety Messages (BSM) Part I and will include a human-machine interface (HMI) to share alerts and advisories to drivers of these vehicles.
- **Develop several V2V, V2I, I2V applications** that will enable communication to drivers of alerts and advisories regarding various road conditions. These applications include support for in-vehicle dissemination of advisories for collision avoidance, speed management, detours, parking, and presence of work zones and maintenance and emergency vehicles downstream of their current location.
- Enable overall improvements in WYDOT's traffic management and traveler information practices by using data collected from connected vehicles. Targeted improvements include ingesting more location specific mobile road weather information system (RWIS) data, using Pikalert®1 to provide for more accurate and road segment specific conditions

[1] Pikalert is a trademark of the University Corporation for Atmospheric Research.

to define better variable speed limits (VSLs), and improving road condition dissemination via 511, Dynamic Message Signs (DMS) and other WYDOT sources.

1.2 Purpose of the Operational Readiness Plan

This document is the Operational Readiness Plan (ORP) for The Wyoming Department of Transportation (WYDOT) Connected Vehicle (CV) Pilot project for the United States Department of Transportation's (USDOT) CV program. The purpose of this document is to outline plans to monitor and report the readiness of the WYDOT CV Pilot for full deployment and implementation. This document describes the plans by which the WYDOT CV Pilot Team will verify and demonstrate to WYDOT leadership, USDOT, and other stakeholders that the WYDOT Connected Vehicle Pilot Deployment (CVPD) meets performance requirements, is operational, and will be reliable, available, maintainable, and safe.

1.3 Document Overview

As with all CV deployments, the WYDOT CV Pilot is a complex undertaking, requiring the coordinated development, integration, testing, deployment and implementation of CV technology within WYDOT traffic management systems, ITS communications infrastructure, snowplow and maintenance vehicles, as well as private fleet trucks operating on I-80 across Wyoming. The WYDOT Team will track the coordinated development, integration, testing, deployment and implementation progress and report those to the USDOT monthly and in its regular biweekly leadership conference call and status report. The WYDOT Team will also conduct a demonstration for USDOT and other stakeholders to show that the project objectives have been achieved and that the system and team are ready to follow through with full deployment and implementation.

For the WYDOT CV Pilot Team operational readiness means that WYDOT CV components, subsystems, and systems:

- Support project scope and objectives
- Are fully developed, integrated, tested and deployed, and
- Meet functional and performance requirements and acceptance tests.

Operational readiness also means that:

- Staff resources are trained and ready to support operations
- CV systems are as robust as possible,
- Likelihood of achieving project objectives is as high as possible, and
- Operational risks are as low as possible, with available technology and resources.

The WYDOT Team has identified ten operational readiness measures by which it will track and monitor progress toward full readiness. These ten measures are:

1. End-to-end System Development and Integration
2. End-to-End System Operational Readiness Testing
3. Acquisition, Installation, and Production Deployment Readiness
4. Operational Readiness Demonstration

5. Performance Measurement and Evaluation Support Readiness
6. Planning and Design Readiness
7. Operations and Maintenance Procedures Readiness
8. Training and IRB Readiness
9. Institutional, Staff, and Financial Readiness
10. Safety, Security, and Privacy Readiness

A central component of operational readiness will be End-to-End System Operational Readiness Testing under Measure 2. An attachment to this Plan provides detailed descriptions of the Test Cases for End-to-end Message Communication Testing and End-to-end Applications Performance Testing, planned to verify readiness for full deployment. Another key component of operational readiness will be Operational Readiness Demonstration (Measure 6), wherein the WYDOT Team will provide a demonstration for the USDOT and stakeholders verifying that the WYDOT CV Pilot system is fully functional and operational, ready for full deployment.

Operational readiness progress and status will be tracked and reported through an Operational Readiness Schedule and Checklist. This report includes a description of Readiness Schedule and Checklist components and how they will be reported.

1.4 Document Organization

This document is organized according to the readiness measures above into the following chapters

1. Introduction
2. References
3. Operational Readiness Schedule and Checklist Approach
4. End-to-end System Development and Integration Readiness
5. End-to-end System Operational Readiness Testing
6. Acquisition, Installation, and Deployment Readiness
7. Operational Readiness Demonstration
8. Performance Measurement and Evaluation Support Readiness
9. Planning and Design Readiness
10. Operations and Maintenance Procedures Readiness
11. Training and IRB Readiness
12. Institutional, Staff, and Financial Readiness
13. Safety, Security, and Privacy Readiness
14. Glossary and Acronyms

Three components of this Operational Readiness Plan are provided as attachments. *Attachment A* is the WYDOT CV Pilot Operational Readiness Schedule and Checklist Spreadsheets containing the operational readiness schedule and checklist for each measure, organized in spreadsheet tabs for ease of compilation and reporting. *Attachment B* provides the detailed descriptions of the test procedures and test cases through which the WYDOT team will verify readiness and requirements compliance. *Attachment C* provides detailed description of the subset of test cases used as demonstrations for the USDOT and stakeholders of operational readiness.

2 References

The following table lists the documents and sources used and referenced to develop the concepts in this document.

Table 2-1. References.

#	Documents, Sources Referenced
1	Deepak Gopalakrishna, et al. (2015). *CV Pilot Deployment Program Phase 1, Concept of Operations (ConOps), ICF/Wyoming (FHWA-JPO-16-287)*. US Department of Transportation.
2	Deepak Gopalakrishna, et al. (2016b). *Connected Vehicle Pilot Deployment Program Phase 1, System Requirements Specification (FHWA-JPO-16-291) – ICF/Wyoming.* U.S Department of Transportation.
3	Deepak Gopalakrishna, et al. (2016a). *Connected Vehicle Pilot Deployment Program Phase 1, Application Deployment Plan – ICF/Wyoming (FHWA-JPO-16-292).* U.S Department of Transportation.
4	Deepak Gopalakrishna, et al. (2016a). *Connected Vehicle Pilot Deployment Program Phase 1, Security Management Operational Concept, Version 2 – ICF/Wyoming (FHWA-JPO-16-288).* U.S Department of Transportation.
5	Deepak Gopalakrishna, et al. (2016a). *Connected Vehicle Pilot Deployment Program Phase 1, Safety Management Plan, Version 2 – ICF/Wyoming (FHWA-JPO-16-289).* U.S Department of Transportation.
6	Kitchener, et al. (2016), *Connected Vehicle Pilot Deployment Program Phase 1, Performance Measurement and Evaluation Support Plan (version 2) – ICF/Wyoming (FHWA-JPO-16-290).* U.S. Department of Transportation.
7	Mohamed Ahmed, et al. (2016a). *Connected Vehicle Pilot Deployment Program Phase 1, Participant Training and Education Plan, Version 2 – ICF/Wyoming (FHWA-JPO-16-294).* U.S Department of Transportation.
8	University of Wyoming (2016). IRB Proposal Form. Institutional Review Board.
9	Tony English, et al. (2017). *Connected Vehicle Pilot Deployment Program Phase 2, System Architecture Document, WYDOT CV Pilot (FHWA-JPO-17-451).* U.S Department of Transportation.
10	Tony English, et al. (2017). *Connected Vehicle Pilot Deployment Program, System Design Document, WYDOT CV Pilot (FHWA-JPO-17-468).* U.S Department of Transportation.
11	Tony English, et al. (2017). *Connected Vehicle Pilot Deployment Program, Interface Control Document, WYDOT CV Pilot (FHWA-JPO-17-468a).* U.S Department of Transportation.
12	Tony English, et al. (2017). *Connected Vehicle Pilot Deployment Program, Comprehensive Acquisition Plan, WYDOT CV Pilot.* U.S Department of Transportation.
13	Tony English, et al. (2017). *Connected Vehicle Pilot Deployment Program, Comprehensive Installation Plan, WYDOT CV Pilot (FHWA-JPO-17-471).* U.S Department of Transportation.

3 Operational Readiness Schedule and Checklist Approach

For the WYDOT Team, operational readiness means that all WYDOT CV components, subsystems, and systems:

- Support project scope and objectives
- Are fully developed, integrated, tested and deployed
- Meet functional and performance requirements and acceptance tests

Further it means that

- Resources are trained and ready to support operations
- CV Systems are as robust as possible
- Likelihood of achieving project objectives is as high as possible
- Operational risks are as low as possible

Literally hundreds of detailed activities must be coordinated and completed to ensure all elements necessary to ensure success of the WYDOT CV pilot are ready to support full operations. The remainder of this report details the WYDOT Team Operational Readiness Schedule and Checklist through which we will both track and report to WYDOT management and the USDOT readiness for operations.

Operational readiness tracking is structured under ten primary "readiness measures," summarized in Table 3-1, that cover the breadth of activities and issues that contribute to successful deployment and operations. Each of these topics is addressed in a subsequent chapter in this document. Each topic is broken down into key readiness elements that can be tracked in the form of a schedule and checklist. These ten checklists are combined into a companion Attachment A WYDOT CV Pilot Operational Readiness Schedule and Checklist Spreadsheets that will be updated monthly by the WYDOT Team and reported to the USDOT.

Table 3-1. Summary of WYDOT CV Pilot Operational Readiness Measures (RM) and Relevant Chapter

Ch No.	RM No.	Readiness Measure	Measure Description
4	1	End-to-end System Development and Integration	Completion of all hardware, software and application development, integration, and acceptance testing.
5	2	End-to-end System Operational Readiness Testing	Completion and acceptance of end-to-end functionality and performance testing, and requirements verification of WYDOT CV Pilot development systems.
6	3	Acquisition, Installation, and Production Deployment Readiness	Completion of acquisition, installation, integration, acceptance testing, and deployment

Ch No.	RM No.	Readiness Measure	Measure Description
			of all production hardware, software, and application components.
7	4	Operational Readiness Demonstration	Completion of selected end-to-end functionality and performance acceptance testing of development systems with USDOT and stakeholder participation to demonstrate operational readiness.
8	5	Performance Measurement and Evaluation Support Readiness	Completion of all WYDOT CV Pilot systems and interfaces supporting performance measurement and analysis by the WYDOT Team and the Independent Evaluator
9	6	Planning and Design Readiness	Completion of all WYDOT CV Pilot planning and design documents.
10	7	Operations and Maintenance Procedures Readiness	Completion of preparation of systems and resources which support ongoing operations and maintenance of the YWDOT CV Pilot Systems.
11	8	Training and IRB Readiness	Completion of Operational and Maintenance Procedures, documentation and training for drivers and operational staff.
12	9	Institutional, Staff, and Financial Readiness	Completion and approval of institutional agreements, budgets, staff assignments and financial support.
13	10	Safety, Security, and Privacy Readiness	Completion of safety, security and privacy preparations and inspections.

Table 3-2 is the summary level Operational Readiness Schedule and Checklist, wherein the summary status of each readiness measure will be reported in terms of Status(R/Y/G), % Complete, Due Date, Completion Date and Comments. Status of each of the readiness measures details is reported similarly, as shown in subsequent chapters.

Attachment A is the WYDOT CV Pilot Operational Readiness Schedule and Checklist Spreadsheets containing the operational readiness schedule and checklist for each measure, organized in spreadsheet tabs for ease of compilation and reporting. Supporting Measure 2 WYDOT CV Pilot End-to-End Operational Readiness Testing, Attachment B of this document provides the WYDOT CV Pilot Operational Readiness Testing Plan, detailing test cases and test procedures, planned to verify end-to-end functionality and performance of the system and to verify system requirements. Supporting Measure 4, WYDOT CV Pilot Operational Readiness Demonstration, Attachment C to this document provides the WYDOT CV Pilot Operational Readiness Demonstration Plan, leveraging Test Cases from Attachment B.

Operational readiness reporting will integrate two existing status reporting activities, the Applications Development (under Measure 1) and the Performance Measures status report (Under Measure 5, WYDOT CV Pilot Performance Measures Readiness). Those existing reports are duplicated directly in the applicable measures section.

Table 3-2. Operational Readiness Summary Schedule and Checklist

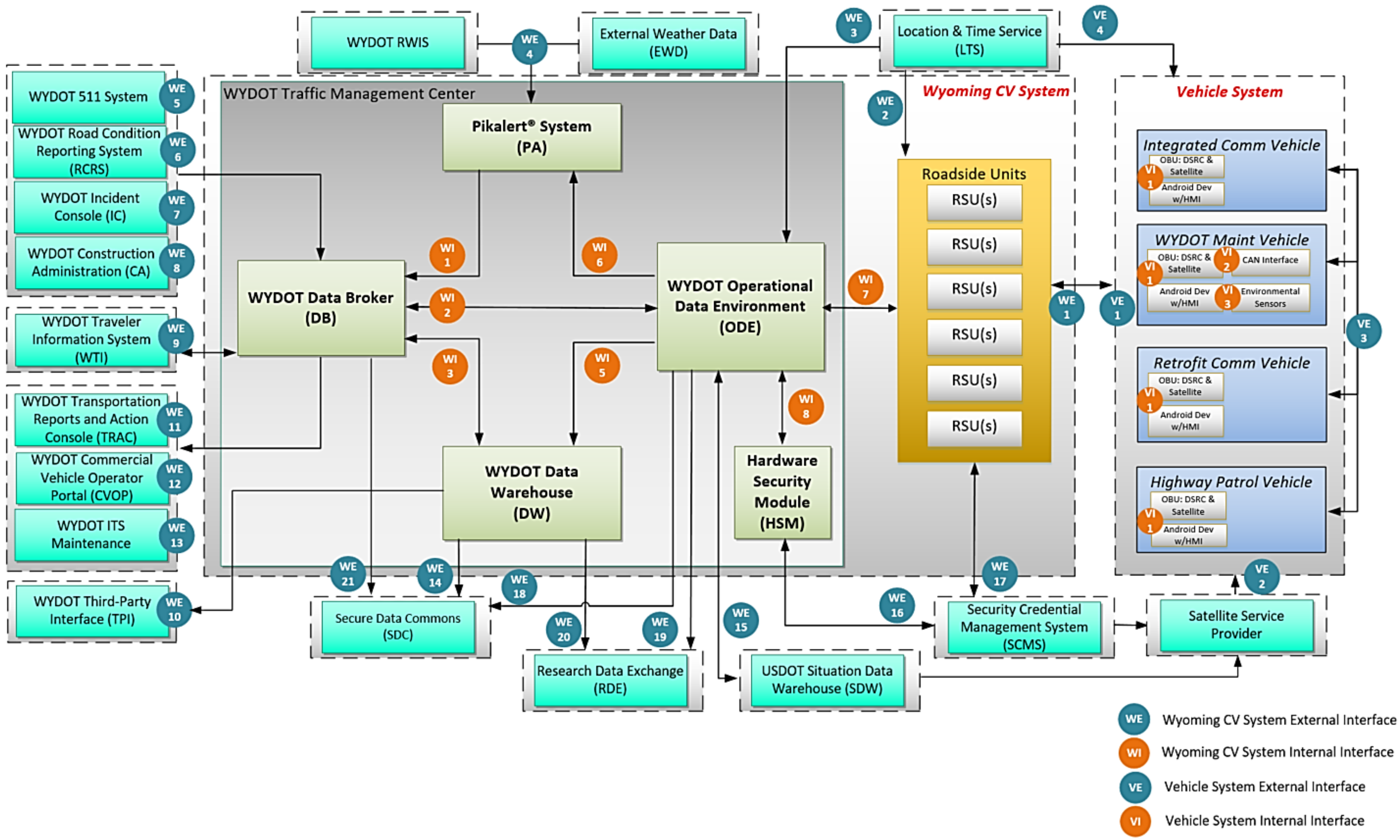
Ch No.	RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
4	1	End-to-end System Development and Integration					
5	2	End-to-end System Operational Readiness Testing					
6	3	Acquisition, Installation and Production Deployment Readiness					
7	4	Operational Readiness Demonstration					
8	5	Performance Measurement and Evaluation Support Readiness					
9	6	Planning and Design Readiness					
10	7	Operations and Maintenance Procedures Readiness					
11	8	Training and IRB Readiness					
12	9	Institutional, Staff, and Financial Readiness					
13	10	Safety, Security, and Privacy Policy Readiness					

4 End-to-end System Development Integration Readiness

Details of the WYDOT CV Pilot System are described in the project ConOps, System Architecture Document (SAD), System Design Document(SDD), and Interface Control Document(ICD). This system is illustrated by the Physical Architectural diagram in Figure 4-1. Readiness to support full operations requires the successful development, testing, and integration of each of the elements identified in this diagram, including implementation of all interfaces. Table 4-1 details the Operational Readiness schedule and checklist developed by the WYDOT Team for monitoring and tracking the end-to-end development and integration of the WYDOT CV Pilot System. This readiness measure schedule and checklist is organized into 8 sub measures for ease of reporting:

- 1.1 Wyoming CV System Component Development
- 1.2 Wyoming CV System Internal Interface Integration
- 1.3 Vehicle System Component Development
- 1.4 Vehicle System Internal Interface Integration
- 1.5 Vehicle System Integration
- 1.6 CV Pilot External Interface Integration
- 1.7 Applications Component Development
- 1.8 End-to-end Applications Integration

This structure tracks the development of development of components, their integration into Wyoming CV System and Vehicle Systems, followed by integration into the overall WYDOT CV Pilot System. As with other schedule and checklist elements, system development and integration readiness will be tracked in terms of Status (R/Y/G), % Complete, Due Date, Completion Date and Comments.



NOTE: The Wyoming CV System Interface WI4 (PA→DW) was not implemented in the final system design.

Figure 4-1. WYDOT CV Pilot System Physical Architecture (Source: WYDOT)

Table 4-1. End-to-end System Development and Integration Schedule and Checklist

RM No.	Readiness Measure	Status (RYG)	% Complete	Due Date	Completion Date	Comments
1.1	Wyoming CV System Component Development					
1.1.1	WYDOT ODE			3/1/2018		
1.1.2	WYDOT Pikalert			1/1/2018		
1.1.3	WYDOT Data Broker			3/1/2018		
1.1.4	WYDOT Data Warehouse			3/1/2018		
1.1.5	RSU			10/1/2018		
1.2	Wyoming CV System Internal ***Interface Integration***					
1.2.1	WI1-PA to DB			12/20/2017		
1.2.2	WI2-DB - ODE			12/20/2017		
1.2.3	WI3-DB - DW			12/1/2017		
1.2.4	WI5-ODE to DW			12/1/2017		
1.2.5	WI6-ODE to PA			12/1/2017		
1.2.6	WI7-ODE to RSUs			3/1/2018		
1.2.7	WI8-ODE - HSM			5/1/2018		
1.3	Vehicle System Component Development					
1.3.1	OBU DSRC Only (No CAN)			12/1/2017		
1.3.2	OBU DSRC and Satellite (Incl. CAN)			3/1/2018		
1.3.3	Android Development & HMI			3/1/2018		
1.3.4	Environmental Sensors			12/1/2017		
1.4	Vehicle System Internal Interface Integration					
1.4.1	VI1-OBU to HMI			3/1/2018		
1.4.2	VI2-OBU to CAN Interface					*Not part of the Pilot*

RM No.	Readiness Measure	Status (RYG)	% Complete	Due Date	Completion Date	Comments
1.4.2	VI3-OBU to Environmental Sensors			10/1/2017		
1.5	Vehicle System Integration					
1.5.1	Retrofit Commercial Vehicle (DSRC, Satellite)			3/1/2018		
1.5.2	Integrated Commercial Vehicle (DSRC, Satellite)			3/1/2018		
1.5.3	Highway Patrol Vehicle (DSRC, Satellite)			1/1/2018		
1.5.4	WYDOT Maintenance Vehicle (DSRC, Satellite, Environmental Sensor)			1/1/2018		
1.6	***CV Pilot External Interface Integration***					
1.6.1	VE1/WE1-RSU - OBU			10/1/2017		
1.6.2	VE2-SSP to OBU			10/1/2017		
1.6.3	VE3-OBU to OBU			10/1/2017		
1.6.4	VE4-LTS to OBU			10/1/2017		
1.6.5	WE2-LTS to RSU			10/1/2017		
1.6.6	WE3-LTS to ODE			10/1/2017		
1.6.7	WE4-RWIS to Pikalert			9/1/2017		
1.6.8	WE4-EWD to Pikalert			9/1/2017		
1.6.9	WE5-511 App to DB			11/16/2017		
1.6.10	WE6-RCRS to DB			3/1/2017		
1.6.11	WE7-IC to DB			9/1/2017		
1.6.12	WE8-CA to DB			1/1/2018		
1.6.13	WE9-WTI - DB			12/1/2017		
1.6.14	WE10-DW to TPI			5/1/2017		
1.6.15	WE11-DB to TRAC			4/1/2017		

RM No.	Readiness Measure	Status (RYG)	% Complete	Due Date	Completion Date	Comments
1.6.16	WE12-DB to CVOP			9/20/2017		
1.6.17	WE13-DB to ITS Maint.			12/1/2017		
1.6.18	WE14-DW to SDC			9/1/2017		
1.6.19	WE15-ODE to SDW			6/1/2017		
1.6.20	WE16-HSM - SCMS			4/1/2018		
1.6.21	WE17-SCMS to RSU			3/1/2018		
1.6.22	WE18-ODE to SDC			3/1/2018		
1.6.23	WE19-ODE to RDE			3/1/2018		
1.6.24	WE20-DW to RDE			3/1/2018		
1.6.25	WE21-DB to SDC			3/1/2018		
1.7	Applications Component Development					
1.7.1	OBU Spot Weather Impact Warning			10/1/2017		
1.7.2	OBU Work Zone Warning			10/1/2017		
1.7.3	OBU I2V Situational Awareness			10/1/2017		
1.7.4	OBU Distress Notification Application			10/1/2017		
1.7.5	OBU Forward Collision Warning			10/1/2017		
1.7.6	OBU Vehicle Support Services			3/1/2018		
1.7.7	OBU Vehicle Trust Management			3/1/2018		
1.7.8	RSU Roadway Traffic Information Dissemination			10/1/2017		
1.7.9	RSU Distress Notification Application			10/1/2017		
1.7.10	RSU Basic Safety Monitoring			10/1/2017		
1.7.11	RSU Support Services			3/1/2018		
1.7.12	RSU Trust Management			3/1/2018		
1.7.13	Operational Data Environment			3/1/2018		
1.7.14	Pikalert			3/1/2018		

RM No.	Readiness Measure	Status (RYG)	% Complete	Due Date	Completion Date	Comments
1.7.15	TMC Data Brokerage			4/1/2018		
1.7.16	WYDOT Third Party Interface			5/1/2017		
1.7.17	Service Monitor Device Management			9/20/2017		
1.7.18	CVOP Website Updates			11/1/2017		
1.7.19	WYDOT Transportation Reports and Action Console			7/1/2017		
1.7.20	WYDOT Wyoming Traveler Information			7/1/2017		
1.7.21	WYDOT Construction Administration			3/1/2018		
1.7.22	WYOROAD.INFO Website			1/1/2017		
1.7.23	OBU/RSU Management Application			11/1/2017		
1.7.24	Participant Tracking Application			4/1/2017		
1.7.25	WYDOT 511 App			10/1/2017		
1.7.26	Vehicle Messaging Display/Interface			11/20/2017		
1.8	End-to-end Applications Integration					
1.8.1	Pikalert - Spot Weather Impact Warning			12/1/2017		
1.8.2	WYDOT Construction Admin - Work Zone Warning			5/1/2018		
1.8.3	WYDOT Traveler Information - Posted Speed, VSL, Restrictions, closures			2/1/2018		
1.8.4	Incident Console - Incident Information			4/1/2018		
1.8.5	Road Condition Reporting System			10/1/2017		
1.8.6	WYDOT 511 App - Truck Parking Availability			6/1/2018		

5 End-to-end System Operational Readiness Testing

Measure 2 of Operational Readiness is end-to-end system operational readiness testing. In this aspect of the program, the WYDOT Team will undertake a series of tests, organized as test cases, which will verify that component development and integration under Measure 1 has been successfully completed and that the system is fully operational and ready for full implementation. They are detailed in Attachment B. WYDOT CV Pilot Operational Readiness Test Plan.

5.1 Test Plan Overview

Referring back to the Physical Architecture Diagram in Figure 4-1, end-to-end testing is organized by the WYDOT Team into two major categories:

- End-to-end Message Communication Test Procedures and Test Cases
- End-to-end Applications Performance Test Procedures and Test Cases

The first category encompasses test cases designed to verify end-to-end communication of the key messages and data files through the components and interfaces shown Figure 4-1, including

- V2I Basic Safety Messages
- I2V Situational Awareness (I2V SA) Traveler Information Messages (TIMs)
- Distress Notification (DN) TIMs (both V2V and V2I),
- V2I Environmental Sensor Data, and
- V2I Log files.

End-to-end Message Communication Test Cases also verify wireless DSRC and satellite communication range and coverage performance necessary to meet applications requirements. These test cases also support verification of logging and storage of messages for subsequent analysis.

Recognizing that communications performance depends upon the design and engineering of OBUs, RSUs, and their antennas, selected test cases in the End-to-end Message Communication Test Cases will be performed for each vendor's OBU/antenna configuration and each vendor's RSU/antenna configuration.

The End-to-end Applications Performance Test Cases are designed to verify the WYDOT CV Pilot applications: Forward Collision Warning, I2V Situational Awareness (Spot Weather Impact Warning, Work Zone, Variable Speed Limit, Incident Information, Road Condition, and Truck Parking) and Distress Notification. These test cases verify

- Correct compilation of messages at their origin
- Correct parsing and accurate implementation at their receiving end.
- Processing and communication speed performance necessary to meet application requirements
- Correct Prioritization of driver messaging

- Correct event logging

Some test cases will be performed to tune application parameters for each vehicle type, such as FCW warning distance for passenger vehicles and trucks.

Because applications performance can depend upon design and engineering of the application, End-to-end Applications Performance Test Cases must be performed for each vendor's applications. Because V2V DSRC performance depends significantly upon OBU and antenna design, as well as vehicle geometry, V2V applications will be tested for each vehicle type.

This approach for End-to-end testing to demonstrate System Operational Readiness is designed to verify that the component development and integration outlined under Measure 1 in Chapter 3 has been done correctly and completely and that the system is fully operational. This approach assumes that developers have performed component and subsystem testing and requirements verification as part of their development and integration process. These test cases provide objective verification, at the end-to-end system level, that requirements are satisfied and that development and integration has been completed successfully.

5.2 Test Locations

Test cases outlined here consist of tests to performed on a “test track”, and tests to be performed “on road”, likely on I-80 across Wyoming and on I-25 between Ft. Collins Colorado and Cheyenne Wyoming.

Track test cases are conducted with moving vehicles to verify wireless communications performance and applications performance that are influenced by vehicle motion and dynamics, particularly those that cannot be performed safely in operational traffic environments. Track testing includes all tests that require significant, unobstructed distance between OBUs and/or RSUs, and/or vehicles moving freely without obstruction.

The “track” used for conducting these test cases can be any controlled access flat, pavement area, free of obstruction to vehicle travel and to radio communications. The track area should be large enough to enable vehicles to accelerate from 0 to 35 mph, perform a driving scenario or maneuver, and then decelerate safely to a stop. The track area should also be free of potential radio interference to the degree possible.

When they can be performed safely, track test cases may be performed on open roadways that are relatively flat, without major traffic, or major obstruction.

On road test cases are performed to verify message communications and applications performance in operational traffic environments with deployed RSU infrastructure. On road test cases are designed to baseline DSRC and satellite communications performance on I-80, followed by periodic repeats during shakedown period to confirm RSU and other component performance and durability, particularly after heavy wind and weather events.

5.3 Test Procedure and Test Case Descriptions

Attachment B describes a series of Test Procedures and Test Cases planned to be performed. Table 5-1 provides a listing of the Test Procedures and Test Cases under each Test Group by number and title. Table 5-2 provides a description of each test case, summarizing the objective, driving scenario, and pass/fail criterion for each.

Some message communications and applications test cases employ similar system configurations and input driving scenarios. These test cases may be performed concurrently and integrated to improve testing efficiency. These test cases are identified in the rightmost column of Table 5-2 labeled “Integrated Test Case ID”. To assist testing staff, this integration is explicitly shown in test procedure and test case descriptions in Attachment B.

Table 5-1. List of WYDOT CV Pilot Test Procedures and Test Cases by Test Plan Section

Test Plan Document	Test Procedure	Test Cases
B.1	WV2VMCT – V2V Message Communications	• Integrated with other Test Procedures below
B.2	WV2IMCT-TP -- V2I Message Communications	• WV2IMCT-3 - V2I & End-to-end Communication of Environmental Sensor Data
B.3	WI2VMCT-TP -- I2V Message Communications	• WI2VMCT-3 - Simultaneous DSRC Upload/Download of messages and log files
B.4	WFCWT-TP -- Forward Collision Warning	• WFCWT-1 - FCW Stopped Vehicle Ahead *including* o WV2VMCT-1 - V2V exchange of BSMs o WV2IMCT-2 - V2I & End-to-end Communication of BSMs o WV2IMCT-4 - V2I & End-to-end communication of log files • WFCWT-2 - FCW Passing Stopped Vehicle • WFCWT-3 - FCW Steady State • WFCWT-4 - FCW Braking Vehicle Ahead • WFCWT-5 - FCW Stopped Vehicle in a Curve • WFCWT-6 - FCW Passing Stopped Vehicle in a Curve • WFCWT-7 - FCW Obstructed Vehicle Ahead • WFCWT-8 - FCW Slow Moving Vehicle • WFCWT-9 - Simultaneous Message Prioritization
B.5	WI2VSAT-TP -- I2V Situational Awareness	• WI2VSAT-1-REP - Message Display in Travel Lanes – Representative *including* o WI2VMCT-1 - End-to-end & DSRC Delivery of I2V SA TIMs • WI2VSAT-1-Pikalert - Message Display in Travel Lanes - Pikalert • WI2VSAT-1-511 - Message Display in Travel Lanes - 511 • WI2VSAT-1-RCRS - Message Display in Travel Lanes - RCRS • WI2VSAT-1-IC - Message Display in Travel Lanes - IC • WI2VSAT-1-CA - Message Display in Travel Lanes - CA • WI2VSAT-1-WTI-Speed - Message Display in Travel Lanes - WTI Speed

<table>
<tr><th>Test Plan Document</th><th>Test Procedure</th><th>Test Cases</th></tr>
<tr><td></td><td></td><td>• WI2VSAT-1-WTI-Restriction - Message Display in Travel Lanes - WTI - Restriction
• WI2VSAT-1-WTI-DMS - Message Display in Travel Lanes - DMS
• WI2VSAT-1-WTI-Closure - Message Display in Travel Lanes - Closures
• WI2VSAT-2 - Message Display in Shoulder Lanes
• WI2VSAT-3 - Message Display on Adjacent Service Road
• WI2VSAT-4 - I2V SA - Message Display Perpendicular to Travel Lanes
• WI2VSAT-5 - Message Display in Travel Lanes sent via Satellite
    o WI2VMCT-2 - End-to-end & Satellite Delivery of I2V SA TIMs
• WI2VSAT-6 - Message Display in Opposing Travel Lanes
• WI2VSAT-7 - Simultaneous DSRC and Satellite I2V SA TIMs communications
• WI2VSAT-8 - Message Display Start Time
• WI2VSAT-9 - Message Display Stop Time</td></tr>
<tr><td>B.6</td><td>WDNR-TP -- Distress Notification</td><td>• WDNR-1 - Same Direction Distress Notification relay to RSU including
    o WV2VMCT-2 - V2V exchange of DNMs
    o WV2IMCT-1 - V2I and End-to-end communication of DNMs
    o WDNT-1 - Manual Distress Notification
• WDNR-2 - Opposite Direction Distress Notification relay to RSU and Following Vehicle</td></tr>
<tr><td>B.7</td><td>WSHKR-TP -- On-road Shakedown</td><td>• WSHKR-1 - OBU Shakedown
• WSHKR-2 - RSU and Backhaul Communications Shakedown
• WSHKR-3 - I-80 Satellite TIM coverage
• WSHKR-4 - Verify I80 geofence map</td></tr>
<tr><td>B.8</td><td>WINSTQ-TP -- Installation Robustness and Quality Control</td><td>• WINSTQ-1 - OBU Installation Robustness
• WINSTQ-2 - RSU Installation Robustness
• WINSTQ-3 - OBU Installation Quality Control Test Cases
• WINSTQ-4 - RSU Installation Quality Control Test Cases</td></tr>
<tr><td>B.9</td><td>WSYSAA-TP -- Pilot System Availability and Administration</td><td>• WSYSAA-1 - WYDOT CV Pilot System Unavailable Notification</td></tr>
</table>

Test Plan Document	Test Procedure	Test Cases
		• WSYSAA-2 - System Administration Demonstration Test Case
B.10	WEXTSS-TP -- External Systems Support	• WEXTSS-511 - Truck Parking Information Entry and Delivery • WEXTSS-CAM - Pikalert Camera Imagery • WEXTSS-SCMSCRL - WYDOT CV System Misbehavior and CRL support (*Note Misbehavior Report and CRL not currently supported by SCMS) • WEXTSS-VCRL - Vehicle Systems CRL support (*Note CRL not currently supported by SCMS) • WEXTSS-OTA - OBU over the air updates • WEXTSS-RSUFIRM - RSU Firmware update
B.11	WSYSDOC-TP Pilot Components Documentation	• WOBUDOC-1 - Inspection of OBU Certification and Test Documents • WOBUDOC-2 - Inspection of Environmental Sensor Certification and Test Documents • WRSUDOC-1 - Inspection of RSU Certification and Test Documents • WODEDOC-1 - Inspection of ODE Design and Test Documents • WDWDOC-1 - Inspection of DW Design and Test Documents

Table 5-2. Summary of Planned WYDOT Pilot End-to-end System Operational Readiness Test Cases

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
V2V Message Communications Test Procedure and Test Cases					
WV2VMCT-1	V2V exchange of BSMs	Verify V2V BSM Communication Range and Antenna Performance.	* Remote vehicle is stopped in travel lane, broadcasting BSMs. * Host vehicle approaches, broadcasting BSMs, initially traverse at 35 mph, slowing to stop 2 meters behind remote vehicle.	* A configurable threshold percentage of BSMs sent are received and logged by host and remote vehicle OBUs, when vehicles are at least 300 meters apart. * A configurable threshold percentage of BSMs continue to be received and logged until host vehicle stops. * Verified by inspection of logs.	WFCWT-1
WV2VMCT-2	V2V exchange of DNMs	Verify V2V DNM Communication Range and Antenna Performance	* Host and remote vehicle pass each other from opposite directions, each traveling at 35 mph, while host vehicle broadcasts DNMs.	* A configurable threshold percentage of DNMs are received and processed by remote vehicle OBU when vehicles are at least 300 meters apart. * Verified by inspection of logs.	WDNR-1
V2I Message Communications Test Procedure and Test Cases					
WV2IMCT-1	V2I and End-to-end communication of DNMs	Verify End-to-end Communication of DNMs and V2I DNM communication range	* Host vehicle approaches RSU from outside of DSRC communication range.	* A configurable threshold percentage of DNMs are received and processed by RSUs when vehicle is at least 300 meters away. * DNMs are received and processed by Data Broker. * Verified by inspection of logs.	WDNR-1
WV2IMCT-2	V2I & End-to-end Communication of BSMs	Verify End-to-end Communication of BSMs and V2I BSM communication range	* Host vehicle approaches RSU from outside of DSRC communication range.	* A configurable threshold percentage of BSMs are received and processed by RSU when vehicle is at least 300 meters away.	WFCWT-1

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
				* BSMs are received and processed by Data Warehouse. * Verified by inspection of logs.	
WV2IMCT-3	V2I & End-to-end communication of Environmental Sensor Data	Verify End-to-end Communication of Environmental Sensor Data and V2I Environmental Sensor Data communication range	* Host vehicle approaches RSU from outside of DSRC communication range.	* Environmental Sensor Data are received and processed by ODE when vehicle is at least 150 meters away from RSU. * Environmental Sensor Data are received and processed by Pikalert. * Verified by inspection of logs.	
WV2IMCT-4	V2I & End-to-end communication of log files	Verify End-to-end Communication of log files and V2I log files communication range	* Host vehicle approaches RSU from outside of DSRC communication range.	* Log files are received and processed by ODE when vehicle is at least 150 meters away from RSU. * Log files are received and processed by ODE and are stored by Data Warehouse. * Verified by inspection of logs.	WFCWT-1
I2V Message Communications Test Procedure and Test Cases					
WI2VMCT-1	End-to-end & DSRC Delivery of I2V SA TIMs	Verify End-to-end Communication (DB to OBU) of I2V SA TIMs via DSRC and I2V SA TIM DSRC communication range	* I2V SA TIM is formulated by Data Broker and distributed to test RSU. * Host vehicle approaches RSU from outside of DSRC communication range.	* A configurable threshold percentage of I2V SA TIMs are received and processed by OBU when vehicle is at least 300 meters away. * Verified by inspection of logs.	WI2VSAT-1-REP
WI2VMCT-2	End-to-end & Satellite Delivery of I2V SA TIMs	Verify End-to-end Communication (DB to OBU) of I2V SA TIMs via satellite.	* I2V SA TIM is formulated by Data Broker and distributed to satellite service provider. * Five locations along Wyoming I-80 are selected for satellite testing. * Satellite test locations are between RSU locations.	* A configurable threshold percentage of I2V SA TIMs are received and processed by OBU at each of the 5 locations. * Verified by inspection of logs.	WI2VSAT-5

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
WI2VMCT-3	Simultaneous DSRC Upload/Download of messages and log files.	Verify simultaneous capture of BSMs, End-to-end Communication (DB to OBU) of I2V SA TIMs, and End-to-end Communication of log files (OBU to ODE) and DSRC communication range.	* I2V SA TIM is formulated by Data Broker and distributed to test RSU. * Host vehicle broadcasts BSMs and approaches RSU from outside of DSRC communication range.	* A configurable threshold percentage of BSMs are received and processed by RSU when vehicle is at least 300 meters away. * A configurable threshold percentage of I2V SA TIMs are received and processed by OBU when vehicle is at least 300 meters away. * All log files are received and processed by ODE when vehicle is at least 150 meters away from RSU. * Log files are received and processed by ODE and are stored by Data Warehouse. * Verified by inspection of logs.	
Forward Collision Warning Test Procedure and Test Cases					
WFCWT-1	FCW Stopped Vehicle Ahead	* Verify FCW application issues a warning in time for driver to avoid forward collision. * This test case is used to “tune” FCW to deliver timely warnings, while avoiding nuisance warnings.	* Host vehicle approaches stopped remote vehicle at 35 mph. * After receiving warnings, vehicle slows to stop 2 meters behind remote vehicle or veers to clear adjacent lane.	* FCW application issues a warning in time for driver to take action to avoid collision. Verified visually and by inspection of logs.	
WFCWT-2	FCW Passing Stopped Vehicle	* FCW does NOT issue a warning when there are no FCW	* Host vehicle passes stopped remote vehicle at 35 mph.	* FCW does NOT issue a warning when there are no FCW threats in the Host vehicle path.	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
		threats in the host vehicle path.		* Verified visually and by inspection of logs.	
WFCWT-3	FCW Steady State	* FCW does NOT issue a warning when host vehicle follows closely. * This test case is used to "tune" FCW to deliver timely warnings, while avoiding nuisance warnings.	* Host vehicle follows remote vehicle closely at 35 mph.	* FCW does NOT issue a warning. * Verified visually and by inspection of logs.	
WFCWT-4	FCW Braking Vehicle Ahead	* When remote vehicle brakes heavily FCW application issues a warning in time for driver to avoid forward collision.	* Host vehicle follows braking remote vehicle slowing from 35 mph.	* FCW issues an alert after the remote vehicle brakes heavily in time for driver to take action to avoid collision. * Verified visually and by inspection of logs.	
WFCWT-5	FCW Stopped Vehicle in a Curve	* When there is a stopped vehicle in the same lane of travel in a curve, FCW application issues a warning in time for driver to avoid forward collision.	* Host vehicle approaches remote vehicle stopped in a curve.	* FCW issues a warning when there is a stopped vehicle in the same lane of travel in a curve in time for driver to take action to avoid collision. * Verified visually and by inspection of logs.	
WFCWT-6	FCW Passing Stopped Vehicle in a Curve	* FCW does NOT issue a warning when there are no FCW threats in the host vehicle path in curve.	* Host vehicle passes remote vehicle stopped in a curve at 35 mph.	* FCW does NOT issue a warning when there are no FCW threats in the Host vehicle path. * Verified visually and by inspection of logs.	
WFCWT-7	FCW Stopped and Obstructed	* FCW application issues a warning, in	* Remote vehicle enters track, approaches and stops at	* FCW issues a warning in time for driver to take action to avoid	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
	Remote Vehicle Ahead	time for driver to avoid forward collision, when following an obstructing vehicle that changes lanes to reveal a stopped vehicle ahead in the same lane of travel.	designated test location. * Obstructing Vehicle (with or without active OBU) enters track from outside communication range. * Obstructing Vehicle approaches stopped remote at 35 mph. When nearing the stopped remote vehicle, the Obstructing vehicle veers to clear adjacent lane and proceeds past stopped vehicle. * Host vehicle enters track from outside communication range and follows Obstructing Vehicle at 35 mph. * After Obstructing Vehicle veers out of the lane, Host Vehicle continues until receiving FCW warning when driver stops or veers to clear adjacent lane and proceeds past stopped vehicle.	collision, when obstructing vehicle veers out of lane and there is a stopped vehicle ahead in the same lane of travel. * Verified visually and by inspection of logs.	
WFCWT-8	FCW Slow Moving Vehicle	* FCW application issues a warning when approaching a slow moving remote vehicle in time for driver to avoid forward collision.	* Host vehicle traveling at 35 mph approaches remote vehicle traveling at 15 mph.	* FCW issues a warning when there is a slow-moving vehicle in the same lane of travel in a curve in time for driver to take action to avoid collision. * Verified visually and by inspection of logs.	
WFCWT-9	Simultaneous Message Prioritization	* Verify prioritization of simultaneous FCW, Distress	* I2V SA TIM is configured with geofence beginning outside DSRC communication range of planned remote vehicle	* I2V SA Message displays within 8 meters of beginning of specified geofence. * DNM message displays at	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
		Notification, and I2V SA messages.	location. * Remote vehicle stops in travel lane in the middle of geofence and issues Manual Distress Notification, along with broadcasting BSMs. * Host vehicle passes RSU and downloads I2V SA TIM and enters I2V SA TIM geofence. * Host vehicle then approaches distressed vehicle, downloads DNM. * Finally Host vehicle continues approaching stopped distressed remote vehicle at 35 mph. * (all while still in I2V SA and DNM geofence)	specified distance from distressed vehicle, prioritized over I2V SA message. * As host vehicle approaches remote vehicle, FCW advisory alert is issued, followed by FCW imminent alert, prioritized over I2V SA and DNM, in time for driver to avoid collision. * Verified visually and by inspection of logs.	
I2V Situational Awareness Test Procedure and Test Cases					
WI2VSAT-1-REP	Message Display in Travel Lanes - Representative	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle driving in travel lanes in "message direction". * This is performed using “representative” TIM message.	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.	
WI2VSAT-1-Pikalert	Message Display in Travel Lanes - Pikalert	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS	* Host vehicle driving in travel lanes in "message direction". * This is performed for Pikalert (Spot Weather Impact Warning).	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence.	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
		accuracy supports accurate display of I2V SA Messages.		* Verified visually and by inspection of logs.	
WI2VSAT-1-511	Message Display in Travel Lanes - 511	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle driving in travel lanes in "message direction". * This is performed for 511 (Truck Parking).	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.	
WI2VSAT-1-RCRS	Message Display in Travel Lanes - RCRS	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle driving in travel lanes in "message direction". * This is performed for RCRS (Road condition).	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.	
WI2VSAT-1-IC	Message Display in Travel Lanes - IC	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle driving in travel lanes in "message direction". * This is performed for IC (Incident caution).	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.	
WI2VSAT-1-CA	Message Display in Travel Lanes - CA	Verify I2V SA TIM is parsed correctly and message begins and ends display at	* Host vehicle driving in travel lanes in "message direction". * This is performed for CA (Work Zone Warning).	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
		correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.		geofence. * Verified visually and by inspection of logs.	
WI2VSAT-1-WTI-Speed	Message Display in Travel Lanes - WTI Speed	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle driving in travel lanes in "message direction". * This is performed for WTI (Variable Speed Limit).	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.	
WI2VSAT-1-WTI-Restriction	Message Display in Travel Lanes WTI - Restriction	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle driving in travel lanes in "message direction". * This is performed for WTI (Vehicle Restriction).	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.	
WI2VSAT-1-WTI-DMS	Message Display in Travel Lanes - DMS	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	Host vehicle driving in travel lanes in "message direction". * This is performed for WTI (DMS Message).	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
WI2VSAT-1-WTI-Closure	Message Display in Travel Lanes - Closures	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle driving in travel lanes in "message direction". * This is performed for WTI (Road Closure).	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.	
WI2VSAT-2	Message Display in Shoulder Lanes	Verify I2V SA TIM geofence is parsed correctly and messages begins and ends display on shoulders at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle traveling in "message direction" on inside shoulder and outside shoulder. This is performed using “representative” TIM message.	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.	
WI2VSAT-3	Message Display on Adjacent Service Road	Verify I2V SA TIM geofence is parsed correctly and messages do not display on adjacent service roads. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle traveling in "message direction" on adjacent service road. This is performed using “representative” TIM message	* No message is displayed. * Verified visually and by inspection of logs.	
WI2VSAT-4	Message Display Perpendicular to Travel Lanes	Verify I2V SA TIM geofence is parsed correctly and messages do not	* Host vehicle approaches "travel lanes" on intersecting road perpendicular to "message direction".	* No message is displayed. * Verified visually and by inspection of logs.	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
		display when approaching on perpendicular service roads. Verify GPS accuracy supports accurate display of I2V SA Messages.	* This is performed using “representative” TIM message		
WI2VSAT-5	Message Display in Travel Lanes sent via Satellite	* Verify I2V SA TIM sent via Satellite is identical to I2V SA TIM sent via DSRC in WI2VSAT-1. * Verify messages are parsed correctly and message begins and ends display at correct geofence milepost.	Similar to WI2VSAT-1, Host vehicle driving in travel lanes in "message direction". * This is performed using “representative” TIM message.	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.	
WI2VSAT-6	Message Display in Opposing Travel Lanes	Verify I2V SA TIM geofence is parsed correctly and messages do not display when approaching in travel lanes opposite from specified message direction. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle approaches in travel lanes opposite to TIM "message direction". * This is performed using “representative” TIM message.	* No message is displayed. * Verified visually and by inspection of logs.	
WI2VSAT-7	Simultaneous DSRC and Satellite I2V SA TIMs	Verify correct processing of end-to-end communication (DB to OBU) of I2V	* I2V SA TIM is formulated by Data Broker and distributed to test RSU and to satellite service provider.	* OBU correctly processes identical I2V SA TIMs from DSRC and satellite. * Message displays within 8	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
	communications	SA TIMs simultaneously via satellite and via DSRC.	* Host vehicle approaches RSU from outside of DSRC communication range, while in satellite communication range. Host vehicle driving in travel lanes in "message direction". * This is performed using “representative” TIM message.	meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.	
WI2VSAT-8	Message Display Start Time	* Verify geofence implementation and I2V SA TIM start and stop time functionality and performance on I-80. * Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle driving in travel lanes on I-80 in "message direction". Vehicle enters geofence 10 seconds before start time. * This is performed using “representative” TIM message.	* Message begins displays within 1 second of specified start date and time (while inside the geofence). * Verified visually and by inspection of logs.	
WI2VSAT-9	Message Display Stop Time	* Verify geofence implementation and I2V SA TIM start and stop time functionality and performance on I-80. * Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle driving in travel lanes on I-80 in "message direction". Vehicle enters geofence at least 10 seconds before message stop time. * This is performed using “representative” TIM message.	* Message ceases displays within 1 second of specified stop date and time (while inside the geofence). * Verified visually and by inspection of logs.	
Distress Notification Test Procedure and Test Cases					
WDNR-1	Same direction Distress Notification relay to RSU	* Verify the functionality and performance of the Distress Notification	* Distressed vehicle enters roadway and pulls to shoulder at specified safe location, outside of DSRC communication range from	* Same Direction Relay Vehicle receives DNM at least 300 meters before reaching Distressed Vehicle. * Same Direction Relay Vehicle	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
		Application for same direction relay.	RSUs. * Driver manually initiates Distress Notification. * Same Direction Relay Vehicle approaches in same direction from outside DSRC communication range, passes host vehicle and continues, passing and relaying message to RSU.	OBU issues caution to driver upon receipt of DNM. * RSU receives DNM from Same Direction Relay Vehicle. * DNMs are received and processed by Data Broker. * TRAC receives DNM after receipt by RSU and issues distress notification message to operator. * Verified by inspection of logs.	
WDNR-2	Opposite direction Distress Notification relay to RSU and Following Vehicle	Verify the functionality and performance of the Distress Notification Application for opposite direction relay.	* 'Distressed vehicle enters roadway and pulls to shoulder at specified safe location, outside of DSRC communication range from RSUs. * Driver manually initiates Distress Notification. * Opposing Direction Relay Vehicle approaches Distressed Vehicle from opposite direction, outside DSRC communication range, and passes Distressed Vehicle, receiving DNM. * Opposing Direction Relay Vehicle continues to the nearest RSU, where it uploads DNM, and continues relaying DNM to vehicles approaching from same direction as Distressed Vehicle for a configurable distance or time. * Opposing Direction Relay Vehicle continues relays DNM	* Opposing Direction Relay Vehicle receives DNM at least 300 meters before reaching Distressed Vehicle. * Opposing Direction Relay Vehicle OBU issues caution to driver upon receipt of DNM. * RSU receives DNM from Opposing Direction Relay Vehicle at least 300 meters before reaching RSU. * TRAC receives DNM and issues distress notification message to operator. * Same Direction Following Vehicle receives DNM from Opposing Direction Relay Vehicle at least 300 meters before reaching Opposing Direction Relay Vehicle. * Same Direction Following Vehicle issues caution to driver a configurable distance before reaching Distressed Vehicle.	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
			to Same Direction Following Vehicle before it is within communication range of Distressed Vehicle. * Same Direction Following Vehicle continues to the nearest RSU, where it uploads DNM, and continues relaying DNM to Opposing Direction Vehicles for a configurable distance or time. (Note: Distressed Vehicle shall be over 5 miles downstream from RSU to enable Opposing Direction Relay Vehicle to cease broadcasting DNMs and go silent after 5 miles (or configurable distance), and prior to encountering the RSU for upload of the DNM.)	* Same Direction Following Vehicle relays DNM to Opposing Direction Vehicles for a configurable distance or time from Distressed Vehicle. * Verified by inspection of logs.	
On Road Shakedown Test Procedure and Test Cases					
WSHKR-1	OBU Shakedown	Perform baseline DSRC communication range test on all vehicles, followed by repetition periodically and after severe weather deployments (WYDOT Maintenance Vehicles) to verify OBU functionality and performance during	* Setup vehicle communication range test site on I-80 incorporating an OBU (in a simulated vehicle) and an RSU, each capturing vehicle BSMs. * Schedule each vehicle to pass test site independently and determine minimum V2V and V2I communication range for each. * Separation distance at which a configurable threshold percentage of BSMs sent are	* A configurable threshold percentage of BSMs are received and processed by RSU when vehicle is at least 300 meters away. * A configurable threshold percentage of BSMs are received and processed by remote vehicle OBU when vehicle is at least 300 meters away. * Inspection and troubleshooting is recommended for any OBU failing this test or demonstrating	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
		shakedown test period. * Inspection and troubleshooting is recommended when failure or reduced performance is found, to identify and remediate problems prior to full deployment.	received and logged by test OBU and RSU is recorded as baseline for subsequent vehicle performance assessment.	significantly reduced performance from baseline to identify and remediate problems prior to full deployment.	
WSHKR-2	RSU and Backhaul Communications Shakedown	Perform baseline DSRC communication range test on all RSUs, followed by repetition periodically and after severe weather events to verify RSU functionality and performance during shakedown test period. * Inspection and troubleshooting is recommended when failure or reduced performance is found, to identify and remediate problems prior to full deployment.	* Host (WYDOT maintenance) vehicle approaches each RSU broadcasting BSMs, uploading log files and capturing TIMs via DSRC. * Separation distance at which a configurable threshold percentage of I2V TIM and V2I BSM and log file sent are received is recorded as baseline for subsequent RSU performance assessment.	* A configurable threshold percentage of I2V TIMs sent from the RSU to the OBU and a configurable threshold percentage of V2I BSMs sent from the OBU to the RSU at a range of at least 300 meters are received. All log files are received. * Inspection and troubleshooting is recommended for any RSU failing this test or demonstrating significantly reduced performance from baseline, to identify and remediate problems prior to full deployment.	
WSHKR-3	I-80 Satellite TIM coverage	Verify and baseline the satellite-to-OBU	* Test engineers identify at least 10 locations along I-80	* A configurable threshold percentage of Satellite TIMs sent	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
		TIM coverage across I-80.	remote from RSU coverage. * Host (WYDOT maintenance) vehicle visits each site, capturing TIMs via satellite communications and recording the percentage of TIMs sent that are received.	are received at each of the selected locations.	
WSHKR-4	Verify I80 geofence map	Verify that map used for geofence generation accurately follows I-80 and will support accurate I2V SA message display.	* BSMs are logged from WYDOT Maintenance vehicles traveling I80.	* BSM location results are analyzed to verify that they fall on I80 geofence map. * Inspection and troubleshooting is recommended for map location in which BSMs fall more than one lane distance outside geofence map, to identify and remediate problems prior to full deployment.	
Installation Robustness and Quality Control Test Procedure and Test Cases					
WINSTQ-1	OBU Installation Robustness	Verify nominal OBU hardware installation robustness and ruggedness	* Install and remove OBU in vehicle 5 times.	* OBU shall pass the following two test cases after fifth installation * WV2VMCT-1 V2V exchange of BSMs * WV2IMCT-2 V2I & End-to-end communication of BSMs	
WINSTQ-2	RSU Installation Robustness	Verify nominal RSU hardware installation robustness and ruggedness	* Install and remove RSU on pole 3 times.	* RSU shall pass the following two test cases after third installation * WV2IMCT-2 V2I & End-to-end communication of BSMs * WI2VMCT-1 End-to-end & DSRC Delivery of I2V SA TIMs	
WINSTQ-3	OBU Installation Quality Control	Verify the functionality and performance of an OBU and antenna after installation in a vehicle	* Installation in a vehicle.	* OBU shall pass the following two test cases after installation * WV2VMCT-1 V2V exchange of BSMs	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
				* WV2IMCT-2 V2I & End-to-end communication of BSMs	
WINSTQ-4	RSU Installation Quality Control	Verify the functionality and performance of an RSU and antenna after installation on a roadside structure.	* Installation on a roadside structure.	* RSU shall pass the following two test cases after installation * WV2IMCT-2 V2I & End-to-end communication of BSMs * WI2VMCT-1 End-to-end & DSRC Delivery of I2V SA TIMs	
Pilot System Availability and Administration Test Procedure and Test Cases					
WSYSAA-1	WYDOT CV Pilot System Monitoring and Availability	Demonstrate Wyoming CV System availability monitoring and ITS Maintenance team notification.	* Disable or simulate unavailability of Wyoming CV System * Disable or simulate unavailability of Wyoming CV System monitored function. * Disable or simulate unavailability of Wyoming CV System subsystem. * Disable or simulate unavailability of Wyoming CV System external interface. * Simulate disk space under 10% availability	* Wyoming CV System sends alert to the WYDOT ITS Maintenance team within five minutes of a system becoming unavailable.	
WSYSAA-2	System Administration Demonstration Test Case	Demonstration System Administration functionality	* Demonstrate TMC administrator adding equipment to internal inventory list * Demonstrate TMC administrator editing equipment in internal inventory list * Demonstrate TMC administrator deleting equipment in internal inventory list * Demonstrate TMC	* Inspect the System Logs and verify * Adding equipment to internal inventory list * editing equipment in internal inventory list * deleting equipment in internal inventory list * testing the RSUs by allowing a series of Python testing scripts to be run on an RSU.	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
			administrator testing the RSUs by allowing a series of Python testing scripts to be run on an RSU and inspecting results of the test returned to the user. * Demonstrate Wyoming CV System provides the TMC administrator the geolocation of all RSUs. * Demonstrate Wyoming CV System provides the TMC administrator the ability to push out updates to the RSU firmware.	* the geolocation of all RSUs. * the ability to push out updates to the RSU firmware.	
External Systems Support Test Procedure and Test Cases					
WEXTSS-511	Truck Parking Information Entry and Delivery	Verify the accurate capture and dissemination of truck parking information via the WYDOT 511 App.	* Driver in host vehicle located at a truck parking area enters truck parking status.	* Driver in remote vehicle located upstream of parking area receives correct truck parking status within 15 minutes of entry by host vehicle driver.	
WEXTSS-CAM	Pikalert Camera Imagery	Demonstrate Pikalert receives camera imagery from the TMC File Transfer Protocol (FTP) server	* Demonstrate Pikalert Web Interface.	* Pikalert Web Interface displays camera imagery.	
WEXTSS-SCMSCRL	WYDOT CV System Misbehavior and CRL support	Verify Wyoming CV System misbehavior reporting and CRL support. (*Note Misbehavior Report and CRL not currently supported by SCMS)	* Remote Vehicle system simulates misbehavior sufficient to be placed on CRL. * Wyoming CV System detects misbehavior and sends report to the USDOT SCMS * Host Vehicle detects misbehavior and sends report	* Wyoming CV System detects misbehavior by Remote Vehicle * Wyoming CV System sends misbehavior reports to the USDOT SCMS within 24 hours after detection * Wyoming CV System downloads the CRL from the USDOT SCMS	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
			to the USDOT SCMS * Wyoming CV System downloads CRL from USDOT SCMS * Host Vehicle downloads CRL from USDOT SCMS * Wyoming CV System rejects message from Remote Vehicle on CRL * Host Vehicle rejects message from Remote Vehicle on CRL	* Wyoming CV System rejects messages received from Remote Vehicle on the current CRL. * Host Vehicle detects misbehavior by Remote Vehicle * Host Vehicle detects sends misbehavior reports to the USDOT SCMS * Host Vehicle detects downloads the CRL from the USDOT SCMS * Host Vehicle detects rejects messages received from Remote Vehicle on the current CRL.	
WEXTSS-OTA	OBU over the air updates	Verify OBU Over the Air Update	* Perform an OBU over the air update.	* Vehicle System receives and successfully performs update. * OTA requirements are satisfied.	
WEXTSS-RSUFIRM	RSU Firmware update	Verify RSU firmware update initiated by the TMC administrator.	* Perform an RSU firmware update initiated by the TMC administrator.	* RSU receives and successfully performs update. * Firmware update requirements are satisfied.	
Pilot Components Documentation Test Procedure and Test Cases					
WOBUDOC-1	Inspection of OBU Certification and Test Documents	Verify OBU and HMI requirements are satisfied by vendor certification and test documentation.	None.	* OBU requirements are satisfied.	
WOBUDOC-2	Inspection of Environmental Sensor Certification and Test Documents	Verify Environmental Sensor requirements are satisfied by vendor certification and test documentation.	None.	* Environmental Sensor requirements are satisfied.	
WRSUDOC-1	Inspection of RSU	Verify RSU requirements are	None.	* RSU requirements are satisfied.	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
	Certification and Test Documents	satisfied by vendor certification and test documentation.			
WODEDOC-1	Inspection of ODE Design and Test Documents	Verify ODE requirements are satisfied by developer design and test documentation.	None.	* ODE requirements are satisfied.	
WDWDOC-1	Inspection of DW Design and Test Documents	Verify DW requirements are satisfied by developer design and test documentation.	None.	* DW requirements are satisfied.	

5.4 End-to-end System Operational Readiness Testing Schedule and Checklist

Table 5-3 provides the Operational Readiness schedule and checklist developed by the WYDOT Team for monitoring and tracking the completion of Test Cases.

Table 5-3. Operational Readiness Testing Schedule and Checklist for Completion of Test Cases

RM No.	Test Case No.	Test Case Title	Status (RYG)	% complete	Due Date	Completion Date	Comments
V2V Message Communications Track Test Procedure and Test Cases							
2.1	WV2VMCT-1	V2V exchange of BSMs			8/30/2018		
2.2	WV2VMCT-2	V2V exchange of DNMs			7/15/2018		
V2I Message Communications Track Test Procedure and Test Cases							
2.3	WV2IMCT-1	V2I and End-to-end communication of DNMs			6/30/2018		
2.4	WV2IMCT-2	V2I & End-to-end Communication of BSMs			5/30/2018		

RM No.	Test Case No.	Test Case Title	Status (RYG)	% complete	Due Date	Completion Date	Comments
2.5	WV2IMCT-3	V2I & End-to-end communication of Environmental Sensor Data			8/30/2018		
2.6	WV2IMCT-4	V2I & End-to-end communication of log files			5/30/2018		
I2V Message Communications Track Test Procedure and Test Cases							
2.7	WI2VMCT-1	End-to-end & DSRC Delivery of I2V SA TIMs			8/30/2018		
2.8	WI2VMCT-2	End-to-end & Satellite Delivery of I2V SA TIMs			7/30/2018		
2.9	WI2VMCT-3	End-to-end & DSRC Delivery of I2V SA TIMs			8/30/2018		
Forward Collision Warning Test Procedure and Test Cases							
2.10	WFCWT-1	FCW Stopped Vehicle Ahead			5/30/2018		
2.11	WFCWT-2	FCW Passing Stopped Vehicle			5/30/2018		
2.12	WFCWT-3	FCW Steady State			5/30/2018		
2.13	WFCWT-4	FCW Braking Vehicle Ahead			5/30/2018		
2.14	WFCWT-5	FCW Stopped Vehicle in a Curve			5/30/2018		
2.15	WFCWT-6	FCW Passing Stopped Vehicle in a Curve			5/30/2018		
2.16	WFCWT-7	FCW Obstructed Vehicle Ahead			8/30/2018		
2.17	WFCWT-8	FCW Slow Moving Vehicle			5/30/2018		
2.18	WFCWT-9	Simultaneous Message Prioritization			8/30/2018		
I2V Situational Awareness Test Procedure and Test Cases							
2.19	WI2VSAT-1-REP	Message Display in Travel Lanes			5/30/2018		
2.20	WI2VSAT-1-Pikalert	Message Display in Travel Lanes - Pikalert			5/30/2018		

RM No.	Test Case No.	Test Case Title	Status (RYG)	% complete	Due Date	Completion Date	Comments
2.21	WI2VSAT-1-511	Message Display in Travel Lanes - 511			9/30/2018		
2.22	WI2VSAT-1-RCRS	Message Display in Travel Lanes - RCRS			9/30/2018		
2.23	WI2VSAT-1-IC	Message Display in Travel Lanes - IC			7/30/2018		
2.24	WI2VSAT-1-CA	Message Display in Travel Lanes - CA			9/30/2018		
2.25	WI2VSAT-1-WTI-Speed	Message Display in Travel Lanes - WTI Speed			9/30/2018		
2.26	WI2VSAT-1-WTI-Restriction	Message Display in Travel Lanes - WTI - Restriction			9/30/2018		
2.27	WI2VSAT-1-WTI-DMS	~~Message Display in Travel Lanes - DMS~~					*No longer part of the Pilot*
2.28	WI2VSAT-1-WTI-Closure	Message Display in Travel Lanes - Closures			9/30/2018		
2.29	WI2VSAT-2	Message Display in Shoulder Lanes			8/30/2018		
2.30	WI2VSAT-3	Message Display on Adjacent Service Road			8/30/2018		
2.31	WI2VSAT-4	I2V SA - Message Display Perpendicular to Travel Lanes			7/30/2018		
2.32	WI2VSAT-5	Message Display in Travel Lanes sent via Satellite			7/30/2018		
2.33	WI2VSAT-6	Message Display in Opposing Travel Lanes			7/30/2018		
2.34	WI2VSAT-7	Simultaneous DSRC and Satellite I2V SA TIMs communications			9/30/2018		
2.35	WI2VSAT-8	Message Display Start Time			9/30/2018		
2.36	WI2VSAT-9	Message Display Stop Time			7/30/2018		
Distress Notification Test Procedure and Test Cases							

RM No.	Test Case No.	Test Case Title	Status (RYG)	% complete	Due Date	Completion Date	Comments
2.37	WDNR-1	Same direction Distress Notification relay to RSU			6/30/2018		
2.38	WDNR-2	Opposite direction Distress Notification relay to RSU and Following Vehicle			6/30/2018		
On-road Shakedown Test Procedure and Test Cases							
2.39	WSHKR-1	OBU Shakedown			9/30/2018		
2.40	WSHKR-2	RSU and Backhaul Communications Shakedown			9/30/2018		
2.41	WSHKR-3	I-80 Satellite TIM coverage			9/30/2018		
2.42	WSHKR-4	Verify I80 geofence map			9/30/2018		
Installation Robustness and Quality Control Test Procedure and Test Cases							
2.43	WINSTQ-1	OBU Installation Robustness			10/30/2018		
2.44	WINSTQ-2	RSU Installation Robustness			10/30/2018		
2.45	WINSTQ-3	OBU Installation Quality Control Test Cases			10/30/2018		
2.46	WINSTQ-4	RSU Installation Quality Control Test Cases			10/30/2018		
Pilot System Availability and Administration Test Procedure and Test Cases							
2.47	WSYSAA-1	WYDOT CV Pilot System Unavailable Notification			10/30/2018		
2.48	WSYSAA-2	System Administration Demonstration Test Case			10/30/2018		
External Systems Support Test Procedure and Test Cases							
2.49	WEXTSS-511	Truck Parking Information Entry and Delivery			8/30/2018		
2.50	WEXTSS-CAM	Pikalert Camera Imagery			8/30/2018		
2.51	WEXTSS-SCMSCRL	~~WYDOT CV System Misbehavior and CRL support~~					*No longer part of the Pilot*
2.53	WEXTSS-OTA	OBU over the air updates			10/30/2018		
2.54	WEXTSS-RSUFIRM	RSU Firmware update			8/30/2018		

RM No.	Test Case No.	Test Case Title	Status (RYG)	% complete	Due Date	Completion Date	Comments
Pilot Components Documentation Test Procedure and Test Cases							
2.55	WOBUDOC-1	Inspection of OBU Certification and Test Documents			9/30/2018		
2.56	WOBUDOC-2	Inspection of Environmental Sensor Certification and Test Documents			9/30/2018		
2.57	WRSUDOC-1	Inspection of RSU Certification and Test Documents			9/30/2018		
2.58	WODEDOC-1	Inspection of ODE Design and Test Documents			9/30/2018		
2.59	WDWDOC-1	Inspection of DW Design and Test Documents			9/30/2018		

6 Acquisition, Installation, and Production Deployment Readiness

Following the system development, integration and testing, operational readiness will track the deployment of the system by major components, including key components of the

- Management Center Equipment, including servers, storage arrays, and switches
- RSU Subsystems
- Vehicle Subsystems

Specifications for each of these units is detailed in the WYDOT CV Pilot Comprehensive Acquisition Plan. Installation of these units will be detailed in the forthcoming Comprehensive Installation Plan (CIP).

For each of these the Operational Readiness Schedule and Checklist will track

- Component Purchase or Acquisition
- Acceptance Testing
- Installation
- Integration with the Integration Environment
- Acceptance Testing in the Integration Environment
- Deployment in the Production Environment

While the purchase and installation of management center equipment is routine, the purchase and installation of RSU and vehicle subsystems is new and untried. The first unit purchase, installation, integration and deployment will take place during the system development and testing. The remaining unit purchase, installation, integration and deployments will take place as part of the system production deployment.

For the purposes of tracking operational readiness of RSU and vehicle systems, the Operational Readiness Schedule and Checklist will track the purchase, installation, integration and deployment of the first unit, which is expected to be the most challenging and the proof of the procedures. Tracking of the remaining unit purchase, installation, integration and deployments will be in a lumped percent complete fashion.

Table 6-1. Acquisition, Installation, and Production Deployment Readiness Schedule and Checklist

RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
3.1	Management Center Equipment (Server, Storage Array, and Switch) Acquisition, Installation & Deployment					
3.1.1	MCE Purchase Specifications Completed			4/20/2018		
3.1.2	MCE Units Purchased, Delivered, and Accepted			6/1/2018		
3.1.3	MCE Units Installation, Integration, Acceptance Test, & Production Deployment Completed			7/1/2018		
3.2	RSU System Purchase, Installation & Deployment					
3.2.1	RSU Subsystem Purchase &			8/10/2018		

RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
	Acceptance Testing					
3.2.1.1	Purchase Specifications Completed			12/1/2016		
3.2.1.2	First RSU Subsystem Purchased			12/1/2016		
3.2.1.3	First RSU Subsystem Acceptance Test Completed			8/10/2018		
3.2.1.4	Remaining RSU Subsystems Purchased, Delivered & Accepted			8/15/2018		
3.2.2	RSU Subsystem Installation & Deployment			8/15/2018		
3.2.2.1	Subsystem Installation, Integration, Acceptance Test, & Production Deployment Procedures Completed			8/15/2018		
3.2.2.2	First Subsystem Field Installation,			8/15/2018		

RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
	Integration, Acceptance Test, & Production Deployment Completed					
3.2.2.3	Remaining Subsystems Installation, Integration, Acceptance Testing, and Production Deployment Completed			8/30/2018		
3.3	Vehicle Subsystem Purchase, Installation & Deployment					
3.3.1	**Vehicle Subsystem Purchase & Acceptance Testing**					
3.3.1.1	*Lear Roadstar (Integrated Commercial Vehicle, Highway Patrol & WYDOT*			9/31/2018		

RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
	Maintenance Vehicle)					
3.3.1.1.1	- Purchase Specifications Completed			12/1/2016		
3.3.1.1.2	- First Vehicle Subsystem Purchased			12/1/2016		
3.3.1.1.3	- First Vehicle Subsystem Acceptance Test Completed			7/1/2018		
3.3.1.1.4	- Remaining Vehicle Subsystems Purchased, Delivered & Accepted			8/30/2018		
3.3.1.2	*SiriusXM (Retrofit Commercial Vehicle)*			9/31/2018		
3.3.1.2.1	- Purchase Specifications Completed			7/31/2017		
3.3.1.2.2	- First Vehicle Subsystem Purchased			7/15/2018		
3.3.1.2.3	- First Vehicle Subsystem			7/30/2018		

RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
	Acceptance Test Completed					
3.3.1.2.4	- Remaining Vehicle Subsystems Purchased, Delivered & Accepted			9/15/2018		
3.3.2	**Vehicle Subsystem Installation & Deployment**			9/30/2018		
3.3.2.1	*Retrofit Commercial Vehicle (SiriusXM)*			9/30/2018		
3.3.2.1.1	- Subsystem Installation, Integration, Acceptance Test, & Production Deployment Procedures Completed			8/1/2018		
3.3.2.1.2	- First Subsystem Field Installation, Integration, Acceptance Test, & Production			8/15/2018		

RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
	Deployment Completed					
3.3.2.1.3	- Remaining Subsystems Installation, Integration, Acceptance Testing, and Production Deployment Completed			9/30/2018		
3.3.2.2	*Integrated Commercial Vehicle (Lear Roadstar)*			9/30/2018		
3.3.2.2.1	- Subsystem Installation, Integration, Acceptance Test, & Production Deployment Procedures Completed			8/6/2018		
3.3.2.2.2	- First Subsystem Field Installation, Integration, Acceptance Test, & Production Deployment Completed			8/15/2018		

RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
3.3.2.2.3	- Remaining Subsystems Installation, Integration, Acceptance Testing, and Production Deployment Completed			9/30/2018		
3.3.2.3	*Highway Patrol Vehicle (Lear full sized OBU)*			9/30/2018		
3.3.2.3.1	- Subsystem Installation, Integration, Acceptance Test, & Production Deployment Procedures Completed			9/10/2018		
3.3.2.3.2	- First Subsystem Field Installation, Integration, Acceptance Test, & Production Deployment Completed			9/15/2018		
3.3.2.3.3	- Remaining Subsystems Installation,			9/30/2018		

RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
	Integration, Acceptance Testing, and Production Deployment Completed					
3.3.2.4	*WYDOT Maintenance Vehicle (Lear Roadstar)*			9/30/2018		
3.3.2.4.1	- Subsystem Installation, Integration, Acceptance Test, & Production Deployment Procedures Completed			9/1/2018		
3.3.2.4.2	- First Subsystem Field Installation, Integration, Acceptance Test, & Production Deployment Completed			9/10/2018		
3.3.2.4.3	- Remaining Subsystems Installation, Integration, Acceptance			9/30/2018		

RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
	Testing, and Production Deployment Completed					

7 Operational Readiness Demonstration

A key component of readiness will be a demonstration for the USDOT and stakeholders demonstrating that the WYDOT CV Pilot system is fully functional and operational, ready for full deployment. The WYDOT Team proposes to conduct an in-person demonstration of its systems near the completion of system development, in early November, prior to Winter 17-18 shakedown period. This in-person demonstration will be followed as needed by virtual demonstrations of system operations, prior to full deployment and implementation in Phase 3 of the program.

7.1 Readiness Demonstration Agenda

Readiness demonstrations will consist of TMC tours and ride-along demonstrations of application end-to-end functionality, showing that the WYDOT CV Pilot has the functionality and performance to support WYDOT's current and future needs for CV support. The agenda for this demonstration event will include the following:

- Repeat selected Application End-to-End System Level Acceptance Tests which demonstrate end-to-end functionality and performance, and readiness for deployment. These demonstrations will verify
    - System Components Readiness
    - System Functions Readiness
    - Applications Readiness
    - Operational Scenarios Readiness
- Review and inspection of
    - Safety-Focused Readiness Elements (Measure 10.1, section 12.1 of this document)
    - Security-Focused Readiness Elements (Measure 10.2, section 12.2 of this document)
    - Privacy-Focused Readiness Elements (Measure 10.3, section 12.3 of this document)
    - Performance Measurement and Evaluation Support Readiness Elements (Measure 5, section 7 of this document)
    - Institutional, Staff, and Financial readiness (Measure 9, section 11 of this document)
    - Maintenance-oriented demonstration elements (Measure 7, section 9 of this document)

- Review documentation of Requirements Verification and Acceptance Tests

7.2 Readiness Demonstration Event

The WYDOT Team envisions the Pilot Readiness Demonstration as part of a two-day event. The first day will be the formal project application end-to-end system readiness demonstrations by the WYDOT Team for the USDOT and Noblis. The second day will expand to provide demonstrations for Wyoming transportation and governmental agencies and officials and fleet partners in a mini-showcase. This mini-showcase will provide opportunities for dialogue between the USDOT, Wyoming agencies and officials and fleet partners. On the second day, in parallel with the mini-showcase, WYDOT system engineers will provide a review of Requirements Verification and Acceptance Test documentation for Noblis and interested USDOT stakeholders.

The Operational Readiness Event will provide participants with an opportunity to inspect key components of the system including

- Vehicles
    - Integrated Commercial Vehicle with Lear Roadstar OBU
    - WYDOT Maintenance Vehicle with Lear Roadstar OBU
- Lear RSUs
- TMC Back Office Systems
    - WYDOT 511 System
    - WYDOT Road Condition Reporting System (RCRS)
    - WYDOT Incident Console (IC)
    - WYDOT Construction Administration (CA)
    - WYDOT Traveler Information System (WTI)
    - WYDOT Third Party Interface (TPI)
    - WYDOT Transportation Reports and Action Console (TRAC)
    - WYDOT Commercial Vehicle Operator Portal (CVOP)
    - WYDOT Maintenance Dispatch
- CV Pilot TMC Components with visual displays
    - Pikalert System

Functionality of the Data Broker, Operational Data Environment, and Data Warehouse will be demonstrated through end-to-end System demonstrations.

7.3 Demonstration Test Cases

The WYDOT Team will provide USDOT and stakeholder with ride-along demonstrations of application end-to-end functionality. Following demonstration of the initiation of I2V advisories for drivers from WYDOT back office systems such as 511 System, Road Condition Reporting System, Incident Console, Construction Administration, and WYDOT Traveler information, participants will ride in connected vehicles to observe, first-hand, Forward Collision Warning, Distress Notification, and I2V Situational Awareness application performance. These demonstrations will be repetitions of the selected test cases Attachment B Test Plan. The test procedures and test cases planned for the event include:

- Test Procedure DWFCWT Forward Collision Warning Track Demonstration
    - Objectives

        - Verify the FCW application issues an advisory FCW alert when there is a potential for forward collision with a vehicle directly ahead in the same lane of travel.
        - Verify the FCW application issues an imminent FCW alert when there is an imminent threat of forward collision with a vehicle directly ahead in the same lane of travel and immediate action is required from the driver to avoid the collision.
        - Verify requirements associated with Demonstration Case.
    - Test Cases to be performed
        - DWFCWT-1 -- FCW Stopped Vehicle Ahead
- Test Procedure DWI2VSAT I2V Situational Awareness Track
    - Objectives
        - Verify that Back Office Component compiles and delivers Driver Advisory/Warning information to DB
        - Verify that DB correctly compiles I2VSA TIM from Back Office Component information
        - Verify TIM is delivered to vehicles via DSRC
        - Verify I2VSA TIM is received by OBU
        - Verify TIM is parsed correctly and Driver Advisory/Warning display begins and ends display at correct geofence milepost or does not display as required.
    - Test Cases to be performed
        - DWI2VSAT-Pikalert - Pikalert TIM

Table 7-2 provides the checklist for measure 4, Readiness Demonstration.

Attachment B to this document is the WYDOT CV Pilot Demonstration Plan which provides a detailed description of each of these demonstration cases, leveraging the Attachment A. WYDOT CV Pilot Test Plan.

Table 7-1. Operational Readiness Demonstration Schedule and Checklist

RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
4.1	System Components Readiness			5/1/2018		
4.2	System Functions Readiness			5/1/2018		
4.3	Applications Readiness			2/1/2018		
4.4	Operational Scenarios Readiness			2/1/2018		
4.5	Safety-Focused Readiness Elements			2/1/2018		
4.6	Security-Focused Readiness Elements			5/1/2018		
4.7	Privacy-Focused Readiness Elements			5/1/2018		
4.8	Performance Measurement and Evaluation Support Readiness Elements			5/1/2018		
4.9	Institutional, Staff, and Financial readiness			8/1/2018		
4.10	Maintenance-oriented demonstration elements			3/1/2018		
4.11	Documentation of Requirements Verification and Acceptance Tests			9/30/2018		
4.12	DWFCWT-1 -- FCW Stopped Vehicle Ahead			12/1/2017		
4.13	DWDNR-1 -- Distress Notification Relay to RSU and Following Vehicle			12/1/2017		
4.14	DWI2VSAT-Pikalert			12/1/2017		

8 Performance Measurement and Evaluation Support Readiness

The fifth measure of WYDOT CV Pilot Operational Readiness is Performance Measurement and Evaluation Support Readiness. WYDOT and FHWA are interested in a collaborative activity to assess the Pilot's system performance and other impacts. There are two distinct, but coordinated, efforts planned. The first will be conducted by the Wyoming Project Team, and the second by FHWA's Independent Evaluators (IE) Texas A&M Transportation Institute and Volpe Transportation Research Center.

The focus of the Project Team's evaluation will be to understand what worked, what didn't, and how to improve the system and determine future enhancements. Additionally, the Project Team's evaluation will measure the impacts to the trucking industry, Wyoming residents, and other users of the I-80 corridor and look for ways to expand upon the identified benefits.

The FHWA IE will focus on national programmatic aspects of this CV Pilot project, combined with other similar projects being conducted. The IE team will strive to understand how the project outcomes can contribute to the future of the Connected Vehicle Program nationally. Toward this end, the Wyoming Project Team will work collaboratively to ensure a comprehensive and successful evaluation is completed and documented in such a way to benefit Wyoming, other interested states, and the national CV Program. The Wyoming Team will make available the needed data, where available, identified by the IE.

The *WYDOT CV Pilot Performance Measurement and Evaluation Support Plan* (Phase 1) provides an overview of the performance measures and evaluation plan utilized in this pilot. As such, it identifies and describes the measures and corresponding targets, data needs, and evaluation designs that will be used to complete a successful performance measurement and evaluation of the WYDOT CV Pilot Demonstration. Additionally, this document addresses confounding factors and mitigation approaches, system performance reporting, and data collection and management. The Plan is supported by the Phase 2 *Performance Measurement and Evaluation Support Schedule (PMESS)*. The PMESS provides a work breakdown structure of performance measurement and evaluation activities. A progress report based upon this PMESS is updated and submitted to the USDOT bi-weekly.

8.1 Performance Measures and Evaluation Support Schedule and Checklist

The operational readiness schedule and checklist for this measure leverages the previously developed PMESS. Table 8-1 below is the operational readiness schedule and checklist for Performance Measures and Evaluation. Description of each component are provided in the PMESS deliverable. Moving forward, progress on this activity will be reported as part of a monthly operational readiness progress report.

Table 8-1. Performance Measurement and Evaluation Support Readiness Schedule & Checklist

RM No.	PM WBS	Performance Measurement Activities	Status (RYG)	% Complete	Due Date	Completion Date	Comments
5.1	T2K.1	**Prepare Schedule**					
5.1.1	T2K.1.1	Submit Draft PMESS			3/1/2017		
5.1.2	T2K.1.2	USDOT Review			3/15/2017		
5.1.3	T2K.1.3	Prepare Final PMESS			4/3/2017		
5.1.3	T2K.1.3	Submit Weekly Progress Reports and Issues/Risks			Ongoing, every 2 weeks		
5.2	T2K.2	**Provide Support Information**					
5.2.1	T2K.2.1	Pre-Deployment (Baseline) Data Collection					
5.2.1.1	T2K.2.1.1	Road weather condition reports			1/31/2018		
5.2.1.2	T2K.2.1.2	Commercial Vehicle Fleets Information			1/31/2018		
5.2.1.3	T2K.2.1.3	Individual vehicle speeds			1/31/2018		
5.2.1.4	T2K.2.1.4	Vehicle crashes			1/31/2018		
5.2.2	T2K.2.2	Develop Analytical Methods					
5.2.2.1	T2K.2.2.1	Road weather condition reports			3/30/2018		
5.2.2.2	T2K.2.2.2	TMC generated alerts and advisories			9/30/2018		
5.2.2.3	T2K.2.2.3	Disseminate and Receive I2V and V2I messages			9/30/2018		
5.2.2.4	T2K.2.2.4	Commercial Vehicle Fleets Information			3/30/2018		
5.2.2.5	T2K.2.2.5	Transmitted V2V messages			9/30/2018		
5.2.2.6	T2K.2.2.6	Automated Emergency Notifications of a Crash			9/30/2018		
5.2.2.7	T2K.2.2.7	Individual vehicle speeds			3/30/2018		
5.2.2.8	T2K.2.2.8	Vehicle crashes			3/30/2018		
5.2.3	T2K.2.3	Develop and Calibrate Simulation Models			9/30/2018		
5.2.4	T2K.2.4	Apply Methods and Develop Initial Pre-Deployment Conditions			8/31/2017		
5.2.5	T2K.2.5	Apply Methods and Develop Final Pre-Deployment Conditions			7/30/2018		
5.2.6	T2K.2.6	Support Independent Evaluator			9/30/2018		

RM No.	PM WBS	Performance Measurement Activities	Status (RYG)	% Complete	Due Date	Completion Date	Comments
5.3	T2K.3	**Prepare System Performance Reports**					
5.3.1	T2K.3.1	Provide Support to Initial System Readiness Testing			8/30/2017		
5.3.1.1	T2K.3.1.1	Support bench testing to ensure end-to-end data transmission			8/30/2017		
5.3.2	T2K.3.2	Prepare Initial Phase 2 System Performance Report			9/29/2017		
5.3.3	T2K.3.3	Provide Support to Final System Readiness Testing and Demonstration			Fall 2018		
5.3.3.1	T2K.3.3.1	Support field testing to ensure end-to-end data transmission			Fall 2018		
5.3.3.2	T2K.3.3.2	Support USDOT demonstration of end-to-end data transmission			Fall 2018		
5.3.4	T2K.3.4	Prepare Final Phase 2 System Performance Report			7/30/2018		
5.4	T2K.4	**Update PMESP**					
5.4.1	T2K.4.1	Prepare Draft PMESP Update			4/1/2018		
5.4.2	T2K.4.2	USDOT Review			4/15/2018		
5.4.3	T2K.4.3	Prepare Final PMESP Update			7/30/2018		

9 Planning & Design Readiness

Planning and design readiness is captured in measure 6 of the Operational Readiness Plan. Planning and design aspects of the WYDOT CV Pilot are captured and presented through the project Phase 1 and 2 deliverables. The operational readiness checklist for this measure, shown in Table 9-1, consists of Phase 1 and 2 deliverables.

Table 9-1. Pilot Planning and Design Operational Readiness Schedule and Checklist

RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
6.1	Phase 1 Deliverables					
6.1.1	Task 2 Concept of Operations		100	2/11/2016		
6.1.2	Task 3 Security Management Operating Concept		100	3/28/2016		
6.1.3	Task 4 Safety Management Plan		100	3/28/2016		
6.1.4	Task 5 Performance Measurement and Evaluation Plan		100	6/6/2016		
6.1.5	Task 6 System Requirements		100	7/18/2016		
6.1.6	Task 7 Application Deployment Plan		100	4/5/2016		
6.1.7	Task 8 Human Use Summary		100	7/18/2016		
6.1.8	Task 9 Participant Training and Education Plan		100	6/23/2016		
6.1.9	Task 10 Partnership Coordination Plan		100	6/27/2016		
6.1.10	Task 11 Outreach Plan		100	9/13/2016		
6.1.11	Task 12 Comprehensive Deployment Plan		100	8/1/2016		
6.1.12	Task 13 Deployment Readiness Summary		100	9/22/2016		
6.2	Phase 2 Deliverables					
6.2.1	2A Kick-off Meeting			9/23/2016		
6.2.2	2A Project Management Plan (PMP)			10/20/2016		
6.2.3	2A Project Schedules			10/20/2016		
6.2.4	2B Systems Architecture Document			10/1/2017		
6.2.5	2B Systems Design Document			10/1/2017		
6.2.6	2B Updated Phase 1 Deliverables			6/15/2018		
6.2.7	2C Data Privacy Plan			12/30/2016		
6.2.8	2C Notice of Privacy Management Consistency			1/6/2017		
6.2.9	2C Data Management Plan			6/30/2017		
6.2.10	2D Comprehensive Acquisition Plan			9/1/2017		

RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
6.2.11	2D Comprehensive Installation Plan			10/23/2017		
6.2.12	2E Application Development Schedule (ADS)			2/9/2017		
6.2.13	2E Open Source Software and Supporting Documentation			4/27/18		
6.2.14	2F Training Implementation Schedule (TIS)			4/4/2017		
6.2.15	2F Training Materials			2/28/2018		
6.2.16	2F Human Use Approval Confirmation Materials			4/27/18		
6.2.17	2G Operational Readiness Concept Briefing			3/9/2017		
6.2.18	2G Operational Readiness Plan			10/13/2017		
6.2.19	2H Installation and Operational Readiness Schedule (IORS)			10/2/2017		
6.2.20	2H Operational Readiness Demonstrations			4/27/2018		
6.2.21	2I Comprehensive Maintenance and Operations Plan (CMOP)			6/15/2018		
6.2.22	2J Deployment Outreach Plan (DOP)			5/31/2017		
6.2.23	2J Outreach Implementation Schedule (OIS)			4/30/2018		
6.2.24	2J Outreach Materials			4/30/2018		
6.2.25	2K Performance. Meas. and Eval. Support Schedule (PMESS)			4/4/2017		
6.2.26	2K Pre-Deployment Performance. Data, logbooks, models and other info			4/30/2018		
6.2.27	2K Final System Performance Report			7/30/2018		
6.2.28	2L SDO-specific Technical Memoranda			9/15/18		

10 Operations and Maintenance Procedures Readiness

Detailed plans for operations and maintenance will be defined in the Comprehensive Maintenance and Operations Plan (CMOP). The type and number of each piece of equipment required to be maintained during the Pilot phase of the operation and beyond will be recorded as part of the CMOP. For each equipment type identified in the CMOP, a corresponding plan to maintain and operate that type of equipment will be included. Also included in this plan will be information on the manufacturer's operating manual and corresponding manufacturer information regarding maintenance and warranty information.

Table 10-1 below provides the Operations and Maintenance Section of the Operational Readiness Checklist. As illustrated by the table, O&M readiness is focused on ensuring that O&M procedures are completed, appropriately skilled staff have been assigned, and those staff have been trained. O&M Plans include plans for routine operations and preventive maintenance for components of the TMC, for RSUs along the roadway, and for deployed equipped vehicles. Important components of the O&M plans include

- Problem Identification, Troubleshooting & Repair Procedures
- Software & Applications Update/Recall/Replacement Plans
- Hardware Update/Recall/Replacement Plans
- Hardware/software configuration control processes
- Spare parts/warranty contingency plans

Specifics of these will be detailed in the CMOP. Section 10.1 below summarizes plans for development of the CMOP.

Table 10-1. Operations and Maintenance Procedures Readiness Schedule and Checklist

RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
7.1	Comprehensive Maintenance and Operations Plan (CMOP) Completed			3/30/2018		
7.2	TMC Pilot Operations & Maintenance Readiness					
7.2.1	Operations Procedures			TBD		
7.2.2	Operations Staff Training			TBD		
7.2.3	Preventative Maintenance Procedures			11/15/2017		
7.2.4	Problem Identification, Troubleshooting & Repair Procedures			11/15/2017		
7.2.5	Software & Applications Update/Recall/Replacement Plans			11/15/2017		
7.2.6	Hardware Update/Recall/Replacement Plans			11/15/2017		
7.2.7	Hardware/software configuration control processes			11/15/2017		
7.2.8	Spare parts/warranty contingency plans			11/15/2017		
7.2.9	Maintenance Staff Training			8/23/2018		
7.3	RSU Infrastructure Operations & Maintenance					
7.3.1	Operations Procedures			TBD		
7.3.2	Operations Staff Training			TBD		
7.3.3	Preventative Maintenance Procedures			11/15/2017		
7.3.4	Problem Identification, Troubleshooting & Repair Procedures			11/15/2017		
7.3.5	Software & Applications Update/Recall/Replacement Plans			11/15/2017		
7.3.6	Hardware Update/Recall/Replacement Plans			11/15/2017		
7.3.7	Hardware/software configuration control processes			11/15/2017		
7.3.8	Spare parts/warranty contingency plans			8/23/2018		
7.3.9	Maintenance Staff Training			8/23/2018		
7.4	Vehicle Systems Operations & Maintenance					
7.4.1	Operations Procedures			11/15/2017		
7.4.2	Operations Staff Training			11/15/2017		

7.4.3	Preventative Maintenance Procedures			11/15/2017		
7.4.4	Problem Identification, Troubleshooting & Repair Procedures			11/15/2017		
7.4.5	Software & Applications Update/Recall/Replacement Plans			11/15/2017		
7.4.6	Hardware Update/Recall/Replacement Plans			11/15/2017		
7.4.7	Hardware/software configuration control processes			11/15/2017		
7.4.8	Spare parts/warranty contingency plans			8/23/2018		
7.4.9	Maintenance Staff Training			8/23/2018		

10.1 Plans for the Forthcoming Comprehensive Maintenance and Operations Plan

The CMOP will be divided into sections that correspond to Operations and Maintenance broken down into subsections as defined by USDOT (vehicles and in-vehicle equipment, roadside equipment, etc.). As a baseline for maintaining and operating all equipment, the project will default to the manufacturer's recommended approach. When a maintenance or operational issue arise that is not covered under the manufacturer's guidelines, the manufacturer will be contacted for guidance to resolve the issue. Resolutions will be documented and added to the CMOP section(s) corresponding to the associated equipment.

The Operations section of the CMOP will list operating tasks and schedules. An example of this is the following text: [Example: In-Vehicle DSRC: 60 DSRC Radios were installed in WYDOT snowplows for use in the I-80 corridor. The DSRC radios broadcast at a range of 300 meters and operate continuously while the vehicle is in use. The DSRC radios will operate at all times and under all conditions, except when undergoing repair or replacement.] Operations will be updated based on the manufacturer's specifications and on the current operating environment of the connected vehicles.

In the maintenance section of the document, each equipment type will be listed with its maintenance schedule. Information provided within the maintenance section will include, at a minimum, the following information: routine maintenance requirements/schedules, inspection procedures, maintenance/replacement procedures, QA/QC processes, hardware/software configuration control processes, recall processes, and spare parts/warranty contingency plans.

Additionally, all maintenance performed will follow a standard operating procedure (SOP) that will be created and appended to the CMOP. The SOP will contain the following information: purpose, health and safety precautions, equipment, and task procedure. The section content for each of these items is defined below:

- Purpose: Explains the purpose of the SOP and why it has been written for this task.
- Health and Safety: Contains general safety procedures and concerns regarding the task and specific safety training requirements needed to perform the task.
- Equipment: Contains an itemized list of all equipment required to perform this task.
- Task Procedure: Details the procedure to follow in performing maintenance for the equipment. The procedure should include sections for preparation, task activity, and post-activity steps.

11 Training and IRB Readiness

11.1 Training Materials and Staff Training

In moving from experiments to deployment, installation, operation, and maintenance of all CV-related components and systems, training for participants is necessary to ensure consistency and reliability in CV deployment and maintenance. To support this program, training materials will be developed to support all procedures, particularly installation and maintenance procedures, along with post-installation or maintenance quality control tests to verify proper implementation. This training will be based upon the Pilot Operations & Maintenance Procedures described in the previous section. Readiness planning has included identification of the procedures, training, and documentation materials required for successful implementation and deployment of the pilot. Operational readiness tracking will include. Readiness tracking will include tracking the successful completion of the training materials as well as completion of installation, operation, and maintenance training by staff supporting the pilot.

11.2 Training Materials Readiness

A Participant Training and Education Plan (PTEP) (Ahmed, Gopalakrishna, et al. 2016) was developed during Phase 1. The plan identified key stakeholders of Wyoming's CV Pilot Project that will need to be trained and educated to ensure the correct deployment, operation and maintenance of the system. The main stakeholder groups identified for training and education are:

1. Training Instructors
2. CV-Pilot Participants
    a. Drivers of Equipped Vehicles
    b. WYDOT TMC and Highway Patrol (WHP) Dispatch Personnel
    c. WYDOT Operational and Support Personnel
    d. Fleet Management Center Personnel (CVOP Users)
3. Public (Third-Party Interface Users)

The WYDOT Team will use different methodologies to efficiently and effectively train system users (e.g., WYDOT Maintenance, Highway Patrol, and truck drivers), system managers and staff (e.g., TMC operators, technicians), and instructors. These methodologies are categorized into (1) in-person/ online instructional clinics and (2) live demonstrations and test drives. Having an array of options will ensure training is accessible and effective for all stakeholder participants in the project.

Training and education readiness incorporates preparation of the training materials, followed by receipt and completion of the training by participants. Table 11-1 is the Training Materials Readiness Checklist, identifying the training materials to be developed for each group of stakeholders. Following is a preliminary description of products that will be developed:

- Online Training and Education Materials
- Workshop Training and Education Materials
- Driving Simulator Materials
- E-Training Materials
- Field Demonstration Materials

Detailed descriptions of these materials may be found in the PTEP.

These materials will be developed for each class of drivers, tailored to the type of CV equipment installed in their vehicle and the alerts and warnings issued by the onboard applications. Training materials for Operational Staff will include Online and Workshop training materials. CVOP and Third-Party Interface Users will be provided with Online Training. The WYDOT Team has targeted September, 2017 as a deadline to have all Training Materials/ Modules ready with beginning of October 2017 as a Training launching date.

11.3 Staff Training Readiness

The WYDOT team will track and report to the USDOT the numbers of participants completing training in tabular form such as that shown in Table 11-2. The WYDOT Team will report the number of participants requiring training and the number completed for each stakeholder and participant in the program. The potential list of freight partners is preliminary and is expected to evolve through Phase 2 of the project. The number of individuals requiring training and completing training are expected to grow through normal staff additions. Information on which participants have completed training will be kept confidential.

The WYDOT team will also capture and record the number of times training materials are accessed by end users such as users of the Commercial Vehicle Operators Portal and Third-Party Interface, as illustrated in Table 11-3. There is no expected minimum or limitation on the number of users these materials.

Table 11-1. Training Materials Readiness Checklist

RM No.	Readiness Measure	Status (RYG)	Online Training and Education Materials % Complete	Workshop Training and Education Materials % Complete	Driving Simulator Materials % Complete	E-Training Materials % Complete	Field Demonstration Materials % Complete	Due Date	Completion Date	Comments
8.1	Driver Training									
8.1.1	Driver Instructor Training							10/1/2017		
8.1.2	Basic and All Drivers Training							10/1/2017		
8.1.3	Highway Patrol Driver Training							Tentative		
8.1.4	Retrofit Truck Driver Training (Com'l Fleets)							10/1/2017		
8.1.5	Integrated Truck Driver Training (Trihydro Fleet)							10/1/2017		
8.1.6	WYDOT Maintenance/ Snowplow Driver Training							10/1/2017		
8.2	Operational Staff Training									
8.2.1	Operational Staff Instructor Training							10/1/2017		
8.2.2	TMC Operator Training							10/1/2017		
8.2.3	Highway Patrol Dispatcher Training							10/1/2017		
8.2.4	ITS and Telecom Technician Staff							10/1/2017		

RM No.	Readiness Measure	Status (RYG)	Online Training and Education Materials % Complete	Workshop Training and Education Materials % Complete	Driving Simulator Materials % Complete	E-Training Materials % Complete	Field Demonstration Materials % Complete	Due Date	Completion Date	Comments
8.2.5	Maintenance Supervisors							10/1/2017		
8.2.6	WYDOT Supervisory and Support Staff							10/1/2017		
8.2.7	WYDOT Development Staff							10/1/2017		
8.3	Fleet Management Centers									
8.3.1	Commercial Vehicle Operator Portal Users							10/1/2017		
8.4	Public									
8.4.1	Third Party Interface Users									

Table 11-2. WYDOT CV Pilot Driver and Operational Staff Training Completion Status

RM No.	Readiness Measure	Status (RYG)	Staff Trained/ To be Trained	Technicians Trained/ To be Trained	Supervisors Trained/ To be Trained	Due Date	Completion Date	Comments
8.2.1	Operations Staff							
8.2.1.1	WYDOT TMC					9/30/2018		
8.2.1.2	WYDOT IT					9/30/2018		
8.2.1.3	WYDOT Telecom					9/30/2018		
8.2.1.4	WYDOT Highway Patrol					9/30/2018		
8.2.1.5	WYDOT Procurement					9/30/2018		
8.2.1.6	WYDOT Maintenance					9/30/2018		
8.2.1.7	WYDOT GIS/ITS Contractors					9/30/2018		
8.2.2	Freight Partner Training*					**9/30/2018**		

* This includes all participating freight partners. The list of partners is expected to evolve through Phase 2 of the project.

Table 11-3. Other Stakeholders Training and Education

RM No.	Stakeholder Group	Number Accessing Training
8.2.3.1	Commercial Vehicle Operators Portal	
8.2.3.2	Third Party Interface Users	

11.4 IRB Readiness

The WYDOT CV Pilot and participant training follow Federal regulations and the Institutional Review Board (IRB) application and approval processes to protect human participants in the pilot. A Human Use Summary (HUAS) (Ahmed, Gopalakrishna, et al. 2016) was developed in Phase 1 to document and explain the IRB application, obtaining participants' consent, review process, and how the WYDOT addressed the IRB comments and secured the IRB approval for Phases 2 and 3.

The WYDOT pilot team has obtained approval from our IRB of record for the pilot. An IRB application was submitted on April 19th, 2016, and the application was qualified for Full Board Review. The Institutional Review Board at the University of Wyoming met with the human use lead and WYDOT representatives on May 19th, 2016 to discuss and request modifications to the application. All reviews at the University of Wyoming are subject to criteria developed from Belmont Report. The IRB application was approved by the UW IRB on May 23rd, 2016 for a period of 1-year. It should be noted that while the IRB approval is for 1-year, any changes to the study will be reported to the IRB immediately. The Wyoming/ ICF team is planning to amend the IRB application after more details are available about the CV applications. The potential risks of the CV applications on real-life driving will be determined in Phase 2 in a controlled driving simulator environment. The results from driving simulator experiments will be shared with UW IRB.

The IRB application included a brief description of the purpose of the CV Pilot as well as a descriptions of research tasks proposed in Phase 2 and 3. Descriptions of potential participants such as age-range and gender, number of participants, qualifications, recruitment process, benefits and risks to participants, compensations and incentives provided, criteria for exclusion from the study are also included, as well as when participants may terminate participation. A detailed description is provided for the participants' activities and estimated time required in all phases. Method of data collection, procedure that will be used to protect privacy and confidentiality of participants, how and where the data will be stored, how long the data, research summary and signed consent forms will be stored, and who will be giving access to the data are also explained in detail in the application.

The application included 11 attachments required as part of the IRB approval at the University of Wyoming:

a. Informed Consent Forms for Phase 2, and 3
b. Pre- and Post-Driving Survey Questionnaire
c. CITI IRB Training Course Report
d. Driving Simulator Specifications Sheet
e. Eye Tracking/Video Recording Specification Sheet
f. Project Technical Proposal
g. Concept of Operations
h. Privacy and Security Management Operating Concept
i. Safety Management Plan.

The IRB will support many tasks in Phase 2 and 3. It is anticipated that multiple amendments to the original application will be prepared and submitted as the CV-Pilot progresses in Phase 2 and 3. For example, the Institutional Review Board at UW requested an amendment of the IRB application to provide a full description of the refined HMI and other CV systems used in Phase

III. The pilot team will amend the IRB application to include detailed information about the developed CV applications and the HMI after the completion of Phase 2. An addendum will be submitted to the IRB for their review and approval in order to update the protocol before the start of Phase 3. An amended IRB Protocol has been submitted and approved on March 14, 2018. Approval to distribute survey questionnaire for fleet managers has been granted on March 6, 2017. The Wyoming team will not obtain a Certificate of Confidentiality as recommended by the USDOT and UW IRB. The requirement for collecting signed consents has been waived for fleet partners, the consent will be part of the Online training. CITI training has been completed by all partners on this project and all certificates have been collected and archived by UW IRB. IRB agreements between UW and all partners have been collected as well. The next step will be to support the HMI/DVI development and update the identified risks to participants. The HUA team will keep track on any modifications to the original plans and will submit an updated IRB protocol as needed. In addition, all survey questionnaires will be submitted for review prior to distribution. In addition, IRB amendments will be submitted for Data Management Planning, Application Development and Testing, Participant and Staff Training, Performance Measurement and Independent Evaluation in Phase 2 as well as various tasks in Phase 3.

12 Institutional, Staff, and Financial Readiness

Successful implementation and deployment will require the close cooperation of multiple public and private stakeholders outlined in Figure 12-1. All participants must have a clear understanding of their roles and responsibilities and also have committed the staff and financial resources to carry out the required efforts from beginning through to completion of both Phase 2 and 3. This portion of the Operational Readiness Checklist will monitor and track the completion of participant agreements, which define respective roles and responsibilities, and the status of staff and financial resources necessary to follow through and complete the effort.

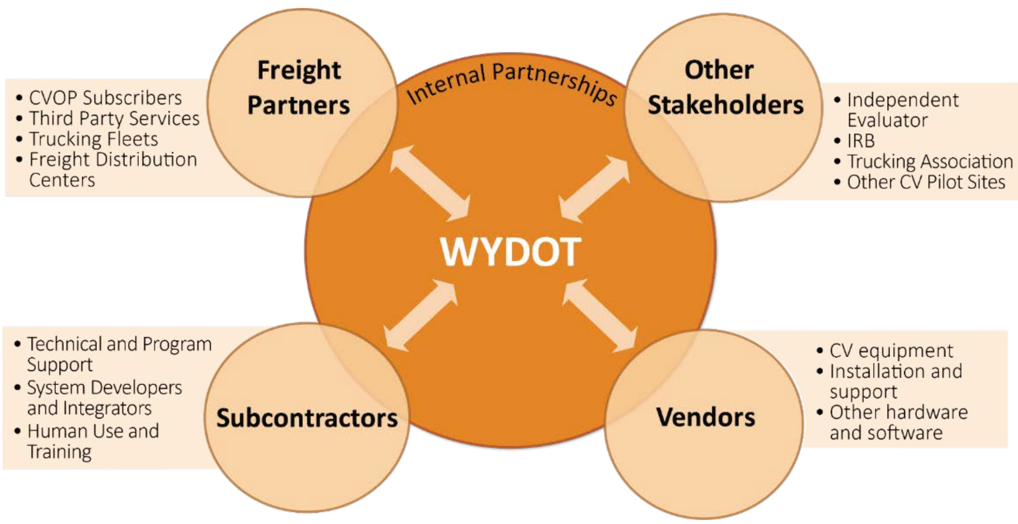


Figure 12-1. Public and private participants in the WYDOT CV Pilot requiring close coordination and cooperation.

Participating institutions will need to establish new communications interfaces and will share data and make decisions based on their and other data. Doing so will require written agreements or MoUs (or both) between parties. Four types of partnership agreements are envisioned as part of the pilot:

- Intra-agency agreements that define various roles and responsibilities for WYDOT departments.
- Memorandums of Understanding (MoUs) with freight partners who will participate in the pilot
- Contractual agreements to support the program development, systems integration and training needs.
- Vendor Purchase Agreements that will be initiated to procure equipment for the CV Pilot.

Figure 12-2 identifies the agreements required between each institution participating in the WYDOT CV Pilot. Responsibility for advancing these agreements will be assigned to appropriate project staff, and the status will be regularly updated for all participants and the USDOT.

In addition to interagency agreements, each involved institution will need to allocate the financial, staff, vehicle, maintenance, and other resources necessary to ensure the successful deployment and maintenance of the system. Participating institutions will be expected to allocate the necessary budgets, and staff time for training, operations, and maintenance for the deployment. This effort could require allocating time of existing staff, or, in some cases, dedicating staff to this deployment. Examples of other required resources include vehicles, IT equipment, ITS equipment, and network communication bandwidth and associated budgets.

Table 12-1 provides the Institutional, Staff, and Financial section of the Operational Readiness Checklist. For each participating institution, the WYDOT Team will track:

- Work Agreements/ MOUs Signed
- Equipment Resources Assigned (e.g. vehicles, servers, communication bandwidth)
- Staff Resources Assigned
- Budgets Allocated & Approved

The table identifies the agreement type for each organization. The list of Freight Partners is current as of the date of this document, but is expected to evolve throughout Phase 2 as freight participants in Phase 3 continue to be recruited.

Equipment, staff, and budget resource supports will depend upon the participant. Key equipment resources for freight partners will be the assignment and commitment of specific vehicles which will participate in the Pilot. These are the vehicles which will operate along Wyoming I80 and in which OBUs and HMIs will be installed. WYDOT equipment will include WYDOT snowplows, other road maintenance vehicles, and highway patrol vehicles. Equipment commitment for WYDOT IT divisions will include the commitment of hardware servers necessary to support the TMC components of the CV Pilot System. Further equipment support from WYDOT will include commitment of the communications bandwidth needed for communications backhaul from TMC to RSUs.

Staffing support by participating agencies will include their commitment to recruit and support drivers of all equipped vehicles and to support time necessary for training and responding to surveys and other Pilot information needs. Staff resources also include providing maintenance staff with the working time required to support installing, operating and maintaining all equipment, ranging from servers and IT equipment, to RSUs deployed on the roadway, to vehicle CV equipment maintenance.

Lastly, budgets must be allocated by organizational managers to support the equipment and staff time necessary for a successful deployment. The Operational Readiness Checklist will track the allocation and management approval of budgets by each organization to support installation, training, operations, and maintenance required for successful Pilot operations.

Further details and specifics of equipment, staff, and budget resources will be tracked by WYDOT leadership team, and will be reported at the summary level to USDOT for clarity and ease of communication.

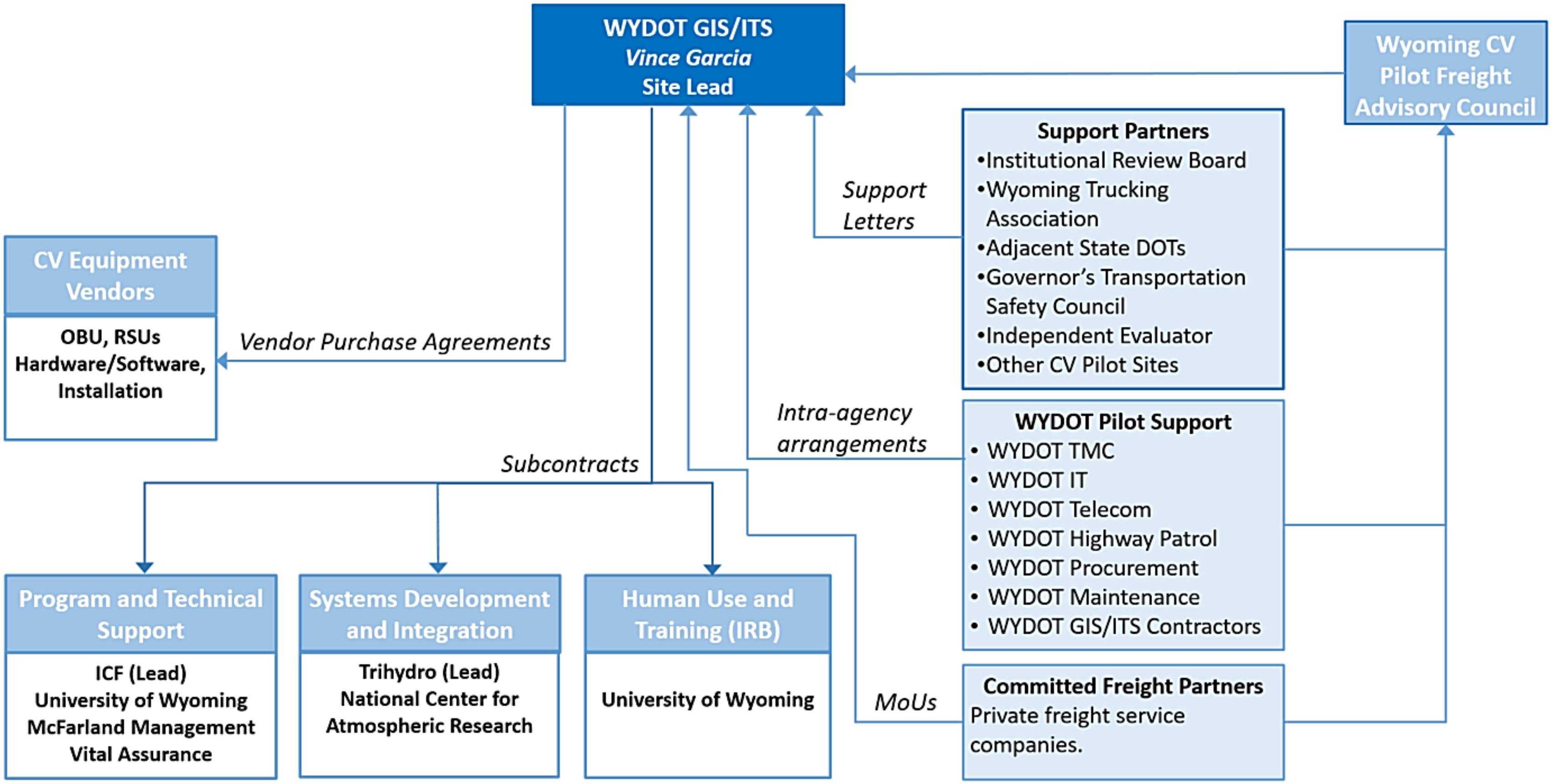


Figure 12-2. WYDOT CV Pilot Partnership Structure

Table 12-1. Institutional, Staffing, and Financial Readiness Schedule and Checklist

RM No.	Readiness Measure	Status (RYG)	Work Agreements / MOUs Completed	Equipment Resources Assigned*	Staff Resources Assigned	Budgets Allocated & Approved	Due Date	Completion Date	Comments
WYDOT Pilot Support - *Intra-agency arrangements*									
9.1.1.1	WYDOT TMC						5/1/2018		
9.1.1.2	WYDOT IT						5/1/2018		
9.1.1.3	WYDOT Telecom						5/1/2018		
9.1.1.4	WYDOT Highway Patrol						5/1/2018		
9.1.1.5	WYDOT Procurement						5/1/2018		
9.1.1.6	WYDOT Maintenance						5/1/2018		
9.1.1.7	WYDOT GIS/ITS Contractors						5/1/2018		
Committed Freight Partners – *MoUs*							**5/1/2018**		
9.1.2.1	Dooley Oil						5/1/2018		
9.1.2.2	North Park Transportation						5/1/2018		
9.1.2.3	Double D Distribution						5/1/2018		
9.1.2.4	*All Others*						5/1/2018		
Subcontracts									
9.1.3.1	ICF						10/30/2016		
9.1.3.2	University of Wyoming						10/30/2016		

9.1.3.3	McFarland Management						10/30/2016		
9.1.3.4	Vital Assurance						10/30/2016		
9.1.3.5	Trihydro						10/30/2016		
9.1.3.6	National Center for Atmospheric Research						10/30/2016		
9.1.3.7	University of Wyoming								
Support Partners - *Support Letters*									
9.1.4.1	Institutional Review Board						Annually and at specific intervals/ milestones		
9.1.4.2	Wyoming Trucking Association						5/1/2018		
9.1.4.4	Governor’s Transportation Safety Council						5/1/2018		

*(vehicles/ Servers/ Comm Bandwidth)

13 Safety, Security and Privacy Readiness

13.1 Safety Readiness

The WYDOT CV Pilot Team developed its Safety Management Plan during Phase 1 of the program. Safety scenarios were developed based on the Pilot Deployment ConOps. The ConOps developed for WYDOT CV Pilot describes the applications to be deployed and operational practices to be followed in Phases 2 and 3. The safety operational concept was developed, contingent on the proposed operational practice in the ConOps.

The WYDOT CV Pilot Team Lead, Vince Garcia was tasked to be Safety Manager for the pilot. As described in the Safety Management Plan, safety management is focused on four areas:

1. Overall Safety Management
2. Safety Management during Testing & Installation Phase (Infrastructure, fleet deployment, installation, testing)
3. Safety Management during Deployment Phase
4. Deployment Closeout

The Safety Manager will leverage existing WYDOT processes to effectively communicate safety anomalies to the responsible persons. Section 4.3 of the Safety Management Plan lists additional safety related risks and mitigations that will be added to the existing risks present for WYDOT. Additional risks associated during development, deployment and operation, are detailed in section 5.4 and 5.5 of the Plan. Additionally, any safety anomalies that occur will use the change management process described in the Configuration Management Plan of the Project Management Plan for issue resolution.

13.1.1 Safety Management Stakeholder Roles and Responsibilities

The principles used by WYDOT to support the prompt response to critical ITS will be employed to support roadside CV systems. This includes proper design of power and communication systems, network monitoring, dedicated support of the roadside devices, a service level-based approach and mutual aid strategy for prompt response to failed systems and the use of well-established support and trouble ticket system. Table 13-1 lists the role and responsibility of each stakeholder.

Table 13-1 – Safety Management Stakeholder Roles and Responsibilities.

Responsible Party	Core Function	Safety Management Role
WYDOT Traffic engineers	Roadside electrical systems design	Ensure reliability and robustness of electrical systems and power supply to roadside elements by mitigating power outages to CV Pilot infrastructure
WYDOT ITS electrical technicians	Roadside electrical systems maintenance	Provide quick response repair capabilities to recover from power outages to CV Pilot System Infrastructure

WYDOT Telecommunications Program	Roadside communication systems design	Ensure reliability and robustness of communication systems to roadside and selected onboard elements
	Roadside communication systems maintenance	Provide quick response repair capabilities to recover from communication failures to CV Pilot System Infrastructure
	WYDOT fleet OBU	Safety management during installation, updates, and maintenance of WYDOT fleet OBU
WYDOT GIS/ITS	Roadside network security and Firewalls	Provide overall safety management for application development and testing
State of Wyoming Enterprise Technology Services	State network security and Firewalls	Provide system security for CV Pilot System
Pilot Contractors	Connected Trucks OBU	Provide equipment installation, updates, and testing per specified safety requirements
	RSU installation	Provide equipment installation, updates, and testing per specified safety requirements
	Application development and testing	Provide application, updates, and testing per specified safety requirements
	System Integration	Monitor and maintain reliability and stability of overall CV pilot system across all applications and physical objects
	Training	Provide training to pilot participants on CV applications per human use approval plan
	Evaluation	Collect data and evaluation-specific information in accordance with human use approval plan
WYDOT Pilot Safety Manager	Overall safety management	Maintain overall safety plan, risk register, conduct periodic safety meetings, conduct after action reviews, and provide corrective action reports. Coordinate with commercial fleet safety managers to have in place a method of communication should and incident occur. Also coordinate with fleet managers to understand safety needs for the fleets and drivers. Has verification responsibilities for commercial fleets and WYDOT fleets to ensure testing and safety management has happened.
WYDOT Highway Patrol	Emergency response	Provide emergency response and field support services for CV pilot participants in accordance to their existing operational responsibilities

13.1.2 Safety Management Schedule and Checklist

Table 13-2 outlines the safety readiness schedule and checklist. Safety Readiness will be tracked and reported for four safety critical phases of the effort:

- Testing
- Installation
- Deployment Operations
- Deployment Closeout and Transition to WYDOT Operations

Three safety activities will be tracked and reported for each phase:

- Safety Plans & Procedures Completed
- Safety Training Completed

- Safety Inspection & Issues Monitoring, Troubleshooting, & Remediation (Ongoing)

Safety plans and procedures will be incorporated with each test plan and test case, as well as every installation plan and installation instructions. Safety training will be incorporated into each training module described in Table 11-1. The project safety manager will be responsible for conducting scheduled and unscheduled safety inspections and monitoring activities throughout the remainder of the project. When safety issues are identified, the safety manager will facilitate efforts to troubleshoot causes and remediation.

Table 13-2. Safety Readiness Schedule and Checklist

RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
10.1.1	**Safety Management during Testing**					
10.1.1.1	Safety Plans & Procedures Completed			10/1/2017		
10.1.1.2	Safety Training Completed			10/1/2017		
10.1.1.3	Safety Inspection & Issues Monitoring, Troubleshooting, & Resolution (Ongoing)			10/1/2017		
10.1.2	**Safety Management during Installation (Infrastructure and Fleets)**					
10.1.2.1	Safety Plans & Procedures Completed			10/1/2018		
10.1.2.2	Safety Training Completed			10/1/2018		
10.1.2.3	Safety Inspection & Issues Monitoring, Troubleshooting, & Resolution (Ongoing)			10/1/2018		
10.1.3	**Safety Management during Deployment**					
10.1.3.1	Safety Plans & Procedures			10/1/2018		
10.1.3.2	Safety Training			10/1/2018		
10.1.3.3	Safety Inspection & Issues Monitoring, Troubleshooting, & Resolution (Ongoing)			10/1/2018		
10.1.4	**Deployment Closeout**					
10.1.4.1	Safety Plans & Procedures			10/1/2018		
10.1.4.2	Safety Training			10/1/2018		
10.1.4.3	Safety Inspection & Issues Monitoring, Troubleshooting, & Resolution (Ongoing)			10/1/2018		

13.2 Security Readiness

The WYDOT CV Pilot Team developed a detailed Security Management Operating Concept (SMOC) during Phase 1 of the program. The SMOC describes, at a high level, the elements to be implemented to meet system security and address how this pilot will use the Security Credential Management System (SCMS) for proposed applications.

13.2.1 Security Overview

provides an overview of the communication security between physical objects from CVRIA and SET-IT Tool. Figure 13-2 details the legend for CVRIA and SET-IT diagrams. The color of each data flow indicates whether it is

- Black - clear text, no authentication
- Blue – encrypted, no authentication
- Green – Clear text, authenticated
- Red – encrypted, authenticated

Each interface is also illustrated graphically in the Section 4.6 Communications Profile Architecture View of the WYDOT CV Pilot System Architecture Document. The Security Plane shown for each interface identifies standards that specify policies and system-to-system authentication, and encryption of data across one or more layers of the communications stack.

In summary, the data in motion is protected by SCMS signing for all DSRC communications and encryption for non-broadcast communications. The data that connects third parties to the WYDOT data center will be done over encrypted Secured Socket Layer (SSL) tunnels. This will be for access to the Commercial Vehicle Operator Portal (CVOP), REST service end points and other web sites that need protection (not for general public access). For back haul connections from RSU's and traditional ITS equipment, data will be protected with Internet Protocol Security (IPSEC) Virtual Private Networks (VPN) or private networks.

13.2.2 Security Readiness Schedule and Checklist

Table 13-3 provides the Security Readiness Schedule and Checklist. As shown here, security will be tracked and reported through verification of security and SCMS requirements by inspection and by security compliance inspection of each component and each interface (data encryption, transport encryption, signature validation, etc.).

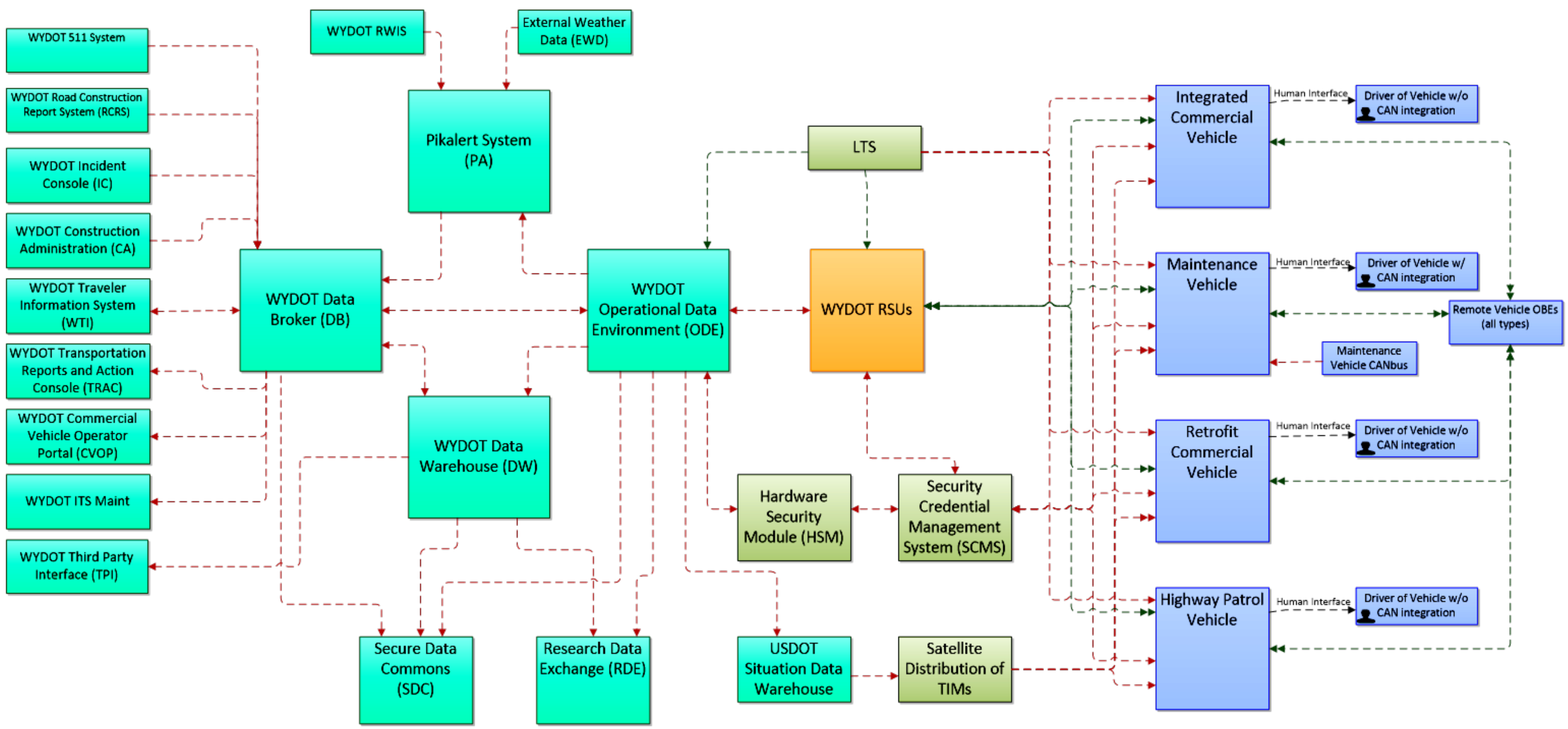


Figure 13-1. Communication Security Diagram for the CV Pilot (Source: WYDOT)

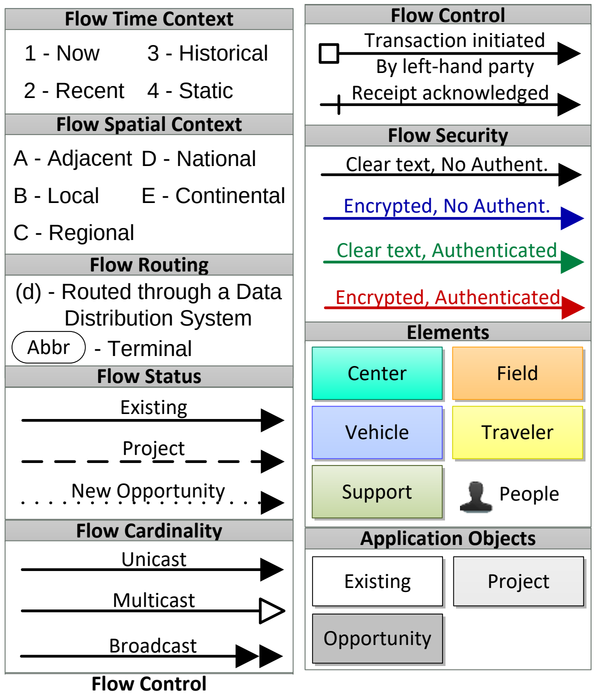


Figure 13-2. Legend for SET-IT and CVRIA Diagrams. (Source: WYDOT)

Table 13-3. Security Readiness Schedule and Checklist

RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
10.2.1	**Security and SCMS Requirements Verification Inspection**					
10.2.1.1	*SCMS-REQ-1 Wyoming CV System (WCVS) SCMS Use*			5/1/2018		
10.2.1.2	*SCMS-REQ-1.1 SCMS Wyoming CV System Certificates*			5/1/2018		
10.2.1.3	~~*SCMS-REQ-1.2 SCMS Wyoming CV System Misbehavior Reporting*~~					*Not part of the Pilot*
10.2.1.4	*SCMS-REQ-1.3 SCMS Wyoming CV System Certificates Revocation List (CRL)*			9/15/2018		
10.2.1.5	*SCMS-REQ-1.4 SCMS Wyoming CV System Rejection*			9/15/2018		
10.2.1.6	*SCMS-REQ-2 Vehicle System SCMS Use*			5/1/2018		
10.2.1.7	*SCMS-REQ-2.1 SCMS Vehicle System Certificates*			5/1/2018		
10.2.1.8	~~*SCMS-REQ-2.2 SCMS Vehicle System Misbehavior Reporting*~~					*Not part of the Pilot*
10.2.1.9	*SCMS-REQ-2.3 SCMS Vehicle System Certificates Revocation List (CRL)*			9/15/2018		
10.2.1.10	*SCMS-REQ-2.4 SCMS Vehicle System Rejection*			9/15/2018		
10.2.1.11	*VS-REQ-43 VSM SCMS*			5/1/2018		
10.2.1.12	*VS-REQ-44 VSM SCMS Encryption*			5/1/2018		
10.2.1.13	*VS-REQ-45 VSM SCMS Sign*			5/1/2018		
10.2.1.14	*VS-REQ-46 VSM SCMS Encryption*			5/1/2018		
10.2.1.15	*VS-REQ-47 VSM SCMS Sign-Log*			9/15/2018		
10.2.1.16	*RSU-REQ-3 SCMS*			5/1/2018		
10.2.1.17	*ODE-REQ-4 SCMS*			5/1/2018		
10.2.1.18	*CSC-REQ-1 OBU SCMS Use*			5/1/2018		

RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
10.2.1.19	*CSC-REQ-2 OBU Certification*			5/1/2018		
10.2.1.20	*CSC-REQ-3 RSU SCMS Use*			5/1/2018		
10.2.1.21	*CSC-REQ-4 RSU Certification*			5/1/2018		
10.2.1.22	*HSM-REQ-1 Receive from ODE*			9/1/2018		
10.2.1.23	*HSM-REQ-2 Share with ODE*			9/1/2018		
10.2.1.24	*HSM-REQ-3 Receive from SCMS*			9/1/2018		
10.2.1.25	*HSM-REQ-4 Share with SCMS*			9/1/2018		
10.2.2	**Wyoming CV System Component Compliance Inspection**					
10.2.2.1	WYDOT ODE			3/1/2018		
10.2.2.2	WYDOT Pikalert			3/1/2018		
10.2.2.3	WYDOT Data Broker			3/1/2018		
10.2.2.4	WYDOT Data Warehouse			3/1/2018		
10.2.2.5	RSU Component			3/1/2018		
10.2.3	**Wyoming CV System Internal *Interface Compliance* Inspection**					
10.2.3.1	WI-1-PA to DB			3/1/2018		
10.2.3.2	WI2-DB - ODE			3/1/2018		
10.2.3.3	WI3-DB - DW			3/1/2018		
10.2.3.4	WI5-ODE to DW			3/1/2018		
10.2.3.5	WI6-ODE to PA			3/1/2018		
10.2.3.6	WI7-ODE - RSUs			3/1/2018		
10.2.3.7	WI8-ODE - HSM			9/1/2018		
10.2.4	**Vehicle System Component *Compliance* Inspection**					
10.2.4.1	OBU DSRC and Satellite (No CAN)			9/15/2018		
10.2.4.2	OBU DSRC and Satellite (Incl. CAN)			9/15/2018		
10.2.4.3	Android Development & HMI			9/15/2018		

RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
10.2.4.4	Environmental Sensors			6/1/2018		
10.2.5	**Vehicle System Internal Interface *Compliance* Inspection**					
10.2.5.1	VI1-OBU to HMI			9/15/2018		
10.2.5.2	VI3-OBU to Environmental Sensors			9/15/2018		
10.2.5.3	VI2-OBU to CAN Interface					*Not part of Pilot.*
10.2.6	**Vehicle System Integration *Compliance* Inspection**					
10.2.6.1	Retrofit Commercial Vehicle (DSRC, Satellite)			9/15/2018		
10.2.6.2	Integrated Commercial Vehicle (DSRC, Satellite)			9/15/2018		
10.2.6.3	Highway Patrol Vehicle (DSRC, Satellite)			9/15/2018		
10.2.6.4	WYDOT Maintenance Vehicle (DSRC, Satellite, Environmental Sensor)			9/15/2018		
10.2.7	***CV Pilot External Interface Compliance*** Inspection					
10.2.7.1	VE1/WE1-RSU to OBU			9/15/2018		
10.2.7.2	VE2-SSP to OBU			9/15/2018		
10.2.7.3	VE3-OBU to OBU			6/1/2018		
10.2.7.4	VE4-LTS to OBU			6/1/2018		
10.2.7.5	WE2-LTS to RSU			6/1/2018		
10.2.7.6	WE3-LTS to ODE			6/1/2018		
10.2.7.7	WE4-RWIS to Pikalert			3/1/2018		
10.2.7.8	WE4-NWS to Pikalert			3/1/2018		
10.2.7.9	WE5-511 App to DB			3/1/2018		
10.2.7.10	WE6-RCRS to DB			3/1/2018		
10.2.7.11	WE7-IC to DB			3/1/2018		
10.2.7.12	WE8-CA to DB			3/1/2018		
10.2.7.13	WE9-WTI to DB			3/1/2018		
10.2.7.14	WE10-DB to TPI			3/1/2018		

RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
10.2.7.15	WE11-DB to TRAC			3/1/2018		
10.2.7.16	WE12-DB to CVOP			3/1/2018		
10.2.7.17	WE13-DB to ITS Maint.			3/1/2018		
10.2.7.18	WE14-DW to SDC			3/1/2018		
10.2.7.19	WE15-ODE to SDW			3/1/2018		
10.2.7.20	WE16-ODE to SCMS			6/1/2018		
10.2.7.21	WE17-SCMS to RSU			9/15/2018		
10.2.7.22	WE18-ODE to SDC			3/1/2018		
10.2.7.23	WE19-ODE to RDE			3/1/2018		
10.2.7.24	WE20-DW to RDE			3/1/2018		
10.2.7.25	WE21-DB to SDC			3/1/2018		
10.2.8	**Applications Component Compliance Inspection**					
10.2.8.1	OBU Spot Weather Impact Warning			6/1/2018		
10.2.8.2	OBU Work Zone Warning			6/1/2018		
10.2.8.3	OBU I2V Situational Awareness			6/1/2018		
10.2.8.4	OBU Distress Notification Application			6/1/2018		
10.2.8.5	OBU Forward Collision Warning			6/1/2018		
10.2.8.6	OBU Vehicle Support Services			6/1/2018		
10.2.8.7	OBU Vehicle Trust Management			6/1/2018		
10.2.8.8	RSU Roadway Traffic Information Dissemination			6/1/2018		
10.2.8.9	RSU Basic Safety Monitoring			6/1/2018		
10.2.8.10	RSU Support Services			6/1/2018		
10.2.8.11	RSU Trust Management			6/1/2018		
10.2.8.12	Operational Data Environment			3/1/2018		
10.2.8.13	Pikalert			3/1/2018		
10.2.8.14	TMC Data Brokerage			7/1/2018		

RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
10.2.8.15	WYDOT Third Party Interface			3/1/2018		
10.2.8.16	Service Monitor Device Management			8/1/2018		
10.2.8.17	CVOP Website Updates			3/1/2018		
10.2.8.18	WYDOT Transportation Reports and Action Console			3/1/2018		
10.2.8.19	WYDOT Wyoming Traveler Information			3/1/2018		
10.2.8.20	WYDOT Construction Administration			8/1/2018		
10.2.8.21	WYOROAD.INFO Website			3/1/2018		
10.2.8.22	OBU/RSU Management Application			6/1/2018		
10.2.8.23	Participant Tracking Application			3/1/2018		
10.2.8.24	WYDOT 511 App			3/1/2018		
10.2.8.25	Vehicle Messaging Display/Interface			3/1/2018		
10.2.8.26	OBU Spot Weather Impact Warning			6/1/2018		
10.2.8.27	OBU Work Zone Warning			6/1/2018		
10.2.8.28	OBU I2V Situational Awareness			6/1/2018		
10.2.8.29	OBU Distress Notification Application			6/1/2018		
10.2.8.30	OBU Forward Collision Warning			6/1/2018		
10.2.8.31	OBU Vehicle Support Services			6/1/2018		
10.2.8.32	OBU Vehicle Trust Management			6/1/2018		
10.2.8.33	RSU Roadway Traffic Information Dissemination			6/1/2018		
10.2.8.34	RSU Basic Safety Monitoring			6/1/2018		
10.2.8.35	RSU Support Services			6/1/2018		
10.2.9	**Applications End-to-end Integration Compliance Inspection**					
10.2.9.1	Pikalert - Spot Weather Impact Warning			5/1/2018		
10.2.9.2	WYDOT Construction Admin - Work Zone Warning			8/1/2018		
10.2.9.3	WYDOT Traveler Information - Posted Speed, VSL, Restrictions, closures			5/1/2018		

RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
10.2.9.4	Incident Console - Incident Information			7/1/2018		
10.2.9.5	Road Condition Reporting System			5/1/2018		
10.2.9.5	WYDOT 511 App - Truck Parking Availability			8/15/2018		

13.3 Privacy Readiness

Privacy management is also described in the WYDOT CV Pilot Security Management Operating Concept (SMOC). This document describes the underlying needs of the WYDOT CV Pilot to protect the privacy of users, ensure secure operations, and outline a concept that addresses these needs. The SMOC determines and documents the extent to which this system will collect and store Personally Identifiable Information (PII) and PII-related information, and ensures that there is a legitimate need for this information in order to meet the goals of the system and that the data is only accessible for and used for these legitimate purposes.

Users' privacy will be managed through the collection of only required data, aggregated where possible to further protect individual privacy. An example of this is to provide a count of CVs that pass an RSU to the Center rather than provide individual vehicle data to the Center to calculate the count. Once data is collected it will be encrypted both over the air for unicast data and on the wire to the Center (using IPSEC VPN technology) to protect privacy. To protect user data over DSRC radio communications the pilot will use the USDOT SCMS POC system to sign communication and provide certificates for encryption.

13.3.1 Privacy Readiness Schedule and Checklist

Table 13-4 provides the Privacy Readiness Schedule and Checklist. As shown here, privacy will be tracked and reported through privacy compliance inspection of pilot Data Collected, Transmitted, and Accessed.

Table 13-4. Privacy Readiness Schedule and Checklist

RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
10.3.1	**Inspection of WYDOT Fleet Data used for pilot activities and performance evaluation - Data Collected**					
10.3.1.1	Vehicle Telematics data from the Controller Area Network (CAN)/OBD II bus and other sensors					may not include with pilot
10.3.1.2	Atmospheric and road condition data from sensors			8/1/2018		
10.3.1.3	Location/Time data from GPS sensors			8/1/2018		
10.3.2	**Inspection of WYDOT Fleet Data used for pilot activities and performance evaluation - Data Communicated**					
10.3.2.1	V2V data will be communicated to vehicles in DSRC range			8/1/2018		
10.3.2.1.1	-- BSM part 1/2 data			8/1/2018		
10.3.2.1.2	-- Emergency Alert of accident, GPS location, time, BSM part 1/2 data			8/1/2018		
10.3.2.2	V2I data communicated with TMC			8/1/2018		
10.3.2.2	-- Limited to road weather, work zone, atmospheric data, VSLs, truck parking, and traffic flow			9/15/2018		
10.3.2.2.1	-- Vehicle telematics data (PII)			8/1/2018		
10.3.2.2.2	-- Vehicle Specific Identifier may be needed for performance evaluation (PII)			8/1/2018		
10.3.2.2.3	-- Emergency Alert of accident, GPS location, time, BSM part 1/2 data			8/1/2018		
10.3.3	**Inspection of Commercial Fleet data used for pilot activities - Data Collected**					
10.3.3.1	-- Vehicle Telematics data from the CAN/OBD II bus and other sensors					may not include with pilot

RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
10.3.3.2	-- Atmospheric and road condition data from sensors					may not include with pilot
10.3.3.3	-- Location/Time data from GPS sensors			8/1/2018		
10.3.4	**Inspection of Commercial Fleet data used for pilot activities - Data Communicated**					
10.3.4.1	V2V data will be communicated to vehicles in DSRC range			10/10/2018		
10.3.4.1.1	-- BSM part 1/2 data			10/10/2018		
10.3.4.1.2	-- Emergency Alert of accident, GPS location, time, BSM part 1/2 data			10/10/2018		
10.3.4.2	V2I data communicated with TMC			10/10/2018		
10.3.4.2.1	-- Limited to road weather, work zone, atmospheric data, VSLs, truck parking, and traffic flow			10/10/2018		
10.3.4.2.2	-- Emergency Alert of accident, GPS location, time, BSM part 1/2 data			10/10/2018		
10.3.4.3	V2I data communicated with private fleet management			10/10/2018		
10.3.4.3.1	-- Road weather, work zone, atmospheric data, VSLs, truck parking, and traffic flow from CVOP			10/10/2018		
10.3.5	**Inspection of PID users data with the pilot activities - Data Communicated**					
10.3.5.1	V2I data communicated with TMC			8/1/2018		
10.3.5.1.1	-- Limited to receiving road weather, work zone, atmospheric data, VSLs, truck parking, and traffic flow			9/15/2018		
10.3.5.1.2	-- Emergency Alert of accident can be sent via text or email, GPS location, time, note			8/1/2018		
10.3.6	**Inspection of Survey Data**					
10.3.7	**Inspection of GPS Trajectories**					
10.3.8	**Inspection of BSM**					
10.3.9	**Inspection of DSRC**					

14 Glossary and Acronyms

Table 14-1. Glossary of Terms.

Term	Definition
Basic Safety Message	Connected V2V safety applications are built around the capability to transmit BSMs, following the Society of Automotive Engineers (SAE) J2735 standard. The BSM is transmitted over DSRC over a range of approximately 300 meters. In general, BSMs are broadcast frequently to provide connected vehicles with data content necessary for the different safety-oriented applications. The BSM is divided into two parts: • Part I, transmitted approximately 10 times per second, contains the core data elements: Message Count, Temporary ID, Time (through a Second Mark), Latitude, Longitude, Elevation, Positional Accuracy, Transmission State, Speed, Heading, Steering Wheel Angle, Acceleration, Brake System Status, and Vehicle Size. • Part II, transmitted less frequently, is added to Part I depending on events (e.g., Anti-lock Braking System (ABS) activated) and contains a variable set of data elements drawn from many optional data elements (availability by vehicle model varies)
Broadcast	Sharing data with no specific destination. All broadcast data is sent unencrypted but is signed with a certificate (based on the Institute of Electrical and Electronics Engineers (IEEE) standard 1609.2).
Data	Data is raw (unorganized and unprocessed) digital messages sent between components. From SAE J2735: Representations of static or dynamic entities in a formalized manner suitable for communication, interpretation, or processing by humans or by machines.
Data Ingest	Obtaining and importing data for use or storage.
Host Vehicle	A connected vehicle that receives messages from a remote vehicle. In this document, the host vehicle is also used to describe the originator of a vehicular transmission of information to an RSU.
Information	Processed data that is organized, structured or presented in a given context to make it useful
Independent Evaluator	USDOT-sponsored evaluators that will focus on measures not covered by the Wyoming team's evaluation, impacts of larger scale CV deployments, and national programmatic aspects of this CV Pilot project, combined with other similar projects being conducted. The IE works to understand how the project outcomes can contribute to the future of the CV Program nationally.
Message	A well-structured set of data elements and data frames that can be sent as a unit between devices to convey some semantic meaning in the context of the applications (adapted from SAE J2735).
On-Board Unit	This represents the package of DSRC radios, computing, sensors and HMI that will be installed on a vehicle. This is similar to the Retrofit Safety Device used in the Safety Pilot Program.

Term	Definition
Receive Data	A connected device accepts a data package broadcast or transmitted by another connected device.
Remote Vehicle	A connected vehicle that periodically and dynamically broadcasts a message about its general situation to a host vehicle.
Requirements	Set of information necessary to accomplish one action.
Roadside Units	This represents the package of DSRC radios, computing, communications that will be installed on the roadside on I-80
WYDOT Road Segment	A road segment is defined as a link in Traffic Management Data Dictionary (TMDD) v3.03c: a roadway or transit right-of-way between two nodes. WYDOT has implemented road segments to fully cover I-80 in both directions.
Transmit	Sharing data directed to a specific receiver. In the case of transmission between Systems, all transmitted data is signed and encrypted, where required, based on SAE J2945/1.
Transportation Management Center	Center that collects information and informs the public about changing travel conditions.
WGS-84	Latest revision of the standard for use in cartography, geodesy, and navigation including by global positioning systems (GPS).

Table 14-2. Acronym List.

Acronym/ Abbreviation	Definition
ABS	Anti-lock Braking System
BSM	Basic Safety Message
DB	Data Broker
DW	Data Warehouse
CA	Construction Administration
CAN bus	Controller Area Network bus
ConOps	Concept of Operations
CRL	Certificates Revocation List
CV	Connected Vehicle
CVOP	Commercial Vehicle Operator Portal
CVRIA	Connected Vehicle Reference Implementation Architecture
DMS	Dynamic Message Signs
DN	Distress Notification
DOT	Department of Transportation
DSRC	Dedicated Short Range Communications
E2E	End-to-end
ESS	Environmental Sensor Station
FCW	Forward Collision Warning
FHWA	Federal Highway Administration
GIS	Geographic Information System
GPS	Global Positioning System
HMI	Human-Machine Interface
I2V	Infrastructure-to-vehicle
I-80	Interstate 80
IC	Incident Console

Acronym/ Abbreviation	Definition
ICD	Interface Control Document
IE	Independent Evaluator
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IRB	Institutional Review Board
ISO	International Organization for Standardization
ITIS	Integrated Transport Information System
ITS	Intelligent Transportation System
LTS	Location and Time Service
MAP	Mapping for Intersection
MoU	Memorandum of Understanding
NCAR	National Center for Atmospheric Research
NWS	National Weather Service
OBU	On-Board Unit
ODE	Operational Data Environment
OSADP	Open Source Application Development Portal
RCRS	Road Condition Reporting System
RSU	Roadside Units
RWH	Road Weather Hazard
RWIS	Road Weather Information System
SAE	Society of Automotive Engineers
SCMS	Security Credential Management System
SDW	Situation Data Warehouse
SET-IT	Systems Engineering Tool for Intelligent Transportation
SPaT	Signal Phase and Timing
SSP	Satellite Service Provider
SWIW	Spot Weather Impact Warning
SyRS	System Requirements Specification
TIM	Traveler Information Message
TMC	Transportation Management Center
TMDD	Traffic Management Data Dictionary
TPI	Third-Party Interface
TRAC	Transportation Reports and Action Console
UoW	University of Wyoming
V2I	Vehicle-to-infrastructure
V2V	Vehicle-to-vehicle
VSL	Variable Speed Limit
WHP	Wyoming Highway Patrol
WYDOT	Wyoming Department of Transportation
WTI	Wyoming Traveler Information system
WZW	Work Zone Warning

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Ch No.	RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
4	1	End-to-end System Development and Integration					
5	2	End-to-end System Operational Readiness Testing					
6	3	Acquisition, Installation and Production Deployment Readiness					
7	4	Operational Readiness Demonstration					
8	5	Performance Measurement and Evaluation Support Readiness					
9	6	Planning and Design Readiness					
10	7	Operations and Maintenance Procedures Readiness					
11	8	Training and IRB Readiness					
12	9	Institutional, Staff, and Financial Readiness					
13	10	Safety, Security, and Privacy Policy Readiness					

RM No.	Readiness Measure	Status (RYG)	% Complete	Due Date	Completion Date	Comments
1.1	Wyoming CV System Component Development					
1.1.1	WYDOT ODE			3/1/2018		
1.1.2	WYDOT Pikalert			1/1/2018		
1.1.3	WYDOT Data Broker			3/1/2018		
1.1.4	WYDOT Data Warehouse			3/1/2018		
1.1.5	RSU			10/1/2018		
1.2	Wyoming CV System Internal ***Interface Integration***					
1.2.1	WI1-PA to DB			12/20/2017		
1.2.2	WI2-DB - ODE			12/20/2017		
1.2.3	WI3-DB - DW			12/1/2017		
1.2.4	WI5-ODE to DW			12/1/2017		
1.2.5	WI6-ODE to PA			12/1/2017		
1.2.6	WI7-ODE to RSUs			3/1/2018		
1.2.7	WI8-ODE - HSM			5/1/2018		
1.3	Vehicle System Component Development					
1.3.1	OBU DSRC and Satellite (No CAN)			12/1/2017		
1.3.2	OBU DSRC and Satellite (Incl. CAN)			3/1/2018		
1.3.3	Android Development & HMI			3/1/2018		
1.3.4	Environmental Sensors			12/1/2017		
1.4	Vehicle System Internal Interface Integration					
1.4.1	VI1-OBU to HMI			3/1/2018		
1.4.2	VI2-OBU to CAN Interface					Not part of the pilot
1.4.3	VI3-OBU to Environmental Sensors			10/1/2017		
1.5	Vehicle System Integration					
1.5.1	Retrofit Commercial Vehicle (DSRC, Satellite)			3/1/2018		
1.5.2	Integrated Commercial Vehicle (DSRC, Satellite)			3/1/2018		
1.5.3	Highway Patrol Vehicle (DSRC, Satellite)			1/1/2018		
1.5.4	WYDOT Maintenance Vehicle (DSRC, Satellite, Environmental Sensor)			1/1/2018		
1.6	***CV Pilot External Interface Integration***					
1.6.1	VE1/WE1-RSU - OBU			10/1/2017		
1.6.2	VE2-SSP to OBU			10/1/2017		
1.6.3	VE3-OBU to OBU			10/1/2017		
1.6.4	VE4-LTS to OBU			10/1/2017		
1.6.5	WE2-LTS to RSU			10/1/2017		
1.6.6	WE3-LTS to ODE			10/1/2017		
1.6.7	WE4-RWIS to Pikalert			9/1/2017		
1.6.8	WE4-EWD to Pikalert			9/1/2017		
1.6.9	WE5-511 App to DB			11/16/2017		
1.6.10	WE6-RCRS to DB			3/1/2017		
1.6.11	WE7-IC to DB			9/1/2017		
1.6.12	WE8-CA to DB			1/1/2018		
1.6.13	WE9-WTI - DB			12/1/2017		
1.6.14	WE10-DW to TPI			5/1/2017		
1.6.15	WE11-DB to TRAC			4/1/2017		
1.6.16	WE12-DB to CVOP			9/20/2017		
1.6.17	WE13-DB to ITS Maint.			12/1/2017		
1.6.18	WE14-DW to SDC			9/1/2017		
1.6.19	WE15-ODE to SDW			6/1/2017		
1.6.20	WE16-HSM - SCMS			4/1/2018		
1.6.21	WE17-SCMS to RSU			3/1/2018		
1.6.22	WE18-ODE to SDC			3/1/2018		
1.6.23	WE19-ODE to RDE			3/1/2018		
1.6.24	WE20-DW to RDE			3/1/2018		
1.6.25	WE21-DB to SDC			3/1/2018		
1.7	Applications Component Development					
1.7.1	OBU Spot Weather Impact Warning			10/1/2017		
1.7.2	OBU Work Zone Warning			10/1/2017		
1.7.3	OBU I2V Situational Awareness			10/1/2017		
1.7.4	OBU Distress Notification Application			10/1/2017		
1.7.5	OBU Forward Collision Warning			10/1/2017		
1.7.6	OBU Vehicle Support Services			3/1/2018		
1.7.7	OBU Vehicle Trust Management			3/1/2018		
1.7.8	RSU Roadway Traffic Information Dissemination			10/1/2017		
1.7.9	RSU Distress Notification Application			10/1/2017		
1.7.10	RSU Basic Safety Monitoring			10/1/2017		
1.7.11	RSU Support Services			3/1/2018		
1.7.12	RSU Trust Management			3/1/2018		
1.7.13	Operational Data Environment			3/1/2018		
1.7.14	Pikalert			3/1/2018		
1.7.15	TMC Data Brokerage			4/1/2018		
1.7.16	WYDOT Third Party Interface			5/1/2017		
1.7.17	Service Monitor Device Management			9/20/2017		
1.7.18	CVOP Website Updates			11/1/2017		
1.7.19	WYDOT Transportation Reports and Action Console			7/1/2017		
1.7.20	WYDOT Wyoming Traveler Information			7/1/2017		
1.7.21	WYDOT Construction Administration			3/1/2018		
1.7.22	WYOROAD.INFO Website			1/1/2017		
1.7.23	OBU/RSU Management Application			11/1/2017		
1.7.24	Participant Tracking Application			4/1/2017		
1.7.25	WYDOT 511 App			10/1/2017		
1.7.26	Vehicle Messaging Display/Interface			11/20/2017		
1.8	End-to-end Applications Integration					
1.8.1	Pikalert - Spot Weather Impact Warning			12/1/2017		
1.8.2	WYDOT Construction Admin - Work Zone Warning			5/1/2018		
1.8.3	WYDOT Traveler Information - Posted Speed, VSL, Restrictions, closures			2/1/2018		
1.8.4	Incident Console - Incident Information			4/1/2018		
1.8.5	Road Condition Reporting System			10/1/2017		
1.8.6	WYDOT 511 App - Truck Parking Availability			6/1/2018		

RM No.	Test Case No.	Test Case Title	Status (RYG)	% complete	Due Date	Completion Date	Comments
	V2V Message Communications Test Procedure and Test Cases						
2.1	WV2VMCT-1	V2V exchange of BSMs			8/30/2018		
2.2	WV2VMCT-2	V2V exchange of DN TIMs			7/15/2018		
	V2I Message Communications Test Procedure and Test Cases						
2.3	WV2IMCT-1	V2I and End-to-end communication of DN TIMs			6/30/2018		
2.4	WV2IMCT-2	V2I & End-to-end Communication of BSMs			5/30/2018		
2.5	WV2IMCT-3	V2I & End-to-end communication of Environmental Sensor Data			8/30/2018		
2.6	WV2IMCT-4	V2I & End-to-end communication of log files			5/30/2018		
	I2V Message Communications Test Procedure and Test Cases						
2.7	WI2VMCT-1	End-to-end & DSRC Delivery of I2V SA TIMs			8/30/2018		
2.8	WI2VMCT-2	End-to-end & Satellite Delivery of I2V SA TIMs			7/30/2018		
2.9	WI2VMCT-3	End-to-end & DSRC Delivery of I2V SA TIMs			8/30/2018		
	Forward Collision Warning Test Procedure and Test Cases						
2.10	WFCWT-1	FCW Stopped Vehicle Ahead			5/30/2018		
2.11	WFCWT-2	FCW Passing Stopped Vehicle			5/30/2018		
2.12	WFCWT-3	FCW Steady State			5/30/2018		
2.13	WFCWT-4	FCW Braking Vehicle Ahead			5/30/2018		
2.14	WFCWT-5	FCW Stopped Vehicle in a Curve			5/30/2018		
2.15	WFCWT-6	FCW Passing Stopped Vehicle in a Curve			5/30/2018		
2.16	WFCWT-7	FCW Obstructed Vehicle Ahead			8/30/2018		
2.17	WFCWT-8	FCW Slow Moving Vehicle			5/30/2018		
2.18	WFCWT-9	Simultaneous Message Prioritization			8/30/2018		
	I2V Situational Awareness Test Procedure and Test Cases						
2.19	WI2VSAT-1-REP	Message Display in Travel Lanes			5/30/2018		
2.20	WI2VSAT-1-Pikalert	Message Display in Travel Lanes - Pikalert			5/30/2018		
2.21	WI2VSAT-1-511	Message Display in Travel Lanes - 511			9/30/2018		
2.22	WI2VSAT-1-RCRS	Message Display in Travel Lanes - RCRS			9/30/2018		
2.23	WI2VSAT-1-IC	Message Display in Travel Lanes - IC			7/30/2018		
2.24	WI2VSAT-1-CA	Message Display in Travel Lanes - CA			9/30/2018		
2.25	WI2VSAT-1-WTI-Speed	Message Display in Travel Lanes - WTI Speed			9/30/2018		
2.26	WI2VSAT-1-WTI-Restriction	Message Display in Travel Lanes - WTI - Restriction			9/30/2018		
2.27	WI2VSAT-1-WTI-DMS	Message Display in Travel Lanes - DMS					No longer part of the CVP
2.28	WI2VSAT-1-WTI-Closure	Message Display in Travel Lanes - Closures			9/30/2018		
2.29	WI2VSAT-2	Message Display in Shoulder Lanes			8/30/2018		
2.30	WI2VSAT-3	Message Display on Adjacent Service Road			8/30/2018		
2.31	WI2VSAT-4	I2V SA - Message Display Perpendicular to Travel Lanes			7/30/2018		
2.32	WI2VSAT-5	Message Display in Travel Lanes sent via Satellite			7/30/2018		
2.33	WI2VSAT-6	Message Display in Opposing Travel Lanes			7/30/2018		
2.34	WI2VSAT-7	Simultaneous DSRC and Satellite I2V SA TIMs communications			9/30/2018		
2.35	WI2VSAT-8	Message Display Start Time			9/30/2018		
2.36	WI2VSAT-9	Message Display Stop Time			7/30/2018		
	Distress Notification Test Procedure and Test Cases						
2.37	WDNR-1	Same direction Distress Notification relay to RSU			6/30/2018		
2.38	WDNR-2	Opposite direction Distress Notification relay to RSU and Following			6/30/2018		
	On-road Shakedown Test Procedure and Test Cases						
2.39	WSHKR-1	OBU Shakedown			9/30/2018		
2.40	WSHKR-2	RSU and Backhaul Communications Shakedown			9/30/2018		
2.41	WSHKR-3	I-80 Satellite TIM coverage			9/30/2018		
2.42	WSHKR-4	Verify I80 geofence map			9/30/2018		
	Installation Robustness and Quality Control Test Procedure and Test Cases						
2.43	WINSTQ-1	OBU Installation Robustness			10/30/2018		
2.44	WINSTQ-2	RSU Installation Robustness			10/30/2018		
2.45	WINSTQ-3	OBU Installation Quality Control Test Cases			10/30/2018		
2.46	WINSTQ-4	RSU Installation Quality Control Test Cases			10/30/2018		
Pilot System Availability and Administration Test Procedure and Test Cases							
2.47	WSYSAA-1	WYDOT CV Pilot System Unavailable Notification			10/30/2018		
2.48	WSYSAA-2	System Administration Demonstration Test Case			10/30/2018		
External Systems Support Test Procedure and Test Cases							
2.49	WEXTSS-511	Truck Parking Information Entry and Delivery			8/30/2018		
2.50	WEXTSS-CAM	Pikalert Camera Imagery			8/30/2018		
2.51	WEXTSS-SCMSCRL	WYDOT CV System Misbehavior and CRL support (*Note Misbehavior Report and CRL not currently supported by SCMS)					No longer part of the CVP
2.52	WEXTSS-OTA	OBU over the air updates			10/30/2018		
2.53	WEXTSS-RSUFIRM	RSU Firmware update			8/30/2018		
Pilot Components Documentation Test Procedure and Test Cases							
2.54	WOBUDOC-1	Inspection of OBU Certification and Test Documents			9/30/2018		
2.55	WOBUDOC-2	Inspection of Environmental Sensor Certification and Test Docume			9/30/2018		
2.56	WRSUDOC-1	Inspection of RSU Certification and Test Documents			9/30/2018		
2.57	WODEDOC-1	Inspection of ODE Design and Test Documents			9/30/2018		
2.58	WDWDOC-1	Inspection of DW Design and Test Documents			9/30/2018		

RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
3.1	Management Center Equipment (Server, Storage Array, and Switch) Acquisition, Installation & Deployment					
3.1.1	MCE Purchase Specifications Completed			4/20/2018		
3.1.2	MCE Units Purchased, Delivered, and Accepted			6/1/2018		
3.1.3	MCE Units Installation, Integration, Acceptance Test, & Production Deployment Completed			7/1/2018		
3.2	RSU System Purchase, Installation & Deployment					
3.2.1	RSU Subsystem Purchase & Acceptance Testing			8/10/2018		
3.2.1.1	Purchase Specifications Completed			12/1/2016		
3.2.1.2	First RSU Subsystem Purchased			12/1/2016		
3.2.1.3	First RSU Subsystem Acceptance Test Completed			8/10/2018		
3.2.1.4	Remaining RSU Subsystems Purchased, Delivered & Accepted			8/15/2018		
3.2.2	RSU Subsystem Installation & Deployment			8/15/2018		
3.2.2.1	Subsystem Installation, Integration, Acceptance Test, & Production Deployment Procedures Completed			8/15/2018		
3.2.2.2	First Subsystem Field Installation, Integration, Acceptance Test, & Production Deployment Completed			8/15/2018		
3.2.2.3	Remaining Subsystems Installation, Integration, Acceptance Testing, and Production Deployment Completed			8/30/2018		
3.3	Vehicle Subsystem Purchase, Installation & Deployment					
3.3.1	**Vehicle Subsystem Purchase & Acceptance Testing**					
3.3.1.1	*Lear Roadstar (Integrated Commercial Vehicle, Highway Patrol & WYDOT Maintenance Vehicle)*			9/31/2018		
3.3.1.1.1	- Purchase Specifications Completed			12/1/2016		
3.3.1.1.2	- First Vehicle Subsystem Purchased			12/1/2016		
3.3.1.1.3	- First Vehicle Subsystem Acceptance Test Completed			7/1/2018		
3.3.1.1.4	- Remaining Vehicle Subsystems Purchased, Delivered & Accepted			8/30/2018		
3.3.1.2	*SiriusXM (Retrofit Commercial Vehicle)*			9/31/2018		
3.3.1.2.1	- Purchase Specifications Completed			7/31/2017		
3.3.1.2.2	- First Vehicle Subsystem Purchased			7/15/2018		
3.3.1.2.3	- First Vehicle Subsystem Acceptance Test Completed			7/30/2018		
3.3.1.2.4	- Remaining Vehicle Subsystems Purchased, Delivered & Accepted			9/15/2018		
3.3.2	**Vehicle Subsystem Installation & Deployment**			**9/30/2018**		
3.3.2.1	*Retrofit Commercial Vehicle (SiriusXM)*			9/30/2018		
3.3.2.1.1	- Subsystem Installation, Integration, Acceptance Test, & Production Deployment Procedures Completed			8/1/2018		
3.3.2.1.2	- First Subsystem Field Installation, Integration, Acceptance Test, & Production Deployment Completed			8/15/2018		
3.3.2.1.3	- Remaining Subsystems Installation, Integration, Acceptance Testing, and Production Deployment Completed			9/30/2018		
3.3.2.2	*Integrated Commercial Vehicle (Lear Roadstar)*			9/30/2018		
3.3.2.2.1	- Subsystem Installation, Integration, Acceptance Test, & Production Deployment Procedures Completed			8/6/2018		
3.3.2.2.2	- First Subsystem Field Installation, Integration, Acceptance Test, & Production Deployment Completed			8/15/2018		
3.3.2.2.3	- Remaining Subsystems Installation, Integration, Acceptance Testing, and Production Deployment Completed			9/30/2018		
3.3.2.3	*Highway Patrol Vehicle (Lear full sized OBU)*			9/30/2018		
3.3.2.3.1	- Subsystem Installation, Integration, Acceptance Test, & Production Deployment Procedures Completed			9/10/2018		
3.3.2.3.2	- First Subsystem Field Installation, Integration, Acceptance Test, & Production Deployment Completed			9/15/2018		
3.3.2.3.3	- Remaining Subsystems Installation, Integration, Acceptance Testing, and Production Deployment Completed			9/30/2018		
3.3.2.4	*WYDOT Maintenance Vehicle (Lear Roadstar)*			9/30/2018		
3.3.2.4.1	- Subsystem Installation, Integration, Acceptance Test, & Production Deployment Procedures Completed			9/1/2018		
3.3.2.4.2	- First Subsystem Field Installation, Integration, Acceptance Test, & Production Deployment Completed			9/10/2018		
3.3.2.4.3	- Remaining Subsystems Installation, Integration, Acceptance Testing, and Production Deployment Completed			9/30/2018		

RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
4.1	System Components Readiness			5/1/2018		
4.2	System Functions Readiness			5/1/2018		
4.3	Applications Readiness			2/1/2018		
4.4	Operational Scenarios Readiness			2/1/2018		
4.5	Safety-Focused Readiness Elements			2/1/2018		
4.6	Security-Focused Readiness Elements			5/1/2018		
4.7	Privacy-Focused Readiness Elements			5/1/2018		
4.8	Performance Measurement and Evaluation Support Readiness Elements			5/1/2018		
4.9	Institutional, Staff, and Financial readiness			8/1/2018		
4.10	Maintenance-oriented demonstration elements			3/1/2018		
4.11	Documentation of Requirements Verification and Acceptance Tests			9/30/2018		
4.12	DWFCWT-1 -- FCW Stopped Vehicle Ahead			12/1/2017		
4.13	DWDNR-1 -- Distress Notification Relay to RSU and Following Vehicle			12/1/2017		
4.14	DWI2VSAT-Pikalert			12/1/2017		

RM No.	PM WBS	Performance Measurement Activities	Status (RYG)	% complete	Due Date	Completion Date	Comments
5.1	T2K.1	**Prepare Schedule**					
5.1.1	T2K.1.1	Submit Draft PMESS			3/1/2017		
5.1.2	T2K.1.2	USDOT Review			3/15/2017		
5.1.3	T2K.1.3	Prepare Final PMESS			4/3/2017		
5.1.3	T2K.1.3	Submit Weekly Progress Reports and Issues/Risks			Ongoing, every 2 weeks		
5.2	T2K.2	**Provide Support Information**					
5.2.1	T2K.2.1	Pre-Deployment (Baseline) Data Collection					
5.2.1.1	T2K.2.1.1	Road weather condition reports			1/31/2018		
5.2.1.2	T2K.2.1.2	Commercial Vehicle Fleets Information			1/31/2018		
5.2.1.3	T2K.2.1.3	Individual vehicle speeds			1/31/2018		
5.2.1.4	T2K.2.1.4	Vehicle crashes			1/31/2018		
5.2.2	T2K.2.2	Develop Analytical Methods					
5.2.2.1	T2K.2.2.1	Road weather condition reports			3/30/2018		
5.2.2.2	T2K.2.2.2	TMC generated alerts and advisories			9/30/2018		
5.2.2.3	T2K.2.2.3	Disseminate and Receive I2V and V2I messages			9/30/2018		
5.2.2.4	T2K.2.2.4	Commercial Vehicle Fleets Information			3/30/2018		
5.2.2.5	T2K.2.2.5	Transmitted V2V messages			9/30/2018		
5.2.2.6	T2K.2.2.6	Automated Emergency Notifications of a Crash			9/30/2018		
5.2.2.7	T2K.2.2.7	Individual vehicle speeds			3/30/2018		
5.2.2.8	T2K.2.2.8	Vehicle crashes			3/30/2018		
5.2.3	T2K.2.3	Develop and Calibrate Simulation Models			9/30/2018		
5.2.4	T2K.2.4	Apply Methods and Develop Initial Pre-Deployment Conditions			8/31/2017		
5.2.5	T2K.2.5	Apply Methods and Develop Final Pre-Deployment Conditions			7/30/2018		
5.2.6	T2K.2.6	Support Independent Evaluator			9/30/2018		
5.3	T2K.3	**Prepare System Performance Reports**					
5.3.1	T2K.3.1	Provide Support to Initial System Readiness Testing			8/30/2017		
5.3.1.1	T2K.3.1.1	Support bench testing to ensure end-to-end data transmission			8/30/2017		
5.3.2	T2K.3.2	Prepare Initial Phase 2 System Performance Report			9/29/2017		
5.3.3	T2K.3.3	Provide Support to Final System Readiness Testing and Demonstration			Fall 2018		
5.3.3.1	T2K.3.3.1	Support field testing to ensure end-to-end data transmission			Fall 2018		
5.3.3.2	T2K.3.3.2	Support USDOT demonstration of end-to-end data transmission			Fall 2018		
5.3.4	T2K.3.4	Prepare Final Phase 2 System Performance Report			7/30/2018		
5.4	T2K.4	**Update PMESP**					
5.4.1	T2K.4.1	Prepare Draft PMESP Update			4/1/2018		
5.4.2	T2K.4.2	USDOT Review			4/15/2018		
5.4.3	T2K.4.3	Prepare Final PMESP Update			7/30/2018		

RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
6.1	Phase 1 Deliverables					
6.1.1	Task 2 Concept of Operations	[redacted]	100	2/11/2016		
6.1.2	Task 3 Security Management Operating Concept	[redacted]	100	3/28/2016		
6.1.3	Task 4 Safety Management Plan	[redacted]	100	3/28/2016		
6.1.4	Task 5 Performance Measurement and Evaluation Plan	[redacted]	100	6/6/2016		
6.1.5	Task 6 System Requirements	[redacted]	100	7/18/2016		
6.1.6	Task 7 Application Deployment Plan	[redacted]	100	4/5/2016		
6.1.7	Task 8 Human Use Summary	[redacted]	100	7/18/2016		
6.1.8	Task 9 Participant Training and Education Plan	[redacted]	100	6/23/2016		
6.1.9	Task 10 Partnership Coordination Plan	[redacted]	100	6/27/2016		
6.1.10	Task 11 Outreach Plan	[redacted]	100	9/13/2016		
6.1.11	Task 12 Comprehensive Deployment Plan	[redacted]	100	8/1/2016		
6.1.12	Task 13 Deployment Readiness Summary	[redacted]	100	9/22/2016		
6.2	Phase 2 Deliverables					
6.2.1	2A Kick-off Meeting			9/23/2016		
6.2.2	2A Project Management Plan (PMP)			10/20/2016		
6.2.3	2A Project Schedules			10/20/2016		
6.2.4	2B Systems Architecture Document			10/1/2017		
6.2.5	2B Systems Design Document			10/1/2017		
6.2.6	2B Updated Phase 1 Deliverables			6/15/2018		
6.2.7	2C Data Privacy Plan			12/30/2016		
6.2.8	2C Notice of Privacy Management Consistency			1/6/2017		
6.2.9	2C Data Management Plan			6/30/2017		
6.2.10	2D Comprehensive Acquisition Plan			9/1/2017		
6.2.11	2D Comprehensive Installation Plan			10/23/2017		
6.2.12	2E Application Development Schedule (ADS)			2/9/2017		
6.2.13	2E Open Source Software and Supporting Documentation			4/27/18		
6.2.14	2F Training Implementation Schedule (TIS)			4/4/2017		
6.2.15	2F Training Materials			2/28/2018		
6.2.16	2F Human Use Approval Confirmation Materials			4/27/18		
6.2.17	2G Operational Readiness Concept Briefing			3/9/2017		
6.2.18	2G Operational Readiness Plan			10/13/2017		
6.2.19	2H Installation and Operational Readiness Schedule (IORS)			10/2/2017		
6.2.20	2H Operational Readiness Demonstrations			4/27/2018		
6.2.21	2I Comprehensive Maintenance and Operations Plan (CMOP)			6/15/2018		
6.2.22	2J Deployment Outreach Plan (DOP)			5/31/2017		
6.2.23	2J Outreach Implementation Schedule (OIS)			4/30/2018		
6.2.24	2J Outreach Materials			4/30/2018		
6.2.25	2K Performance. Meas. and Eval. Support Schedule (PMESS)			4/4/2017		
6.2.26	2K Pre-Deployment Performance. Data, logbooks, models and other info			4/30/2018		
6.2.27	2K Final System Performance Report			7/30/2018		
6.2.28	2L SDO-specific Technical Memoranda			9/15/18		

RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
7.1	Comprehensive Maintenance and Operations Plan (CMOP) Completed			3/30/2018		
7.2	TMC Pilot Operations & Maintenance Readiness					
7.2.1	Operations Procedures			TBD		
7.2.2	Operations Staff Training			TBD		
7.2.3	Preventative Maintenance Procedures			11/15/2017		
7.2.4	Problem Identification, Troubleshooting & Repair Procedures			11/15/2017		
7.2.5	Software & Applications Update/Recall/Replacement Plans			11/15/2017		
7.2.6	Hardware Update/Recall/Replacement Plans			11/15/2017		
7.2.7	Hardware/software configuration control processes			11/15/2017		
7.2.8	Spare parts/warranty contingency plans			11/15/2017		
7.2.9	Maintenance Staff Training			8/23/2018		
7.3	RSU Infrastructure Operations & Maintenance					
7.3.1	Operations Procedures			TBD		
7.3.2	Operations Staff Training			TBD		
7.3.3	Preventative Maintenance Procedures			11/15/2017		
7.3.4	Problem Identification, Troubleshooting & Repair Procedures			11/15/2017		
7.3.5	Software & Applications Update/Recall/Replacement Plans			11/15/2017		
7.3.6	Hardware Update/Recall/Replacement Plans			11/15/2017		
7.3.7	Hardware/software configuration control processes			11/15/2017		
7.3.8	Spare parts/warranty contingency plans			8/23/2018		
7.3.9	Maintenance Staff Training			8/23/2018		
7.4	Vehicle Systems Operations & Maintenance					
7.4.1	Operations Procedures			11/15/2017		
7.4.2	Operations Staff Training			11/15/2017		
7.4.3	Preventative Maintenance Procedures			11/15/2017		
7.4.4	Problem Identification, Troubleshooting & Repair Procedures			11/15/2017		
7.4.5	Software & Applications Update/Recall/Replacement Plans			11/15/2017		
7.4.6	Hardware Update/Recall/Replacement Plans			11/15/2017		
7.4.7	Hardware/software configuration control processes			11/15/2017		
7.4.8	Spare parts/warranty contingency plans			8/23/2018		
7.4.9	Maintenance Staff Training			8/23/2018		

RM No.	Readiness Measure	Status (RYG)	Online Training and Education Materials % Complete	Workshop Training and Education Materials % Complete	Driving Simulator Materials % Complete	E-Training Materials % Complete	Field Demonstration Materials % Complete	Due Date	Completion Date	Comments
8.1	Driver Training									
8.1.1	Driver Instructor Training							10/1/2017		
8.1.2	Basic and All Drivers Training							10/1/2017		
8.1.3	Highway Patrol Driver Training							Tentative		
8.1.4	Retrofit Truck Driver Training (Com'l Fleets)							10/1/2017		
8.1.5	Integrated Truck Driver Training (Trihydro Fleet)							10/1/2017		
8.1.6	WYDOT Maintenance/ Snowplow Driver Training							10/1/2017		
8.2	Operational Staff Training									
8.2.1	Operational Staff Instructor Training							10/1/2017		
8.2.2	TMC Operator Training							10/1/2017		
8.2.3	Highway Patrol Dispatcher Training							10/1/2017		
8.2.4	ITS and Telecom Technician Staff							10/1/2017		
8.2.5	Maintenance Supervisors							10/1/2017		
8.2.6	WYDOT Supervisory and Support Staff							10/1/2017		
8.2.7	WYDOT Development Staff							10/1/2017		
8.3	Fleet Management Centers									
8.3.1	Commercial Vehicle Operator Portal Users							10/1/2017		
8.4	Public									
8.4.1	Third Party Interface Users									

*New HMI using a mobile phone is under development and testing

RM No.	Readiness Measure	Status (RYG)	Staff Trained/ To be Trained	Technicians Trained/ To be Trained	Supervisors Trained/ To be Trained	Due Date	Completion Date	Comments
8.2.1	**Operations Staff**							
8.2.1.1	WYDOT TMC					9/30/2018		
8.2.1.2	WYDOT IT					9/30/2018		
8.2.1.3	WYDOT Telecom					9/30/2018		
8.2.1.4	WYDOT Highway Patrol					9/30/2018		
8.2.1.5	WYDOT Procurement					9/30/2018		
8.2.1.6	WYDOT Maintenance					9/30/2018		
8.2.1.7	WYDOT GIS/ITS Contractors					9/30/2018		
8.2.2	**Freight Partner Training***					**9/30/2018**		

* This includes all participating freight partners. The list of partners is expected to evolve through Phase 2 of the project.

Table 11 3. Other Stakeholders Training and Education

RM No.	Stakeholder Group	Number Accessing Training
8.2.3.1	Commercial Vehicle Operators Portal	
8.2.3.2	Third Party Interface Users	

RM No.	Readiness Measure	Status (RYG)	Work Agreements/ MOUs Completed	Equipment Resources Assigned*	Staff Resources Assigned	Budgets Allocated & Approved	Due Date	Completion Date	Comments
9.1.1	**WYDOT Pilot Support - *Intra-agency***								
9.1.1.1	WYDOT TMC						5/1/2018		
9.1.1.2	WYDOT IT						5/1/2018		
9.1.1.3	WYDOT Telecom						5/1/2018		
9.1.1.4	WYDOT Highway Patrol						5/1/2018		
9.1.1.5	WYDOT Procurement						5/1/2018		
9.1.1.6	WYDOT Maintenance						5/1/2018		
9.1.1.7	WYDOT GIS/ITS Contractors						5/1/2018		
9.1.2	**Committed Freight Partners - *MoUs***						**5/1/2018**		
9.1.2.1	Dooley Oil						5/1/2018		
9.1.2.2	North Park Transportation						5/1/2018		
9.1.2.3	Double D Distribution						5/1/2018		
9.1.2.4	*All Others*						5/1/2018		
9.1.3	**Subcontracts**								
9.1.3.1	ICF						10/30/2016		
9.1.3.2	University of Wyoming						10/30/2016		
9.1.3.3	McFarland Management						10/30/2016		
9.1.3.4	Vital Assurance						10/30/2016		
9.1.3.5	Trihydro						10/30/2016		
9.1.3.6	National Center for Atmospheric Research						10/30/2016		
9.1.4	**Support Partners - *Support Letters***								
9.1.4.1	Institutional Review Board						Annually and at specific intervals/ milestones		
9.1.4.2	Wyoming Trucking Association						5/1/2018		
9.1.4.4	Governor's Transportation Safety Council						5/1/2018		

Provided with Monthly Report

RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
10.1.1	Safety Management during Testing					
10.1.1.1	Safety Plans & Procedures Completed			10/1/2017		
10.1.1.2	Safety Training Completed			10/1/2017		
10.1.1.3	Safety Inspection & Issues Monitoring, Troubleshooting, & Resolution (Ongoing)			10/1/2017		
10.1.2	Safety Management during Installation (Infrastructure and Fleets)					
10.1.2.1	Safety Plans & Procedures Completed			10/1/2018		
10.1.2.2	Safety Training Completed			10/1/2018		
10.1.2.3	Safety Inspection & Issues Monitoring, Troubleshooting, & Resolution (Ongoing)			10/1/2018		
10.1.3	Safety Management during Deployment					
10.1.3.1	Safety Plans & Procedures			10/1/2018		
10.1.3.2	Safety Training			10/1/2018		
10.1.3.3	Safety Inspection & Issues Monitoring, Troubleshooting, & Resolution (Ongoing)			10/1/2018		
10.1.4	Deployment Closeout					
10.1.4.1	Safety Plans & Procedures			10/1/2018		
10.1.4.2	Safety Training			10/1/2018		
10.1.4.3	Safety Inspection & Issues Monitoring, Troubleshooting, & Resolution (Ongoing)			10/1/2018		

RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
10.2.1	**Security and SCMS Requirements Verification Inspection**					
10.2.1.1	SCMS-REQ-1 Wyoming CV System (WCVS) SCMS Use			5/1/2018		
10.2.1.2	SCMS-REQ-1.1 SCMS Wyoming CV System Certificates			5/1/2018		
10.2.1.3	~~SCMS-REQ-1.2 SCMS Wyoming CV System Misbehavior Reporting~~					Not part of pilot
10.2.1.4	System Certificates Revocation List (CRL)			9/15/2018		
10.2.1.5	SCMS-REQ-1.4 SCMS Wyoming CV System Rejection			9/15/2018		
10.2.1.6	SCMS-REQ-2 Vehicle System SCMS Use			5/1/2018		
10.2.1.7	SCMS-REQ-2.1 SCMS Vehicle System Certificates			5/1/2018		
10.2.1.8	~~SCMS-REQ-2.2 SCMS Vehicle System Misbehavior Reporting~~					Not part of pilot
10.2.1.9	SCMS-REQ-2.3 SCMS Vehicle System Certificates Revocation List (CRL)			9/15/2018		
10.2.1.10	SCMS-REQ-2.4 SCMS Vehicle System Rejection			9/15/2018		
10.2.1.11	VS-REQ-42 VSM SCMS			5/1/2018		
10.2.1.12	VS-REQ-43 VSM SCMS Encryption			5/1/2018		
10.2.1.13	VS-REQ-44 VSM SCMS Sign			5/1/2018		
10.2.1.14	VS-REQ-45 VSM SCMS Encryption-Log			5/1/2018		
10.2.1.15	VS-REQ-46 VSM SCMS Sign-Log			9/15/2018		
10.2.1.16	RSU-REQ-3 SCMS			5/1/2018		
10.2.1.17	ODE-REQ-4 SCMS			5/1/2018		
10.2.1.18	CSC-REQ-1 OBU SCMS Use			5/1/2018		
10.2.1.19	CSC-REQ-2 OBU Certification			5/1/2018		
10.2.1.20	CSC-REQ-3 RSU SCMS Use			5/1/2018		
10.2.1.21	CSC-REQ-4 RSU Certification			5/1/2018		
10.2.1.22	HSM-REQ-1 Receive from ODE			9/1/2018		
10.2.1.23	HSM-REQ-2 Share with ODE			9/1/2018		
10.2.1.24	HSM-REQ-3 Receive from SCMS			9/1/2018		
10.2.1.25	HSM-REQ-4 Share with SCMS			9/1/2018		
10.2.2	Wyoming CV System Component Compliance Inspection					
10.2.2.1	WYDOT ODE			3/1/2018		
10.2.2.2	WYDOT Pikalert			3/1/2018		
10.2.2.3	WYDOT Data Broker			3/1/2018		
10.2.2.4	WYDOT Data Warehouse			3/1/2018		
10.2.2.5	RSU Component			3/1/2018		
10.2.3	Wyoming CV System Internal ***Interface Compliance*** Inspection					
10.2.3.1	WI-1-PA to DB			3/1/2018		
10.2.3.2	WI2-DB - ODE			3/1/2018		
10.2.3.3	WI3-DB - DW			3/1/2018		
10.2.3.4	WI5-ODE to DW			3/1/2018		
10.2.3.5	WI6-ODE to PA			3/1/2018		
10.2.3.6	WI7-ODE - RSUs			3/1/2018		
10.2.3.7	WI8-ODE - HSM			9/1/2018		
10.2.4	Vehicle System Component ***Compliance*** Inspection					
10.2.4.1	OBU DSRC and Satellite (No CAN)			9/15/2018		
10.2.4.2	OBU DSRC and Satellite (Incl. CAN)			9/15/2018		
10.2.4.3	Android Development & HMI			9/15/2018		
10.2.4.4	Environmental Sensors			6/1/2018		
10.2.5	Vehicle System Internal Interface ***Compliance*** Inspection					
10.2.5.1	VI1-OBU to HMI			9/15/2018		
10.2.5.2	VI3-OBU to Environmental Sensors			9/15/2018		
10.2.5.3	VI2-OBU to CAN Interface					Not part of pilot
10.2.6	Vehicle System Integration ***Compliance*** Inspection					
10.2.6.1	Retrofit Commercial Vehicle (DSRC, Satellite)			9/15/2018		
10.2.6.2	Integrated Commercial Vehicle (DSRC, Satellite)			9/15/2018		
10.2.6.3	Highway Patrol Vehicle (DSRC, Satellite)			9/15/2018		
10.2.6.4	WYDOT Maintenance Vehicle (DSRC, Satellite, Environmental Sensor)			9/15/2018		
10.2.7	***CV Pilot External Interface Compliance*** Inspection					
10.2.7.1	VE1/WE1-RSU to OBU			9/15/2018		
10.2.7.2	VE2-SSP to OBU			9/15/2018		
10.2.7.3	VE3-OBU to OBU			6/1/2018		
10.2.7.4	VE4-LTS to OBU			6/1/2018		
10.2.7.5	WE2-LTS to RSU			6/1/2018		
10.2.7.6	WE3-LTS to ODE			6/1/2018		
10.2.7.7	WE4-RWIS to Pikalert			3/1/2018		
10.2.7.8	WE4-EWD to Pikalert			3/1/2018		
10.2.7.9	WE5-511 App to DB			3/1/2018		
10.2.7.10	WE6-RCRS to DB			3/1/2018		
10.2.7.11	WE7-IC to DB			3/1/2018		
10.2.7.12	WE8-CA to DB			3/1/2018		
10.2.7.13	WE9-WTI to DB			3/1/2018		
10.2.7.14	WE10-DB to TPI			3/1/2018		
10.2.7.15	WE11-DB to TRAC			3/1/2018		
10.2.7.16	WE12-DB to CVOP			3/1/2018		
10.2.7.17	WE13-DB to ITS Maint.			3/1/2018		
10.2.7.18	WE14-DW to SDC			3/1/2018		
10.2.7.19	WE15-ODE to SDW			3/1/2018		
10.2.7.20	WE16-ODE to SCMS			6/1/2018		
10.2.7.21	WE17-SCMS to RSU			9/15/2018		
10.2.7.22	WE18-ODE to SDC			3/1/2018		
10.2.7.23	WE19-ODE to RDE			3/1/2018		
10.2.7.24	WE20-DW to RDE			3/1/2018		
10.2.7.25	WE21-DB to SDC			3/1/2018		
10.2.8	Applications Component Compliance Inspection					
10.2.8.1	OBU Spot Weather Impact Warning			6/1/2018		
10.2.8.2	OBU Work Zone Warning			6/1/2018		
10.2.8.3	OBU I2V Situational Awareness			6/1/2018		
10.2.8.4	OBU Distress Notification Application			6/1/2018		
10.2.8.5	OBU Forward Collision Warning			6/1/2018		
10.2.8.6	OBU Vehicle Support Services			6/1/2018		
10.2.8.7	OBU Vehicle Trust Management			6/1/2018		
10.2.8.8	RSU Roadway Traffic Information Dissemination			6/1/2018		
10.2.8.9	RSU Basic Safety Monitoring			6/1/2018		
10.2.8.10	RSU Support Services			6/1/2018		
10.2.8.11	RSU Trust Management			6/1/2018		
10.2.8.12	Operational Data Environment			3/1/2018		
10.2.8.13	Pikalert			3/1/2018		
10.2.8.14	TMC Data Brokerage			7/1/2018		
10.2.8.15	WYDOT Third Party Interface			3/1/2018		
10.2.8.16	Service Monitor Device Management			8/1/2018		
10.2.8.17	CVOP Website Updates			3/1/2018		
10.2.8.18	WYDOT Transportation Reports and Action Console			3/1/2018		
10.2.8.19	WYDOT Wyoming Traveler Information			3/1/2018		
10.2.8.20	WYDOT Construction Administration			8/1/2018		
10.2.8.21	WYOROAD.INFO Website			3/1/2018		
10.2.8.22	OBU/RSU Management Application			6/1/2018		
10.2.8.23	Participant Tracking Application			3/1/2018		
10.2.8.24	WYDOT 511 App			3/1/2018		
10.2.8.25	Vehicle Messaging Display/Interface			3/1/2018		
10.2.8.26	OBU Spot Weather Impact Warning			6/1/2018		
10.2.8.27	OBU Work Zone Warning			6/1/2018		
10.2.8.28	OBU I2V Situational Awareness			6/1/2018		
10.2.8.29	OBU Distress Notification Application			6/1/2018		
10.2.8.30	OBU Forward Collision Warning			6/1/2018		
10.2.8.31	OBU Vehicle Support Services			6/1/2018		
10.2.8.32	OBU Vehicle Trust Management			6/1/2018		
10.2.8.33	RSU Roadway Traffic Information Dissemination			6/1/2018		
10.2.8.34	RSU Basic Safety Monitoring			6/1/2018		
10.2.8.35	RSU Support Services			6/1/2018		
10.2.9	Applications End-to-End Integration Compliance Inspection					
10.2.9.1	Pikalert - Spot Weather Impact Warning			5/1/2018		
10.2.9.2	WYDOT Construction Admin - Work Zone Warning			8/1/2018		
10.2.9.3	WYDOT Traveler Information - Posted Speed, VSL, Restrictions, closures			5/1/2018		
10.2.9.4	Incident Console - Incident Information			7/1/2018		
10.2.9.5	Road Condition Reporting System			5/1/2018		
10.2.9.5	WYDOT 511 App - Truck Parking Availability			8/15/2018		

RM No.	Readiness Measure	Status (RYG)	% complete	Due Date	Completion Date	Comments
10.3.1	Inspection of WYDOT Fleet Data used for pilot activities and performance evaluation - Data Collected					
10.3.1.1	Vehicle Telematics data from the Controller Area Network (CAN)/OBD II bus and other sensors					may not include with pilot
10.3.1.2	Atmospheric and road condition data from sensors			8/1/2018		
10.3.1.3	Location/Time data from GPS sensors			8/1/2018		
10.3.2	Inspection of WYDOT Fleet Data used for pilot activities and performance evaluation - Data Communicated					
10.3.2.1	V2V data will be communicated to vehicles in DSRC range			8/1/2018		
10.3.2.1.1	-- BSM part 1/2 data			8/1/2018		
10.3.2.1.2	-- Emergency Alert of accident, GPS location, time, BSM part 1/2 data			8/1/2018		
10.3.2.2	V2I data communicated with TMC			8/1/2018		
10.3.2.2	-- Limited to road weather, work zone, atmospheric data, VSLs, truck parking, and traffic flow			9/15/2018		
10.3.2.2.1	-- Vehicle telematics data (PII)			8/1/2018		
10.3.2.2.2	-- Vehicle Specific Identifier may be needed for performance evaluation (PII)			8/1/2018		
10.3.2.2.3	-- Emergency Alert of accident, GPS location, time, BSM part 1/2 data			8/1/2018		
10.3.3	Inspection of Commercial Fleet data used for pilot activities - Data Collected					
10.3.3.1	-- Vehicle Telematics data from the CAN/OBD II bus and other sensors					may not include with pilot
10.3.3.2	-- Atmospheric and road condition data from sensors					may not include with pilot
10.3.3.3	-- Location/Time data from GPS sensors			8/1/2018		
10.3.4	Inspection of Commercial Fleet data used for pilot activities - Data Communicated					
10.3.4.1	V2V data will be communicated to vehicles in DSRC range			10/10/2018		
10.3.4.1.1	-- BSM part 1/2 data			10/10/2018		
10.3.4.1.2	-- Emergency Alert of accident, GPS location, time, BSM part 1/2 data			10/10/2018		
10.3.4.2	V2I data communicated with TMC			10/10/2018		
10.3.4.2.1	-- Limited to road weather, work zone, atmospheric data, VSLs, truck parking, and traffic flow			10/10/2018		
10.3.4.2.2	-- Emergency Alert of accident, GPS location, time, BSM part 1/2 data			10/10/2018		
10.3.4.3	V2I data communicated with private fleet management			10/10/2018		
10.3.4.3.1	-- Road weather, work zone, atmospheric data, VSLs, truck parking, and traffic flow from CVOP			10/10/2018		
10.3.5	Inspection of PID users data with the pilot activities - Data Communicated					
10.3.5.1	V2I data communicated with TMC			8/1/2018		
10.3.5.1.1	-- Limited to receiving road weather, work zone, atmospheric data, VSLs, truck parking, and traffic flow			9/15/2018		
10.3.5.1.2	-- Emergency Alert of accident can be sent via text or email, GPS location, time, note			8/1/2018		
10.3.6	Inspection of Survey Data					
10.3.7	Inspection of GPS Trajectories					
10.3.8	Inspection of BSM					
10.3.9	Inspection of DSRC					

Connected Vehicle Pilot Deployment Program Phase 2

Operational Readiness Plan – WYDOT CV Pilot

Attachment B - Operational Readiness Test Plan

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Final Report — March 16, 2018

Updated July 30, 2018

FHWA-JPO-17-472B

U.S. Department of Transportation

Produced by DTFH6116H00027

U.S. Department of Transportation

Notice

Technical Report Documentation Page

<table>
<tr><td colspan="2">1. Report No.
FHWA-JPO-17-472B</td><td colspan="2">2. Government Accession No.</td><td colspan="2">3. Recipient's Catalog No.</td></tr>
<tr><td colspan="4" rowspan="2">4. Title and Subtitle
Connected Vehicle Pilot Deployment Program Phase 2, Operational Readiness Plan – WYDOT CV Pilot Attachment B - Operational Readiness Test Plan</td><td colspan="2">5. Report Date
Final 3/16/2018
Updated July 30, 2018</td></tr>
<tr><td colspan="2">6. Performing Organization Code</td></tr>
<tr><td colspan="4">7. Author(s)
Denny Stephens (Vital Assurance), Tony English (Trihydro), Nayel Ureña Serulle (ICF), Deepak Gopalakrishna (ICF), Vince Garcia (Wyoming DOT)</td><td colspan="2">8. Performing Organization Report No.
Task 2G Operational Readiness Test and Demonstration Planning Report Number T2G.02.01</td></tr>
<tr><td colspan="4" rowspan="2">9. Performing Organization Name and Address
Wyoming DOT, 5300 Bishop Boulevard, Cheyenne, WY 82009
ICF International, 1725 Eye St NW, Washington DC, 20006
Trihydro Corporation, 1252 Commerce Drive, Laramie, WY 82070
Vital Assurance, 175 S. Third St., Suite 200, Columbus, OH 43215</td><td colspan="2">10. Work Unit No. (TRAIS)</td></tr>
<tr><td colspan="2">11. Contract or Grant No.
DTFH6116H00027</td></tr>
<tr><td colspan="4" rowspan="2">12. Sponsoring Agency Name and Address
U.S Department of Transportation 1200 New Jersey Ave, SE Washington, DC 20590</td><td colspan="2">13. Type of Report and Period Covered
Operational Readiness Plan, 09/01/2016 to 3/16/2018</td></tr>
<tr><td colspan="2">14. Sponsoring Agency Code</td></tr>
<tr><td colspan="6">15. Supplementary Notes
Kate Hartman (COR), Sarah Tarpgaard (CO)</td></tr>
<tr><td colspan="6">16. Abstract
The Wyoming Department of Transportation's (WYDOT) Connected Vehicle (CV) Pilot Deployment Program is intended to develop a suite of applications that utilize vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communication technology to reduce the impact of adverse weather on truck travel in the I-80 corridor. These applications support a flexible range of services from advisories, roadside alerts, parking notifications and dynamic travel guidance. Information from these applications are made available directly to the equipped fleets or through data connections to fleet management centers (who will then communicate it to their trucks using their own systems). The pilot will be conducted in three Phases. Phase I includes the planning for the CV pilot including the concept of operations development. Phase II is the design, development, and testing phase. Phase III includes a real-world demonstration of the applications developed as part of this pilot.

This document is the WYDOT CV Pilot Operational Test Plan which is Attachment B to the Operational Readiness Plan (ORP) for The WYDOT CV Pilot project for the United States Department of Transportation's (USDOT) CV program. The purpose of this document is to describe plans for end-to-end testing of the WYDOT CV Pilot System to verify and demonstrate to the Team, WYDOT leadership, USDOT, and other stakeholders that the WYDOT Connected Vehicle Pilot Deployment (CVPD) meets functional and performance requirements, is ready for full deployment in Phase 3 of the program.</td></tr>
<tr><td colspan="3">17. Key Words
Connected Vehicle Technology, I-80 Corridor, Road Weather, Truck Safety, System Architecture</td><td colspan="3">18. Distribution Statement
This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161</td></tr>
<tr><td>19. Security Classif. (of this report)
None</td><td colspan="2">20. Security Classif. (of this page)
None</td><td colspan="2">21. No. of Pages
59</td><td>22. Price
NA</td></tr>
</table>

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

Acknowledgements

The Operational Readiness Plan development team would like to thank USDOT and Noblis for their technical assistance throughout the development of this document.

Table of Contents

1 Introduction 1

1.1 Project Scope 1

1.2 Purpose of the Operational Readiness Test Plan 2

1.3 Scope of the Operational Readiness Test Plan 2

1.3.1 Test Cases are Expected to Evolve during Testing 3

1.4 Document Organization 3

2 References 5

3 Overview of WYDOT CV Pilot End-to-end System Operational Readiness Testing 7

3.1 Test Plan Overview 8

3.2 Test Objectives 9

3.3 Test Categories 9

3.4 System Development and Test Sequence 10

3.4.1 Message Communications Integration and Testing 14

3.4.2 Applications Integration and Testing 14

3.4.3 Operational Readiness Demonstration Sequence 15

3.4.4 SCMS Integration 17

3.5 Test Procedure and Test Case Organization 17

3.5.1 Test Case Summary Descriptions 17

3.5.1.1 Integration of Message Communications and Applications and Testing 17

3.5.2 Integration of Test Cases into Test Procedures 37

3.5.3 Requirements Verification Methodology 37

3.5.4 Test Procedure and Test Case Outlines 37

3.5.5 Test Case Host and Remote Vehicle OBU identifiers 39

3.6 Test Locations 39

3.6.1 Controlled Environment Track Locations 39

3.6.2 On-road Test Locations 40

3.7 Participating Vehicles 41

3.8 Applications under Test 42

3.9 Test Rationales 42

3.9.1 Number of Test Case Repetitions 42

3.9.2 Configurable threshold percentage of BSMs, DNMs and I2V SA TIMs received 42

3.10 Test Tools 43

3.11 Test Schedule.. 43

3.12 Test Personnel.. 43

3.13 Participation 43

3.14 Security.. 43

3.15 Pretest Checkout 44

3.16 Safety Checklist.. 44

4 Detailed Operational Readiness Test Procedure and Test Case Descriptions 45

5 Glossary and Acronyms 48

List of Figures

Figure 3-1. WYDOT CV Pilot Performance Measurement Categories (Source: WYDOT). 7
Figure 3-2. WYDOT CV Pilot System Physical Architecture (Source: WYDOT).......................... 11
Figure 3-3. Conceptual System Illustration of End-to-end Message Communication Test Cases (Source: WYDOT) 12
Figure 3-4. Conceptual System Illustration of End-to-end Applications Performance Test Cases 13
Figure 3-5. Sequencing from Pilot development to Fully Operational Deployment (Source: WYDOT). 16
Figure 3-6. Satellite view of Laramie County Fairgrounds (Source: WYDOT through Google Earth) 41

List of Tables

Table 2-1. References. 5
Table 3-1. Summary of Planned WYDOT Pilot End-to-end System Operational Readiness Test Cases.......... 18
Table 4-1. List of WYDOT CV Pilot Test Procedures and Test Cases by Test Plan Documents. 45
Table 5-1. Glossary of Terms. 48
Table 5-2. Acronym List.......... 49

1 Introduction

1.1 Project Scope

Wyoming is one of the first wave of CV Pilot sites selected to showcase the value of and spur the adoption of CV technology in the United States. CV technology is a broad term to describe the applications and the systems that leverage dedicated short-range communications (DSRC) for vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I) and infrastructure-to-vehicle (I2V) communication to improve safety, mobility and productivity of the users of the nation's transportation system.

As one of the three selected pilots, WYDOT is focusing on improving safety and mobility by creating new ways to communicate road and travel information to commercial truck drivers and fleet managers along the 402 miles of Interstate 80 (I-80 henceforth) in the State. For the pilot project, WYDOT concluded Phase 1 (planning) in September 2016 and then initiated Phase 2 (deployment) which is scheduled to conclude in mid-2018. This will be followed by an 18-month demonstration period in the third phase.

Systems and applications developed in the pilot will enable drivers of connected vehicles to have improved awareness of potential hazards and of situations they cannot see. At a very high level, the pilot scope includes the following implementation elements:

- **Deploy about 75 roadside units (RSU)** that can receive and broadcast messages using DSRC along various sections on I-80.
- **Equip around 400 vehicles, a combination of fleet vehicles and commercial trucks, with on-board units (OBU).** Of the 400 vehicles, at least 150 are planned to be heavy trucks. All vehicles are expected to be regular users of I-80. Several types of OBUs are being procured as part of the pilot and differ based on their communication capabilities, ability to integrate with the in-vehicle network, and connectivity to ancillary devices and sensors. All OBUs will have the functionality to broadcast Basic Safety Messages (BSM) and will include a human-machine interface (HMI) to share alerts and advisories to drivers of these vehicles.
- **Develop several V2V, V2I, I2V applications** that will enable communication to drivers of alerts and advisories regarding various road conditions. These applications include support for in-vehicle dissemination of advisories for collision avoidance, speed management, detours, parking, and presence of work zones and maintenance and emergency vehicles downstream of their current location.
- **Enable overall improvements in WYDOT's traffic management and traveler information practices** by using data collected from connected vehicles. Targeted improvements include ingesting more location specific mobile road weather information system (RWIS) data, using Pikalert®[1] to provide for more accurate and road segment specific conditions to define better variable speed limits (VSLs), and improving road

[1] Pikalert is a trademark of the University Corporation for Atmospheric Research.

condition dissemination via 511, Dynamic Message Signs (DMS) and other WYDOT sources.

1.2 Purpose of the Operational Readiness Test Plan

This document is the WYDOT CV Pilot Operational Test Plan which is Attachment B to the Operational Readiness Plan (ORP) for The Wyoming Department of Transportation (WYDOT) Connected Vehicle (CV) Pilot project for the United States Department of Transportation's (USDOT) CV program. The purpose of this document is to describe plans for end-to-end testing of the WYDOT CV Pilot System to verify and demonstrate to the Team, WYDOT leadership, USDOT, and other stakeholders that the WYDOT Connected Vehicle Pilot Deployment (CVPD) meets functional and performance requirements, is ready for full deployment in Phase 3 of the program.

The WYDOT Team has identified ten operational readiness measures by which it will track and monitor progress toward readiness for Phase 3 deployment. These ten measures, described in detail in the WYDOT CV Pilot Operational Readiness Plan document, are

1. End-to-end System Development and Integration
2. End-to-End System Operational Readiness Testing
3. Acquisition, Installation, and Production Deployment Readiness
4. Operational Readiness Demonstration
5. Performance Measurement and Evaluation Support Readiness
6. Planning and Design Readiness
7. Operations and Maintenance Procedures Readiness
8. Training and IRB Readiness
9. Institutional, Staff, and Financial Readiness
10. Safety, Security, and Privacy Readiness

A central component of operational readiness will be End-to-End System Operational Readiness Testing under Measure 2. This attachment to the Plan provides detailed description of the plans for testing that will be undertaken by the Team to verify readiness for full deployment.

The WYDOT Team is conducting a demonstration of a subset of these Test Cases for USDOT and other stakeholders, to demonstrate the functionality and performance of the system prior to Winter 2017-2018 shakedown testing. Further details concerning the demonstration are described in the companion document Attachment C Operational Readiness Demonstration Plan.

1.3 Scope of the Operational Readiness Test Plan

Two classes of end-to-end testing are planned by the WYDOT Team:

- End-to-end Message Communication Testing
- End-to-end Applications Performance Testing

The first class encompasses test cases designed to verify end-to-end communication of the key messages and data files through the components and interfaces of the system. These test cases confirm that traveler information messages are communicated from the WYDOT Data Broker (DB) through the system and are received by vehicles traveling along I-80. These Test Cases further verify wireless DSRC communication range and DSRC and satellite communications coverage necessary to support applications needs.

End-to-end Applications Performance Test cases are designed to verify the functionality and performance of WYDOT CV Pilot applications including:

- Forward Collision Warning,
- I2V Situational Awareness, including
    - Spot Weather Impact Warning,
    - Work Zone Warning,
    - Variable Speed Limit,
    - Incident Information,
    - Road Condition Information, and
    - Truck Parking, and
- Distress Notification.

This category of test cases verifies that valuable traveler information from WYDOT back office systems are sent to the DB and are accurately captured in CV traveler information messages (TIMs). It verifies that receiving vehicles accurately parse the TIMs and deliver traveler information to the drivers at the right location and time. Furthermore, it also verifies the implementation of Forward Collision Warning and Distress Notification applications.

This approach for end-to-end testing to demonstrate System Operational Readiness is designed to verify that the component development and integration (outlined under Measure 1 in Chapter 3 of the Operational Readiness Plan) has been completed correctly and that the system delivers the functionality and performance it has been designed to achieve.

This approach assumes that developers have performed component and subsystem testing and requirements verification as part of their development and integration process. These test cases provide objective verification, at the end-to-end system level, that requirements are satisfied and that development and integration has been completed successfully. Each test case here identifies requirements which it supports. Chapter 5 of this document provides the Requirements Verification Methodology, which shows traceability between test cases and system requirements.

1.3.1 Test Cases are Expected to Evolve during Testing

Each of the test cases described in this document is under review and discussion by the engineering team. Further specifics will be developed as test engineers perform dry runs of each test procedure and test case and develop detailed steps for execution. As such, this document and the test cases it includes are expected to evolve as details of the system are fully implemented and its functionality and performance are more fully characterized during testing. Final details of the test planning will be provided as part of the final Operational Readiness Test Report.

1.4 Document Organization

This WYDOT CV Pilot Operational Readiness Test Plan is organized into six chapters

1. Introduction
2. References
3. Overview of WYDOT CV Pilot End-to-end Operational Readiness Testing
4. Detailed Operational Readiness Test Procedure and Test Case Descriptions

5. Glossary and Acronyms

Appendices A and B (provided in separate documents) detail the Requirements Verification Methodology Tables

2 References

The following table lists the documents and sources used and referenced to develop the concepts in this document.

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SAE J2945/1 (2016). Dedicated Short Range Communication (DSRC) Minimum Performance Requirements. SAE International.

3 Overview of WYDOT CV Pilot End-to-end System Operational Readiness Testing

The WYDOT CV Pilot Team has identified 21 potential improvements in efficiency, safety, and mobility performance offered by this Pilot Deployment. These 21 performance measures are organized in eight (8) performance categories as shown in Figure 3-1. These eight performance categories focus represent the primary activities and outcomes of the Wyoming CV Pilot system, including data collection, information dissemination, alerts, and advisories shared between vehicles and roadside, improved speed adherence and reduced crash rates. The performance measures are detailed in the project Performance Measurement and Evaluation Support Plan.

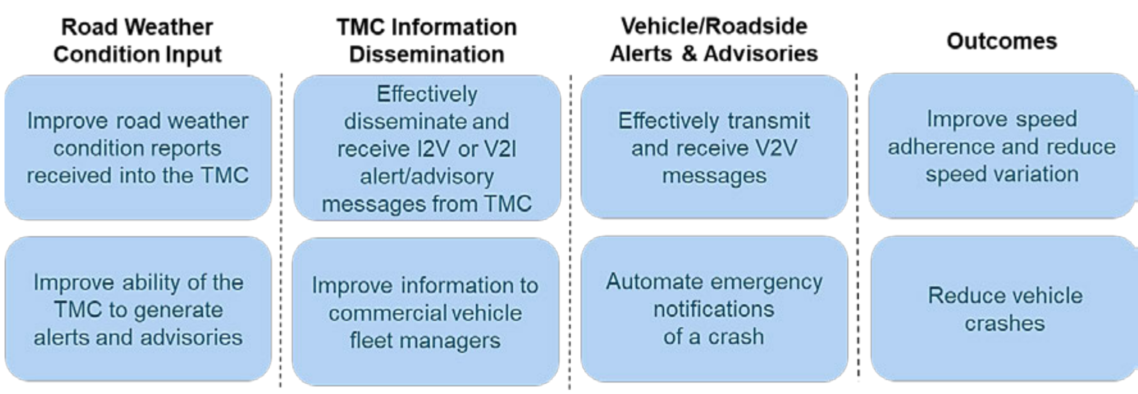


Figure 3-1. WYDOT CV Pilot Performance Measurement Categories (Source: WYDOT).

The WYDOT CV Pilot System developed to accomplish these enhancements is described in the project system engineering reports, including the Concept of Operations(ConOps), System Architecture Document(SAD), System Design Document(SDD), and Interface Control Document(ICD) identified in Chapter 2 References. This system is illustrated by the physical architectural diagram, shown below in NOTE: The Wyoming CV System Interface WI4 (PA→DW) was not implemented in the final system design.

Figure 3-2. Readiness to support full operations requires the successful development and testing of each of the components identified in this diagram, and the successful integration through each interface, enabling the system to communicate information and messages from back office systems on the left side of the diagram to vehicles and drivers on the right side of the diagram. Detailed descriptions are provided in the aforementioned project system engineering reports.

Measure 2 of Operational Readiness is end-to-end system operational readiness testing. In this aspect of the program, the WYDOT Team will undertake a series of tests, organized as test cases, which will verify that component development and integration has been successfully completed, that messages and information are accurately communicated across the system, and that the system is fully operational and ready for Phase 3 deployment.

3.1 Test Plan Overview

This chapter introduces and summarizes the Test Procedures and Test Cases that are detailed in Chapter 4. Following the introduction and summary, this chapter describes the logistics and companion elements needed for planning. These test procedures and test cases provide objective verification, at the end-to-end system level, that requirements are satisfied and that development and integration has been completed successfully. Each Test Case here identifies requirements which are verified upon completing that test case.

This chapter addresses

- Test Objectives
- Test Categories
- System Development and Test Sequence
- Test Procedure and Test Case Organization
  - Test Case Summary Descriptions
  - Integration of Test Cases into Test Procedures
  - Requirements Verification Methodology
  - Test Procedure and Test Case Outlines
  - Test Case Host and Remote Vehicle OBU identifiers
- Test Locations
  - Controlled Environment Track Locations
  - On-road Test Locations
- Participating Vehicles
- Applications under Test
- Test Rationales
- Test Tools
- Test Schedule
- Test Personnel
- Participation
- Security
- Pretest Checkout
- Safety Checklist

As noted, this document and the Test Procedures and Test Cases it includes are expected to evolve during testing and as details of the system are fully implemented and its functionality and performance are more fully characterized.

The structure of this Test Plan document is based upon a blending of four elements:

- Architecture and design of the WYDOT CV Pilot System described in the project SAD, SDD, and ICD.
- Needs of the System Development and Test Team in carrying out the tests described herein to verify that requirements are met and that the system is ready for deployment.
- USDOT requirements for documentation and readability.
- ISO 29119-3 Software and Systems Engineering – Software Testing – Part 3: Test Documentation.

While software testing standards are informative guidance, the primary objective of this document is to support the System Development and Test Team in carrying out the tests described herein to verify requirements are met and that the system is ready for deployment.

3.2 Test Objectives

The objectives of testing described in this document are to verify that

- The WYDOT CV Pilot System is ready for full deployment and operations, and
- System requirements are satisfied.

Although complex, the two fundamental functions of the WYDOT CV Pilot System are to

- Communicate BSM, TIM, DNM messages end-to-end, from the Data Broker to the OBU and the reverse.
- Communicate advisories, alerts, and information end-to-end from Back Office Components to the Driver and the reverse.

While this is a simplification of a complex system with many functions, this understanding explains the system test strategy.

Design and implementation details of the components and system under test are described in the following documents

- Connected Vehicle Pilot Deployment Program Phase 2, System Architecture Document, WYDOT CV Pilot (FHWA-JPO-17-451).
- Connected Vehicle Pilot Deployment Program Phase 2, Application Development Schedule – Wyoming
- Connected Vehicle Pilot Deployment Program, System Design Document, WYDOT CV Pilot (FHWA-JPO-17-468).
- Connected Vehicle Pilot Deployment Program, Interface Control Document, WYDOT CV Pilot (FHWA-JPO-17-468a).

3.3 Test Categories

Referring to the Physical Architecture Diagram in Figure 3-2, end-to-end testing is organized by the WYDOT Team into two major categories:

- End-to-end Message Communication Test Procedures and Test Cases
- End-to-end Applications Performance Test Procedures and Test Cases

The first category encompasses test cases designed to verify end-to-end communication of the key messages and data files through the components and interfaces shown in Figure 3-2, including

- V2I Basic Safety Messages
- I2V Situational Awareness (I2V SA) Traveler Information Messages (TIMs)
- Distress Notification (DN) TIMs (both V2V and V2I),
- V2I Environmental Sensor Data, and
- V2I Log files.

This category of test is illustrated conceptually in Figure 3-3. End-to-end Message Communication Test Cases also detail test procedures to verify wireless DSRC and satellite communication range and coverage performance necessary to meet applications requirements. These test cases also support verification of logging and storage of messages for subsequent analysis.

Recognizing that communications performance depends upon the design and engineering of OBUs, RSUs, and their antennas, selected test cases in the End-to-end Message Communication Test Cases will be performed for each vendor's OBU/antenna configuration and each vendor's RSU/antenna configuration.

The End-to-end Applications Performance Test Cases, illustrated conceptually in Figure 3-4 are designed to verify the WYDOT CV Pilot applications: Forward Collision Warning, I2V Situational Awareness (Spot Weather Impact Warning, Work Zone, Variable Speed Limit, Incident Information, Road Condition, and Truck Parking) and Distress Notification. These test cases verify

- Correct compilation of messages at their origin
- Correct parsing and accurate implementation at their receiving end.
- Processing and communication speed performance necessary to meet application requirements
- Correct Prioritization of driver messaging
- Correct event logging

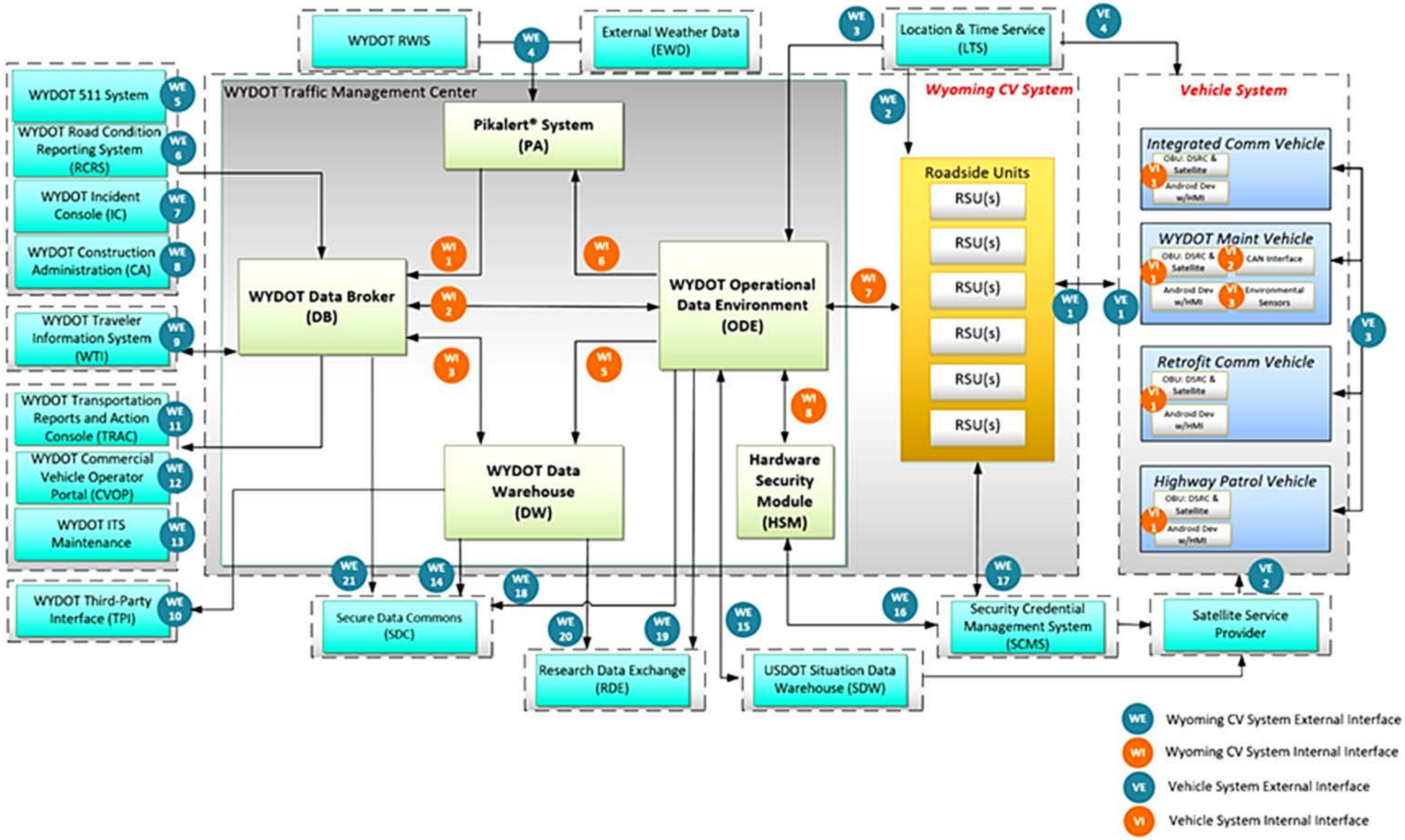
Some test cases will be performed to tune application parameters for each vehicle type, such as FCW warning distance for passenger vehicles and trucks.

Because applications performance can depend upon design and engineering of the application, End-to-end Applications Performance Test Cases must be performed for each vendor's applications. Because V2V DSRC performance depends significantly upon OBU and antenna design, as well as vehicle geometry, V2V applications will be tested for each vehicle type.

3.4 System Development and Test Sequence

Figure 3-5 illustrates the flow of development, integration, and testing for the WYDOT CV Pilot System. This figure also illustrates the dependency of tests on specific levels of integration.

WYDOT CV Pilot System applications are developed primarily using the Agile methodology in which functions and features are developed end-to-end and tested incrementally. Consequently, the test strategy developed here is focused on end-to-end system level testing to verify end-to-end functionality and performance after all features and functions are implemented.



NOTE: The Wyoming CV System Interface WI4 (PA→DW) was not implemented in the final system design.

Figure 3-2. WYDOT CV Pilot System Physical Architecture (Source: WYDOT)

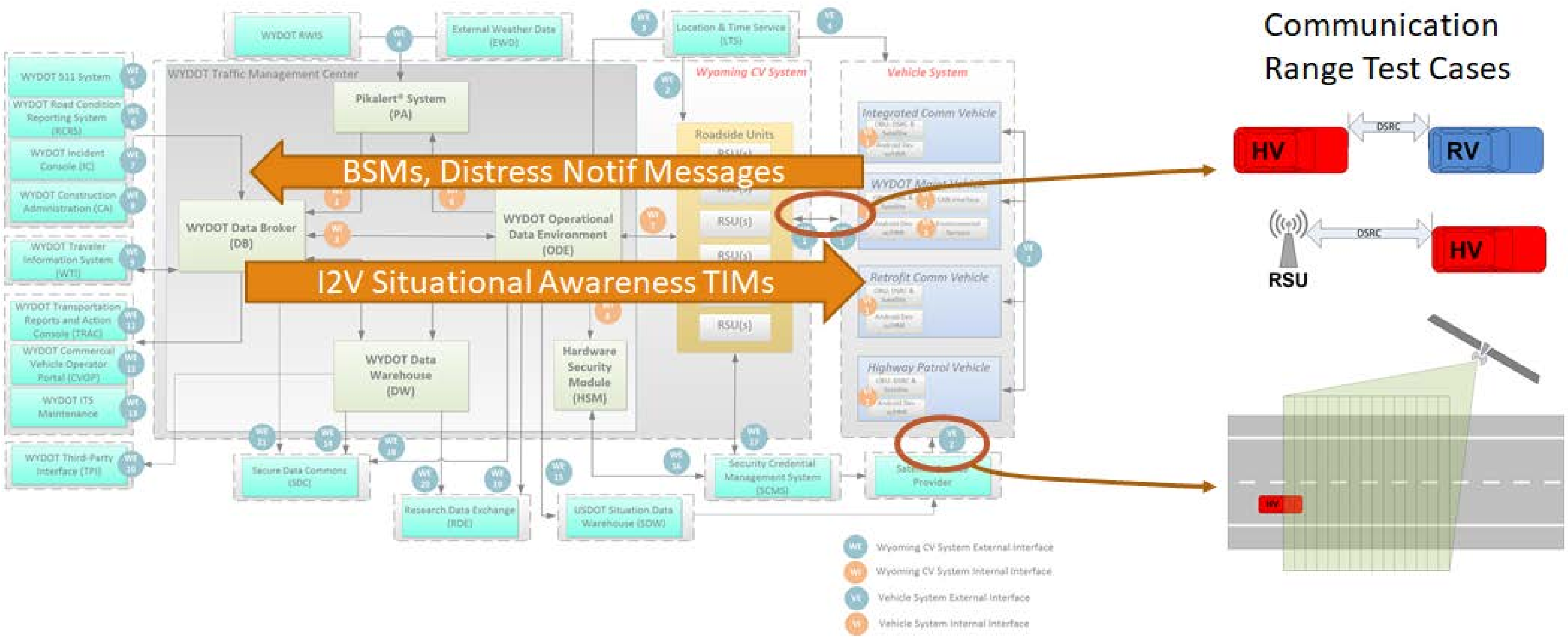


Figure 3-3. Conceptual System Illustration of End-to-end Message Communication Test Cases (Source: WYDOT)

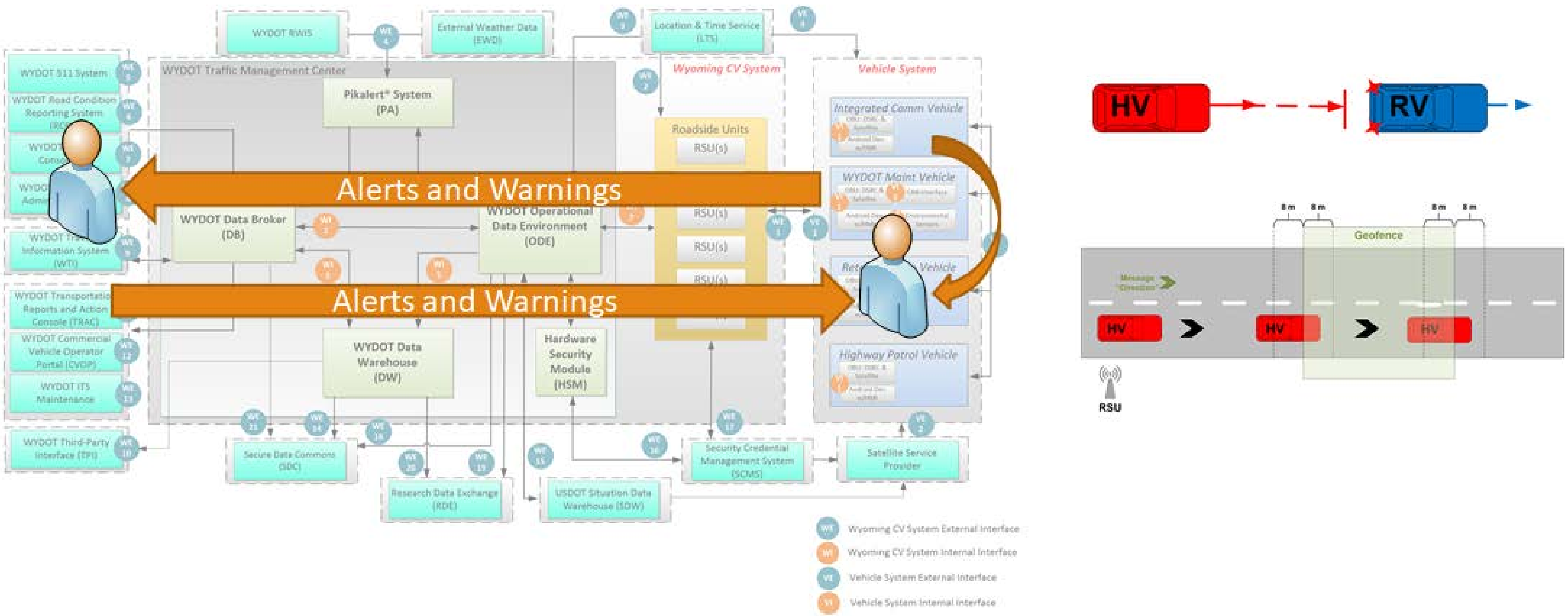


Figure 3-4. Conceptual System Illustration of End-to-end Applications Performance Test Cases

The TMC components of DB and DW are being developed by WYDOT Team members, leveraging and building up existing WYDOT TMC components. The ODE is being developed by Booz Allen Hamilton under contract to the USDOT and direction of WYDOT Team Neaera Consulting. Pikalert is developed by the National Center for Atmospheric Research (NCAR). As they are developed, these components are integrated and message communications are established through internal interfaces WI1, WI2, WI3, WI5, and WI6[2]. TMC and RSU message communications are then established through interface WI7.

Vehicle OBUs and RSUs are purchased from vendors, ready for V2V and V2I communications, including BSMs and I2VSA TIMs. OBUs are integrated with HMI on the benchtop via interface VI1, and on the WYDOT Maintenance Vehicle, with CAN communications via interface VI2, and with environmental sensors via interface VI3. RSU to OBU message communications are established through DSRC communications interface WE1/VE1. OBU to OBU message communications (BSM) are established through interface VE3. Subsequently, DB to OBU message communications are established across the system components, as described in more detail in the WYDOT CV Pilot SDD and ICD.

Concurrent with DSRC communications efforts, satellite communications are established through the USDOT Situation Data Warehouse via interfaces WE15 and VE2.

3.4.1 Message Communications Integration and Testing

This level of integration supports the End-to-end Message Communication Test Cases described in later in this document. This integration and testing verifies traveler information messages are communicated from the DB through the system and are received by vehicles traveling along I-80. It verifies V2V communication of BSMs and V2I communication of BSMs from vehicles through to Pikalert and the DB and DW. This integration and testing further verifies wireless DSRC communication range and DSRC and satellite communications coverage necessary to support applications needs.

3.4.2 Applications Integration and Testing

As illustrated in Figure 3-5, subsequent to Message Communications Integration and Testing, the WYDOT team will establish communication of information, advisories and alerts between back office components (511, RCRS, IC, CA, WTI, TRAC, CVOP, ITS Maintenance, TPI) and the DB via external interfaces WE5 through WE13. External interfaces from the DW to the SDC and RDE are also established. External interfaces WE2, WE3, WE4, and VE4 have been established during component development.

In parallel with Message Communications Integration and Testing, WYDOT Team members and vendors are developing applications that support end-to-end communication of advisories, alerts, and information from Back Office to driver and the reverse. In simplistic terms, applications components are installed in the application layer, overlaid on the message communications layer.

Upon integration of the Applications Layer components, the System will be ready to support End-to-end Applications Performance Test procedures described in this report.

[2] NOTE: The Wyoming CV System Interface WI4 (PA→DW) was not implemented in the final system design.

3.4.3 Operational Readiness Demonstration Sequence

Operational Readiness Demonstrations will take place at a major milestone in the project, when the system is functional and before Winter 2017-2018 shakedown testing. One of the major emphases of this project is to improve safety of trucks operating on I-80 during the winter. Consequently, it is critical that the Team conduct shakedown testing during the Winter 2017-2018 season. The USDOT SCMS is not ready to support system operations during this Winter shakedown period. At this milestone, the Team can demonstrate the functionality and performance of the system, but it is not ready for comprehensive final testing and requirements verification. Figure 3-5 Illustrates sequencing of the Operational Readiness Demonstration, following development and development team testing, prior to shakedown, system refinement and final system testing and requirements documentations.

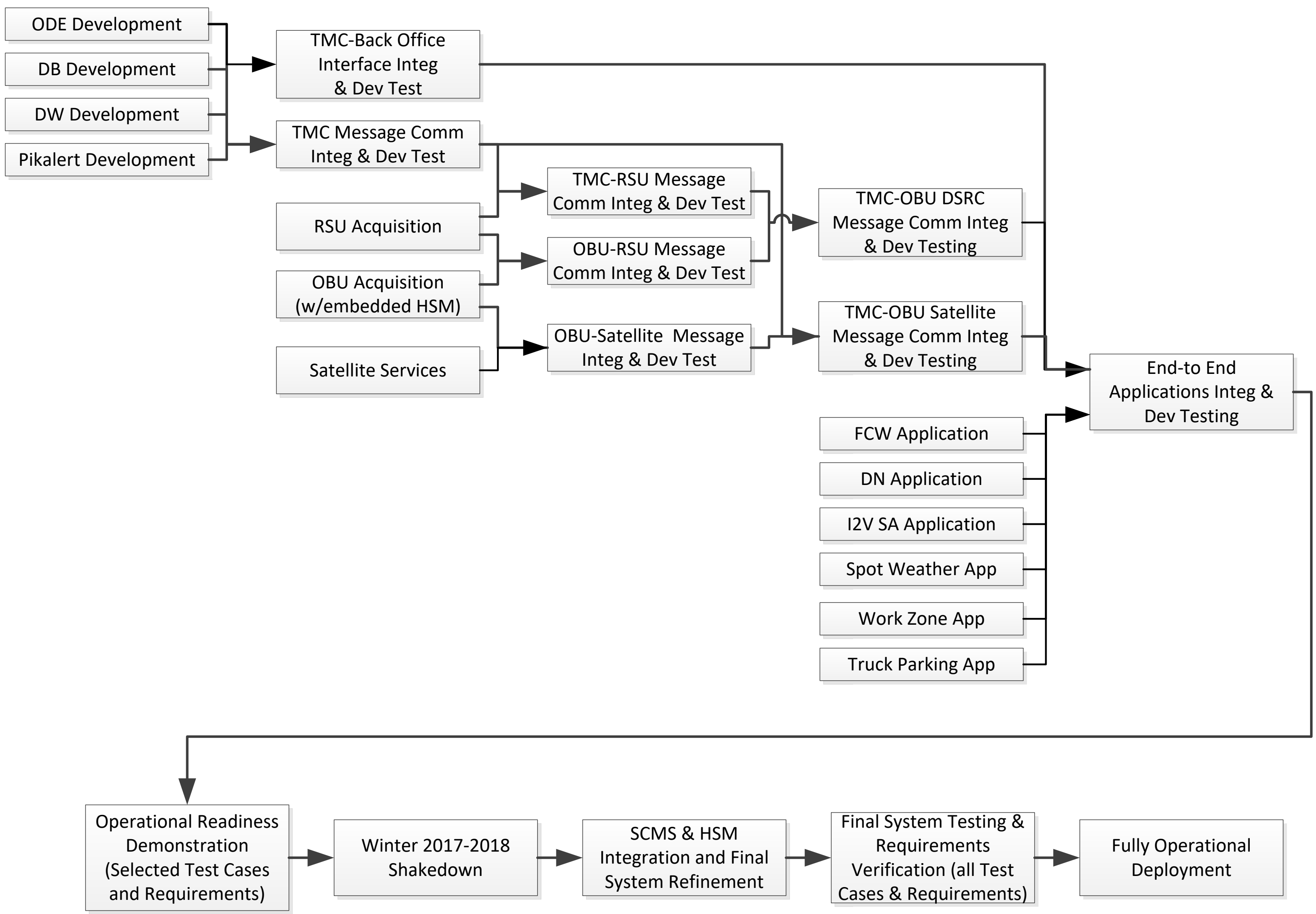


Figure 3-5. Sequencing from Pilot development to Fully Operational Deployment (Source: WYDOT).

3.4.4 SCMS Integration

The SCMS under development by the USDOT supports the encryption and signing of messages between the ODE and vehicles to ensure their data security. For the WYDOT system this will be implemented via interfaces WE16 and WE17 along with a Hardware Security Module (HSM) interfaced to the ODE. The ODE HSM complements the HSMs imbedded in OBUs. Ideally, SCMS and HSM should be integrated with the ODE during ODE development and subsequent integration. Because these externally developed components are not yet available to the WYDOT Team, the Team is proceeding with integration and testing of applications as described below. The Team anticipates that it will perform most, if not all, of the test procedures and test cases (with the exception of SCMS test procedures and cases) described in this report, while it waits upon completion of the SCMS, to make best use of available time. Because the system functionality and performance may be affected by the implementation of the SCMS, it will be necessary for the WYDOT Team to repeat all test procedures and test cases described here, following full SCMS implementation.

3.5 Test Procedure and Test Case Organization

This test plan is organized in terms of Test Procedures and Test Cases. ISO 29119-3 defines a test case as a set of preconditions, inputs (including actions, where applicable), and expected results, developed to drive the execution of a test item to meet test objectives. It defines a test procedure, as a collection of test cases to be executed for a particular objective.

Each Test Case represents a set of system configurations, inputs (such as driving scenarios), expected results (pass/fail criteria) that verify an element of system functionality and/or performance and that verify specific requirements. Test procedures are collections of test cases that use the same system configuration and test location and can be readily conducted in the same time frame.

3.5.1 Test Case Summary Descriptions

Table 3-1 provides a description of each of the test cases planned for this program, summarizing the objective, test case input, and expected result for each. The subsequent section describes their integration into Test Procedures. Each Test Procedure and Test Case is detailed in Section 4 of this document.

3.5.1.1 Integration of Message Communications and Applications and Testing

Some message communications and applications test cases employ similar system configurations and input driving scenarios. These test cases may be performed concurrently and integrated to improve testing efficiency. These test cases are identified in the rightmost column of Table 3-1 labeled “Integrated Test Case ID.” To assist testing staff, this integration is explicitly shown in test procedure and test case descriptions later in this plan.

Table 3-1. Summary of Planned WYDOT Pilot End-to-end System Operational Readiness Test Cases

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
End-to-end Message Communications Test Cases					
V2V Message Communications Test Procedure and Test Cases					
WV2VMCT-1	V2V exchange of BSMs	Verify V2V BSM Communication Range and Antenna Performance.	* Remote vehicle is stopped in travel lane, broadcasting BSMs. * Host vehicle approaches, broadcasting BSMs, initially traverse at 35 mph, slowing to stop 2 meters behind remote vehicle.	* A configurable threshold percentage of BSMs sent are received and logged by host and remote vehicle OBUs, when vehicles are at least 300 meters apart. * A configurable threshold percentage of BSMs continue to be received and logged until host vehicle stops. * Verified by inspection of logs.	WFCWT-1
WV2VMCT-2	V2V exchange of DNMs	Verify V2V DNM Communication Range and Antenna Performance	* Host and remote vehicle pass each other from opposite directions, each traveling at 35 mph, while host vehicle broadcasts DNMs.	* A configurable threshold percentage of DNMs are received and processed by remote vehicle OBU when vehicles are at least 300 meters apart. * Verified by inspection of logs.	WDNR-1
V2I Message Communications Test Procedure and Test Cases					
WV2IMCT-1	V2I and End-to-end communication of DNMs	Verify End-to-end Communication of DNMs and V2I DNM communication range	* Host vehicle approaches RSU from outside of DSRC communication range.	* A configurable threshold percentage of DNMs are received and processed by RSUs when vehicle is at least 300 meters away. * DNMs are received and processed by Data Broker. * Verified by inspection of logs.	WDNR-1
WV2IMCT-2	V2I & End-to-end Communication of BSMs	Verify End-to-end Communication of BSMs and V2I BSM communication range	* Host vehicle approaches RSU from outside of DSRC communication range.	* A configurable threshold percentage of BSMs are received and processed by RSU when vehicle is at least 300 meters	WFCWT-1

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
				away. * BSMs are received and processed by Data Warehouse. * Verified by inspection of logs.	
WV2IMCT-3	V2I & End-to-end communication of Environmental Sensor Data	Verify End-to-end Communication of Environmental Sensor Data and V2I Environmental Sensor Data communication range	* Host vehicle approaches RSU from outside of DSRC communication range.	* Environmental Sensor Data are received and processed by ODE when vehicle is at least 150 meters away from RSU. * Environmental Sensor Data are received and processed by Pikalert. * Verified by inspection of logs.	
WV2IMCT-4	V2I & End-to-end communication of log files	Verify End-to-end Communication of log files and V2I log files communication range	* Host vehicle approaches RSU from outside of DSRC communication range.	* Log files are received and processed by ODE when vehicle is at least 150 meters away from RSU. * Log files are received and processed by ODE and are stored by Data Warehouse. * Verified by inspection of logs.	WFCWT-1
I2V Message Communications Test Procedure and Test Cases					
WI2VMCT-1	End-to-end & DSRC Delivery of I2V SA TIMs	Verify End-to-end Communication (DB to OBU) of I2V SA TIMs via DSRC and I2V SA TIM DSRC communication range	* I2V SA TIM is formulated by Data Broker and distributed to test RSU. * Host vehicle approaches RSU from outside of DSRC communication range.	* A configurable threshold percentage of I2V SA TIMs are received and processed by OBU when vehicle is at least 300 meters away. * Verified by inspection of logs.	WI2VSAT-1-REP
WI2VMCT-2	End-to-end & Satellite Delivery of I2V SA TIMs	Verify End-to-end Communication (DB to OBU) of I2V SA TIMs via satellite.	* I2V SA TIM is formulated by Data Broker and distributed to satellite service provider. * Five locations along Wyoming I-80 are selected for satellite testing.	* A configurable threshold percentage of I2V SA TIMs are received and processed by OBU at each of the 5 locations. * Verified by inspection of logs.	WI2VSAT-5

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
			* Satellite test locations are between RSU locations.		
WI2VMCT-3	Simultaneous DSRC Upload/ Download of messages and log files.	Verify simultaneous capture of BSMs, End-to-end Communication (DB to OBU) of I2V SA TIMs, and End-to-end Communication of log files (OBU to ODE) and DSRC communication range.	* I2V SA TIM is formulated by Data Broker and distributed to test RSU. * Host vehicle broadcasts BSMs and approaches RSU from outside of DSRC communication range.	* A configurable threshold percentage of BSMs are received and processed by RSU when vehicle is at least 300 meters away. * A configurable threshold percentage of I2V SA TIMs are received and processed by OBU when vehicle is at least 300 meters away. * All log files are received and processed by ODE when vehicle is at least 150 meters away from RSU. * Log files are received and processed by ODE and are stored by Data Warehouse. * Verified by inspection of logs.	
End-to-end Applications Performance Test Cases					
Forward Collision Warning Test Procedure and Test Cases					
WFCWT-1	FCW Stopped Vehicle Ahead	* Verify FCW application issues a warning in time for driver to avoid forward collision. * This test case is used to “tune” FCW to deliver timely warnings, while avoiding nuisance warnings.	* Host vehicle approaches stopped remote vehicle at 35 mph. * After receiving warnings, vehicle slows to stop 2 meters behind remote vehicle or veers to clear adjacent lane.	* FCW application issues a warning in time for driver to take action to avoid collision. Verified visually and by inspection of logs.	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
WFCWT-2	FCW Passing Stopped Vehicle	* FCW does NOT issue a warning when there are no FCW threats in the host vehicle path.	* Host vehicle passes stopped remote vehicle at 35 mph.	* FCW does NOT issue a warning when there are no FCW threats in the Host vehicle path. * Verified visually and by inspection of logs.	
WFCWT-3	FCW Steady State	* FCW does NOT issue a warning when host vehicle follows closely. * This test case is used to "tune" FCW to deliver timely warnings, while avoiding nuisance warnings.	* Host vehicle follows remote vehicle closely at 35 mph.	* FCW does NOT issue a warning. * Verified visually and by inspection of logs.	
WFCWT-4	FCW Braking Vehicle Ahead	* When remote vehicle brakes heavily FCW application issues a warning in time for driver to avoid forward collision.	* Host vehicle follows braking remote vehicle slowing from 35 mph.	* FCW issues an alert after the remote vehicle brakes heavily in time for driver to take action to avoid collision. * Verified visually and by inspection of logs.	
WFCWT-5	FCW Stopped Vehicle in a Curve	* When there is a stopped vehicle in the same lane of travel in a curve, FCW application issues a warning in time for driver to avoid forward collision.	* Host vehicle approaches remote vehicle stopped in a curve.	* FCW issues a warning when there is a stopped vehicle in the same lane of travel in a curve in time for driver to take action to avoid collision. * Verified visually and by inspection of logs.	
WFCWT-6	FCW Passing Stopped Vehicle in a Curve	* FCW does NOT issue a warning when there are no FCW	* Host vehicle passes remote vehicle stopped in a curve at 35 mph.	* FCW does NOT issue a warning when there are no FCW threats in the Host vehicle path.	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
		threats in the host vehicle path in curve.		* Verified visually and by inspection of logs.	
WFCWT-7	FCW Stopped and Obstructed Remote Vehicle Ahead	* FCW application issues a warning, in time for driver to avoid forward collision, when following an obstructing vehicle that changes lanes to reveal a stopped vehicle ahead in the same lane of travel.	* Remote vehicle enters track, approaches and stops at designated test location. * Obstructing Vehicle (with or without active OBU) enters track from outside communication range. * Obstructing Vehicle approaches stopped remote at 35 mph. When nearing the stopped remote vehicle, the Obstructing vehicle veers to clear adjacent lane and proceeds past stopped vehicle. * Host vehicle enters track from outside communication range and follows Obstructing Vehicle at 35 mph. * After Obstructing Vehicle veers out of the lane, Host Vehicle continues until receiving FCW warning when driver stops or veers to clear adjacent lane and proceeds past stopped vehicle.	* FCW issues a warning in time for driver to take action to avoid collision, when obstructing vehicle veers out of lane and there is a stopped vehicle ahead in the same lane of travel. * Verified visually and by inspection of logs.	
WFCWT-8	FCW Slow Moving Vehicle	* FCW application issues a warning when approaching a slow moving remote vehicle in time for driver to avoid forward collision.	* Host vehicle traveling at 35 mph approaches remote vehicle traveling at 15 mph.	* FCW issues a warning when there is a slow-moving vehicle in the same lane of travel in a curve in time for driver to take action to avoid collision. * Verified visually and by inspection of logs.	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
WFCWT-9	Simultaneous Message Prioritization	* Verify prioritization of simultaneous FCW, Distress Notification, and I2V SA messages.	* I2V SA TIM is configured with geofence beginning outside DSRC communication range of planned remote vehicle location. * Remote vehicle stops in travel lane in the middle of geofence and issues Manual Distress Notification, along with broadcasting BSMs. * Host vehicle passes RSU and downloads I2V SA TIM and enters I2V SA TIM geofence. * Host vehicle then approaches distressed vehicle, downloads DNM. * Finally Host vehicle continues approaching stopped distressed remote vehicle at 35 mph. * (all while still in I2V SA and DNM geofence)	* I2V SA Message displays within 8 meters of beginning of specified geofence. * DNM message displays at specified distance from distressed vehicle, prioritized over I2V SA message. * As host vehicle approaches remote vehicle, FCW advisory alert is issued, followed by FCW imminent alert, prioritized over I2V SA and DNM, in time for driver to avoid collision. * Verified visually and by inspection of logs.	
I2V Situational Awareness Test Procedure and Test Cases					
WI2VSAT-1-REP	Message Display in Travel Lanes - Representative	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle driving in travel lanes in "message direction". * This is performed using “representative” TIM message.	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.	
WI2VSAT-1-Pikalert	Message Display in	Verify I2V SA TIM is parsed correctly and	* Host vehicle driving in travel lanes in "message direction".	* Message displays within 8 meters of beginning of specified	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
	Travel Lanes - Pikalert	message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	* This is performed for Pikalert (Spot Weather Impact Warning).	geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.	
WI2VSAT-1-511	Message Display in Travel Lanes - 511	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	Host vehicle driving in travel lanes in "message direction". * This is performed for 511 (Truck Parking).	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.	
WI2VSAT-1-RCRS	Message Display in Travel Lanes - RCRS	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle driving in travel lanes in "message direction". * This is performed for RCRS (Road condition).	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.	
WI2VSAT-1-IC	Message Display in Travel Lanes - IC	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle driving in travel lanes in "message direction". * This is performed for IC (Incident caution).	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
WI2VSAT-1-CA	Message Display in Travel Lanes - CA	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle driving in travel lanes in "message direction". * This is performed for CA (Work Zone Warning).	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.	
WI2VSAT-1-WTI-Speed	Message Display in Travel Lanes - WTI Speed	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle driving in travel lanes in "message direction". * This is performed for WTI (Variable Speed Limit).	Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.	
WI2VSAT-1-WTI-Restriction	Message Display in Travel Lanes WTI - Restriction	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle driving in travel lanes in "message direction". * This is performed for WTI (Vehicle Restriction).	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.	
WI2VSAT-1-WTI-DMS	Message Display in Travel Lanes - DMS	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports	Host vehicle driving in travel lanes in "message direction". * This is performed for WTI (DMS Message).	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
		accurate display of I2V SA Messages.			
WI2VSAT-1-WTI-Closure	Message Display in Travel Lanes - Closures	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle driving in travel lanes in "message direction". * This is performed for WTI (Road Closure).	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.	
WI2VSAT-2	Message Display in Shoulder Lanes	Verify I2V SA TIM geofence is parsed correctly and messages begins and ends display on shoulders at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle traveling in "message direction" on inside shoulder and outside shoulder. This is performed using “representative” TIM message.	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.	
WI2VSAT-3	Message Display on Adjacent Service Road	Verify I2V SA TIM geofence is parsed correctly and messages do not display on adjacent service roads. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle traveling in "message direction" on adjacent service road. This is performed using “representative” TIM message	* No message is displayed. * Verified visually and by inspection of logs.	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
WI2VSAT-4	Message Display Perpendicular to Travel Lanes	Verify I2V SA TIM geofence is parsed correctly and messages do not display when approaching on perpendicular service roads. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle approaches "travel lanes" on intersecting road perpendicular to "message direction". * This is performed using “representative” TIM message	* No message is displayed. * Verified visually and by inspection of logs.	
WI2VSAT-5	Message Display in Travel Lanes sent via Satellite	* Verify I2V SA TIM sent via Satellite is identical to I2V SA TIM sent via DSRC in WI2VSAT-1. * Verify messages are parsed correctly and message begins and ends display at correct geofence geofence milepost.	Similar to WI2VSAT-1, Host vehicle driving in travel lanes in "message direction". * This is performed using “representative” TIM message.	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.	
WI2VSAT-6	Message Display in Opposing Travel Lanes	Verify I2V SA TIM geofence is parsed correctly and messages do not display when approaching in travel lanes opposite from specified message direction. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle approaches in travel lanes opposite to TIM "message direction". * This is performed using “representative” TIM message.	* No message is displayed. * Verified visually and by inspection of logs.	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
WI2VSAT-7	Simultaneous DSRC and Satellite I2V SA TIMs communication	Verify correct processing of end-to-end communication (DB to OBU) of I2V SA TIMs simultaneously via satellite and via DSRC.	* I2V SA TIM is formulated by Data Broker and distributed to test RSU and to satellite service provider. * Host vehicle approaches RSU from outside of DSRC communication range, while in satellite communication range. Host vehicle driving in travel lanes in "message direction". * This is performed using “representative” TIM message.	* OBU correctly processes identical I2V SA TIMs from DSRC and satellite. * Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.	
WI2VSAT-8	Message Display Start Time	Verify geofence implementation and I2V SA TIM start and stop time functionality and performance on I-80. * Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle driving in travel lanes on I-80 in "message direction". Vehicle enters geofence 10 seconds before start time. * This is performed using “representative” TIM message.	* Message begins displays within 1 second of specified start date and time (while inside the geofence). * Verified visually and by inspection of logs.	
WI2VSAT-9	Message Display Stop Time	Verify geofence implementation and I2V SA TIM start and stop time functionality and performance on I-80. * Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle driving in travel lanes on I-80 in "message direction". Vehicle enters geofence at least 10 seconds before message stop time. * This is performed using “representative” TIM message.	* Message ceases displays within 1 second of specified stop date and time (while inside the geofence). * Verified visually and by inspection of logs.	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
End-to-end Applications Performance Test Cases					
Distress Notification Test Procedure and Test Cases					
WDNR-1	Same direction Distress Notification relay to RSU	* Verify the functionality and performance of the Distress Notification Application for same direction relay.	* Distressed vehicle enters roadway and pulls to shoulder at specified safe location, outside of DSRC communication range from RSUs. * Driver manually initiates Distress Notification. * Same Direction Relay Vehicle approaches in same direction from outside DSRC communication range, passes host vehicle and continues, passing and relaying message to RSU.	* Same Direction Relay Vehicle receives DNM at least 300 meters before reaching Distressed Vehicle. * Same Direction Relay Vehicle OBU issues caution to driver upon receipt of DNM. * RSU receives DNM from Same Direction Relay Vehicle. * DNMs are received and processed by Data Broker. * TRAC receives DNM after receipt by RSU and issues distress notification message to operator. * Verified by inspection of logs.	
WDNR-2	Opposite direction Distress Notification relay to RSU and Following Vehicle	Verify the functionality and performance of the Distress Notification Application for opposite direction relay.	* 'Distressed vehicle enters roadway and pulls to shoulder at specified safe location, outside of DSRC communication range from RSUs. * Driver manually initiates Distress Notification. * Opposing Direction Relay Vehicle approaches Distressed Vehicle from opposite direction, outside DSRC communication range, and passes Distressed Vehicle, receiving DNM. * Opposing Direction Relay Vehicle continues to the nearest RSU, where it uploads	* Opposing Direction Relay Vehicle receives DNM at least 300 meters before reaching Distressed Vehicle. * Opposing Direction Relay Vehicle OBU issues caution to driver upon receipt of DNM. * RSU receives DNM from Opposing Direction Relay Vehicle at least 300 meters before reaching RSU. * TRAC receives DNM and issues distress notification message to operator. * Same Direction Following Vehicle receives DNM from Opposing Direction Relay Vehicle	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
			DNM, and continues relaying DNM to vehicles approaching from same direction as Distressed Vehicle for a configurable distance or time. * Opposing Direction Relay Vehicle continues relays DNM to Same Direction Following Vehicle before it is within communication range of Distressed Vehicle. * Same Direction Following Vehicle continues to the nearest RSU, where it uploads DNM, and continues relaying DNM to Opposing Direction Vehicles for a configurable distance or time. (Note: Distressed Vehicle shall be over 5 miles downstream from RSU to enable Opposing Direction Relay Vehicle to cease broadcasting DNMs and go silent after 5 miles (or configurable distance), and prior to encountering the RSU for upload of the DNM.)	at least 300 meters before reaching Opposing Direction Relay Vehicle. * Same Direction Following Vehicle issues caution to driver a configurable distance before reaching Distressed Vehicle. * Same Direction Following Vehicle relays DNM to Opposing Direction Vehicles for a configurable distance or time from Distressed Vehicle. * Verified by inspection of logs.	
On Road Shakedown Test Procedure and Test Cases					
WSHKR-1	OBU Shakedown	Perform baseline DSRC communication range test on all vehicles, followed by repetition periodically and after	* Setup vehicle communication range test site on I-80 incorporating an OBU (in a simulated vehicle) and an RSU, each capturing vehicle BSMs. * Schedule each vehicle to	A configurable threshold percentage of BSMs are received and processed by RSU when vehicle is at least 300 meters away. * A configurable threshold	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
		severe weather deployments (WYDOT Maintenance Vehicles) to verify OBU functionality and performance during shakedown test period. * Inspection and troubleshooting is recommended when failure or reduced performance is found, to identify and remediate problems prior to full deployment.	pass test site independently and determine minimum V2V and V2I communication range for each. * Separation distance at which a configurable threshold percentage of BSMs sent are received and logged by test OBU and RSU is recorded as baseline for subsequent vehicle performance assessment.	percentage of BSMs are received and processed by remote vehicle OBU when vehicle is at least 300 meters away. * Inspection and troubleshooting is recommended for any OBU failing this test or demonstrating significantly reduced performance from baseline to identify and remediate problems prior to full deployment.	
WSHKR-2	RSU and Backhaul Communications Shakedown	* Perform baseline DSRC communication range test on all RSUs, followed by repetition periodically and after severe weather events to verify RSU functionality and performance during shakedown test period. * Inspection and troubleshooting is recommended when failure or reduced	* Host (WYDOT maintenance) vehicle approaches each RSU broadcasting BSMs, uploading log files and capturing TIMs via DSRC. * Separation distance at which a configurable threshold percentage of I2V TIM and V2I BSM and log file sent are received is recorded as baseline for subsequent RSU performance assessment.	* A configurable threshold percentage of I2V TIMs sent from the RSU to the OBU and a configurable threshold percentage of V2I BSMs sent from the OBU to the RSU at a range of at least 300 meters are received. All log files are received. * Inspection and troubleshooting is recommended for any RSU failing this test or demonstrating significantly reduced performance from baseline, to identify and remediate problems prior to full deployment.	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
		performance is found, to identify and remediate problems prior to full deployment.			
WSHKR-3	I-80 Satellite TIM coverage	Verify and baseline the satellite-to-OBU TIM coverage across I-80.	* Test engineers identify at least 10 locations along I-80 remote from RSU coverage. * Host (WYDOT maintenance) vehicle visits each site, capturing TIMs via satellite communications and recording the percentage of TIMs sent that are received.	* A configurable threshold percentage of Satellite TIMs sent are received at each of the selected locations.	
WSHKR-4	Verify I80 geofence map	Verify that map used for geofence generation accurately follows I-80 and will support accurate I2V SA message display.	* BSMs are logged from WYDOT Maintenance vehicles traveling I80.	* BSM location results are analyzed to verify that they fall on I80 geofence map. * Inspection and troubleshooting is recommended for map location in which BSMs fall more than one lane distance outside geofence map, to identify and remediate problems prior to full deployment.	
Installation Robustness and Quality Control Test Cases					
WINSTQ-1	OBU Installation Robustness	Verify nominal OBU hardware installation robustness and ruggedness	* Install and remove OBU in vehicle 5 times.	* OBU shall pass the following two test cases after fifth installation * WV2VMCT-1 V2V exchange of BSMs * WV2IMCT-2 V2I & End-to-end communication of BSMs	
WINSTQ-2	RSU Installation Robustness	Verify nominal RSU hardware installation robustness and ruggedness	* Install and remove RSU on pole 3 times.	* RSU shall pass the following two test cases after third installation * WV2IMCT-2 V2I & End-to-end communication of BSMs	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
				* WI2VMCT-1 End-to-end & DSRC Delivery of I2V SA TIMs	
WINSTQ-3	OBU Installation Quality Control	Verify the functionality and performance of an OBU and antenna after installation in a vehicle	* Installation in a vehicle.	* OBU shall pass the following two test cases after installation * WV2VMCT-1 V2V exchange of BSMs * WV2IMCT-2 V2I & End-to-end communication of BSMs	
WINSTQ-4	RSU Installation Quality Control	Verify the functionality and performance of an RSU and antenna after installation on a roadside structure.	* Installation on a roadside structure.	* RSU shall pass the following two test cases after installation * WV2IMCT-2 V2I & End-to-end communication of BSMs * WI2VMCT-1 End-to-end & DSRC Delivery of I2V SA TIMs	
Pilot System Test Procedure and Test Cases					
WSYSAA-1	WYDOT CV Pilot System Monitoring and Availability	Demonstrate Wyoming CV System availability monitoring and ITS Maintenance team notification.	* Disable or simulate unavailability of Wyoming CV System * Disable or simulate unavailability of Wyoming CV System monitored function. * Disable or simulate unavailability of Wyoming CV System subsystem. * Disable or simulate unavailability of Wyoming CV System external interface. * Simulate disk space under 10% availability	* Wyoming CV System sends alert to the WYDOT ITS Maintenance team within five minutes of a system becoming unavailable.	
WSYSAA-2	System Administration Demonstration Test Case	Demonstration System Administration functionality	* Demonstrate TMC administrator adding equipment to internal inventory list * Demonstrate TMC administrator editing equipment	* Inspect the System Logs and verify * Adding equipment to internal inventory list * editing equipment in internal	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
			in internal inventory list * Demonstrate TMC administrator deleting equipment in internal inventory list * Demonstrate TMC administrator testing the RSUs by allowing a series of Python testing scripts to be run on an RSU and inspecting results of the test returned to the user. * Demonstrate Wyoming CV System provides the TMC administrator the geolocation of all RSUs. * Demonstrate Wyoming CV System provides the TMC administrator the ability to push out updates to the RSU firmware.	inventory list * deleting equipment in internal inventory list * testing the RSUs by allowing a series of Python testing scripts to be run on an RSU. * the geolocation of all RSUs. * the ability to push out updates to the RSU firmware.	
External Systems Support Test Procedures and Test Cases					
WEXTSS-511	Truck Parking Information Entry and Delivery	Verify the accurate capture and dissemination of truck parking information via the WYDOT 511 App.	* Driver in host vehicle located at a truck parking area enters truck parking status.	* Driver in remote vehicle located upstream of parking area receives correct truck parking status within 15 minutes of entry by host vehicle driver.	
WEXTSS-CAM	Pikalert Camera Imagery	Demonstrate Pikalert receives camera imagery from the TMC File Transfer Protocol (FTP) server	* Demonstrate Pikalert Web Interface.	* Pikalert Web Interface displays camera imagery.	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
WEXTSS-SCMSCRL	WYDOT CV System Misbehavior and CRL support	Verify Wyoming CV System misbehavior reporting and CRL support. (*Note Misbehavior Report and CRL not currently supported by SCMS)	* Remote Vehicle system simulates misbehavior sufficient to be placed on CRL. * Wyoming CV System detects misbehavior and sends report to the USDOT SCMS * Host Vehicle detects misbehavior and sends report to the USDOT SCMS * Wyoming CV System downloads CRL from USDOT SCMS * Host Vehicle downloads CRL from USDOT SCMS * Wyoming CV System rejects message from Remote Vehicle on CRL * Host Vehicle rejects message from Remote Vehicle on CRL	* Wyoming CV System detects misbehavior by Remote Vehicle * Wyoming CV System sends misbehavior reports to the USDOT SCMS within 24 hours after detection * Wyoming CV System downloads the CRL from the USDOT SCMS * Wyoming CV System rejects messages received from Remote Vehicle on the current CRL. * Host Vehicle detects misbehavior by Remote Vehicle * Host Vehicle detects sends misbehavior reports to the USDOT SCMS * Host Vehicle detects downloads the CRL from the USDOT SCMS * Host Vehicle detects rejects messages received from Remote Vehicle on the current CRL.	
WEXTSS-OTA	OBU over the air updates	Verify OBU Over the Air Update	* Perform an OBU over the air update.	* Vehicle System receives and successfully performs update. * OTA requirements are satisfied.	
WEXTSS-RSUFIRM	RSU Firmware update	Verify RSU firmware update initiated by the TMC administrator.	* Perform an RSU firmware update initiated by the TMC administrator.	* RSU receives and successfully performs update. * Firmware update requirements are satisfied.	
Pilot Components Documentation Test Cases					
WOBUDOC-1	Inspection of OBU Certification and Test Documents	Verify OBU and HMI requirements are satisfied by vendor certification and test documentation.	None.	* OBU requirements are satisfied.	

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID
WOBUDOC-2	Inspection of Environmental Sensor Certification and Test Documents	Verify Environmental Sensor requirements are satisfied by vendor certification and test documentation.	None.	* Environmental Sensor requirements are satisfied.	
WRSUDOC-1	Inspection of RSU Certification and Test Documents	Verify RSU requirements are satisfied by vendor certification and test documentation.	None.	* RSU requirements are satisfied.	
WODEDOC-1	Inspection of ODE Design and Test Documents	Verify ODE requirements are satisfied by developer design and test documentation.	None.	* ODE requirements are satisfied.	
WDWDOC-1	Inspection of DW Design and Test Documents	Verify DW requirements are satisfied by developer design and test documentation.	None.	* DW requirements are satisfied.	

3.5.2 Integration of Test Cases into Test Procedures

Implementation of Test Procedures and Test Cases in this program is best illustrated by Table 4-1 which lists each of the Test Procedures and Test Cases detailed later in this document.

3.5.3 Requirements Verification Methodology

Most tests described in this plan are performed at the WYDOT CV Pilot System Level. Individual component level testing is performed by vendors and by WYDOT Team member component developers. Vendors are required by the team to show certification and test results to verify that they conform to USDOT and industry specifications and to component level requirements, particularly for the OBU and the RSU.

WYDOT Team member applications are developed using the Agile methodology in which functions and features are developed and tested incrementally. As a consequence of the Agile development methodology, the test strategy used here is focused on end-to-end system level testing to verify end-to-end functionality and performance after all features and functions are implemented. WYDOT Team members developing applications are responsible for testing their applications and verifying that they meet their component level requirements as part of their development and integration process. Because of the compact and efficient nature of the WYDOT CV Pilot, application developers will be participating in the system level testing defined here. While not expected, any issues with applications found during test procedures and test cases defined here can be readily resolved by the embedded developer team members.

Chapter 5 of this document describes each system requirement from the WYDOT CV Pilot is planned to be verified by the Team. Tables in Chapter 5 summarize each Test Case, the driving scenario, the post-test analysis and documentation that is planned confirm each requirement is satisfied. In addition, each of the test procedures and test cases in Section 4 provides further details and specifics concerning verification of each requirement as part of the Test Case.

Review of the requirements verification methodology in Chapter 5 shows that, in most cases, WYDOT CV Pilot system requirements can be fully verified by system level testing. The primary exceptions are OBU and RSU Core Requirements, which are the responsibility of the vendor to verify provide supporting documentation. Inspection of component level requirements such as those on the ODE, Pikalert, DB, and DW, deal primarily with message handling and transfer. Review of the requirements verification methodology further shows that these component level message handling requirements and their system level counterparts can be verified by inspection of their respective logs following these system level test cases.

3.5.4 Test Procedure and Test Case Outlines

Chapter 4 provides the detailed Test Procedure and Test Case description for each of these elements summarized in Table 4-1. Each Test Procedure is organized into six tables.

Table (Test Procedure ID)[3]-SUM for each procedure is a high-level summary of the Test Cases addressed in this Test Procedure, providing an orientation for the reader, describing

- Test Case ID
- Test Case Title

[3] Table "numbering" uses "(Test Procedure ID)" and "(Test Case ID)" to clearly identify for test engineers the Test Procedure and Test Case the table applies to.

- Test Case Objective
- Test Case Input (Driving Scenario)
- Test Case Expected Result (Pass/Fail Criterion)
- Integrated Test Case ID
- Requirements Verified

Table (Test Procedure ID)-TP for each procedure describes the Test Procedure itself, including

- Test Procedure ID
- Test Procedure Name
- Test Procedure Completion Date
- Priority
- Objectives
- Relationship to Other Procedures
- Discussion, Guidance, and Rationales
- Test Cases Performed under This Procedure

The rightmost column in the table is blank in this test plan and will be filled in with results and remarks by test engineers during and after performance of the test procedure.

Table (Test Procedure ID)-CI for each Test Procedure describes the configuration of each component of the WYDOT CV Pilot System during conduct of the Test Procedure and the Initialization to be performed for each component prior to conducting the Test Cases.

Table (Test Case ID)-Description defines the specifics of each Test Case to be performed, including, generically,

- Test Case ID
- Test Case Name
- Test Case Completion Date
- Priority
- Requirements Verified (Tracing)
- Objective
- Preconditions
- Test Case Inputs including
  - o Back office message
  - o Remote Vehicle driving scenario
  - o Host Vehicle driving scenario
- Test Case Output including
  - o Driver alerts and advisories displayed
  - o Information to be captured by log file inspection and analysis
- Expected Result (Pass/Fail Criteria)
- Detailed Test Execution Steps

Note that Detailed Test Execution Steps are generic at this time. They will be replaced by detailed execution steps developed by test staff during dry runs. They will be reported as part of the Operational Readiness Test Report.

Table (Test Case ID)-Results is the table wherein Test Engineers capture test case results from each repetition of the test case and their pass/fail assessment. This table defines the specifics of each Test Case to be performed, including, generically

- Test Case ID

- Test Case Name
- Test Case Completion Date
- Driver Advisory/ Warning Visual Results
- Log Analysis Test Case Log File Analysis Results
- Test Case Analysis Tables
- Test Case Pass/Fail Assessment

The rightmost column in the table is blank in this test plan and will be filled in with results and remarks by test engineers during and after performance of the test case.

Table (Test Case ID)-Requirements describes the Post-Test Requirements Verification Methodology for each Test Case, including

- Verification Test Case ID and Name
- Requirement ID and Name
- Requirement Description
- Requirement Verification Methodology
- Test Engineer Verification and Remarks and Confirmation Requirement is Verified

3.5.5 Test Case Host and Remote Vehicle OBU identifiers

The WYDOT Team is implementing this CV Pilot using OBUs from two different vendors, Lear and Sirius XM.[4] The same testing and requirements verification need to be carried out separately for each of the OBUs. Test Case tables are repeated with separate (L) identifier suffix for Lear and (S) identifier suffix for SiriusXM in the table label. While the information is also contained in the body of the Test Case, the identifiers are also included in the table label for ease of navigation in the document. Test Cases with a single, host, vehicle such as WI2VSAT-5-L and WI2VSAT-5-S, are the same general test case, but the first is conducted using a Lear OBU in the Host Vehicle and the second is conducted using a SiriusXM OBU in the Host Vehicle. In test cases with a Host and Remote Vehicles, there are two letters in the suffix (LL, LS, SL) in which the first letter indicates the Remote Vehicle OBU and the second letter indicates the Host Vehicle OBU. In one case the letters “MVL” are used to indicate that the remote vehicle is a WYDOT Maintenance Vehicle, for special communication test cases in which the size of the Maintenance Vehicle may interfere with DSRC communications.

3.6 Test Locations

For convenience and cost management, testing outlined here will be performed in Wyoming or Colorado. Test cases outlined here consist of tests to performed on a “test track” and/or ‘on road”, likely on I-80 across Wyoming and on I-25 between Ft. Collins Colorado and Cheyenne Wyoming. The specific locations and their layout will be selected by test staff during dry runs. They will be reported as part of the Operational Readiness Test Report.

3.6.1 Controlled Environment Track Locations

Track testing is conducted with moving vehicles to verify wireless communications performance and applications performance that are influenced by vehicle motion and dynamics, particularly those that cannot be performed safely in operational traffic environments. Track testing includes

[4] The WYDOT Team is implementing this CV Pilot using RSUs from a single vendor, Lear.

all tests that require vehicles to move freely without obstruction and those that require significant, unobstructed distance between OBUs and/or RSUs.

The “track” used for conducting these test cases can be any controlled access flat, pavement area, free of obstruction to vehicle travel and to radio communications. The track area should be large enough to enable vehicles to accelerate from 0 to 35 mph, perform a driving scenario or maneuver, and then decelerate safely to a stop. The track area should also be free of potential radio interference to the degree possible.

When they can be performed safely, track testing may be performed on open roadways that are relatively flat, without major traffic, or major obstruction.

For the track testing, the facilities and roads within the Laramie County Fairgrounds have been selected, see Figure 3-6. Prairie Center Circle is a good track for tests which simulate in-cab display of weather, work zone, and other advisories and alerts to the driver at the right time and location as a car, a snow plow, and a tractor-trailer traverse the roadway. Additionally, Archer Parkway is a good location for testing forward collision warning in cars approaching slow moving snowplows. Parking areas within the location support preparation and staging of vehicles. In addition, the classrooms and other facilities at the Cheyenne/Laramie County Emergency Management Agency are very helpful for supporting meetings and guests during testing.

3.6.2 On-road Test Locations

On-road testing is performed to verify message communications and applications performance in operational traffic environments with the RSU infrastructure deployed along I-80. On-road test cases are designed to baseline DSRC and satellite communications performance on I-80, followed by periodic repeats during shakedown period to confirm RSU and other component performance and durability, particularly after heavy wind and weather events. The specific locations and their layout has not determined at the time this draft of the document was developed, but it is likely that these will take place on I-80 near Cheyenne and on I-25 south of Cheyenne.

Figure 3-6. Satellite view of Laramie County Fairgrounds (Source: WYDOT through Google Earth)

3.7 Participating Vehicles

Four categories of connected vehicles will participate in WYDOT CV Pilot tests.

- Highway patrol vehicles with Lear Roadstar OBU and Lear FCW application
- Retrofit trucks with SiriusXM OBU and Sirius FCW and I2V SA applications
- Integrated commercial vehicles with Lear Roadstar OBU and Lear FCW, Distress Notification, and I2V SA applications
- WYDOT Maintenance Vehicles (including snowplows) with Lear Roadstar OBU and Lear FCW, Distress Notification, and I2V SA applications

Each of these categories of vehicles with OBU and applications will be included in one or more of the Test Cases detailed in Chapter 4. Specifics are identified in each Test Case.

Because communications performance depends upon the design and engineering of OBUs, RSUs, and their antennas, selected test cases in the End-to-end Message Communication Test Cases will be performed for each vendor's OBU/antenna configuration and each vendor's RSU/antenna configuration.

Because applications performance can depend upon design and engineering of the application, End-to-end Applications Performance Test Cases must be performed for each vendor's applications. Because V2V DSRC performance depends significantly upon OBU and antenna design, as well as vehicle geometry, V2V applications will be tested for WYDOT Maintenance Vehicles.

3.8 Applications under Test

Because tests described here are end-to-end tests of the WYDOT CV Pilot system, they will be conducted with the complete applications described in the SDD, configured for full operations. These include:

- Forward Collision Warning
- Distress Notification
- I2V Situational Awareness
  - Spot Weather Impact Warning from Pikalert
  - Work Zone Warning from Construction Administration
  - Variable Speed Limit from WYDOT Traveler Administration
  - Incident Information from Incident Console
  - Road Condition from Road Condition Reporting System
  - Truck Parking from WYDOT 511 Smart Phone Application

3.9 Test Rationales

Where possible, rationales are provided for specific test parameters such as driving speeds. CV Pilot is still evolving and standards which could normally be relied upon to define test parameters don't yet exist. In most cases, this is the first or second time that the components under test here have been deployed to field environments. There isn't a sufficient history to leverage to justify selected parameters, beyond best engineering judgement.

3.9.1 Number of Test Case Repetitions

Passing most Test Cases described in this document requires that the first 5 out of 5 repetitions meet the individual Test Case expected result pass/fail criteria or the first 9 out of 10 repetitions meet the criteria. This approach is based upon best engineering judgement balanced with practicality of what can be practically tested in vehicles on track or on-road test environments.

Wells and Berg (2014) and Bogard (2014) required passing 4 out of 5 repetitions or 80% for each Test Case when testing V2V safety applications on trucks prior to deployment in the Safety Pilot Model Deployment. For the WYDOT CV Pilot, 90 percent passage rate has been adopted, in the desire for improved reliability for this deployment. Accepting 5 out of 5 as a pass has been adopted as an acceptable balance of resources and test repetitions.

As noted, this is the first or second time that the components under test here have been deployed to field environments. There isn't sufficient history with these systems to justify a statistically derived methodology for Test Case repetitions. In many cases achieving 90 percent pass rate in these Test Cases is a significant achievement.

3.9.2 Configurable threshold percentage of BSMs, DNMs and I2V SA TIMs received

For these series of test cases, the WYDOT team requires a criterion for DSRC communication range that can be readily computed from data captured in system logs. For planning purposes, prior to conducting the tests, the WYDOT team had defined a criterion based upon percentage of BSMs, DNMs, and I2V SA TIMs received versus those sent. This is loosely based upon the SAE J2945/1 definition of packet error ratio in section 6.3.8 as the number of missed BSMs from a remote vehicle divided by the expected number of BSMs for a remote vehicle during a window in time. The percentage value to use for this criterion has not been defined. During system and development testing, engineers will be required to empirically determine a percentage threshold for BSM and DNM transmissions which are reliable indicators of DSRC communication performance necessary to support WYDOT CV applications. If this testing suggests an alternative criterion is more reliable and repeatable and easier to compute from system logs, then this criterion may be revised throughout this test plan by test engineers.

3.10 Test Tools

No specialized test tools are planned for conducting these tests. Results of most tests will be confirmed through inspection of logs from relevant components or inspection of the contents of relevant databases.

3.11 Test Schedule

As illustrated in Figure 3-5, tests outlined here will be performed after system development is fully completed, including integration of SCMS and HSM. Consequently, these Test Cases are largely independent and may be performed in any order that is convenient for test conductors and participants. Tests may be combined at the discretion of the Test Engineer when it can be confirmed that they do not interfere with each other and the pass/fail outcomes will be clearly delineated. More specifics are provided with each Test Procedure.

3.12 Test Personnel

All Test Procedure and Test Cases defined within this document will be performed by the WYDOT CV Pilot Team and/or its vendors.

3.13 Participation

U.S. DOT representatives are welcome to witness any testing conducted by the team, but the schedule and location for this testing will be at the discretion of the WYDOT Test Team. As described in the Attachment C WYDOT CV Pilot Operational Readiness Demonstration Plan, selected test cases will be repeated for the USDOT and its Noblis support team in a Demonstration Event.

3.14 Security

The WYDOT CV Pilot Team developed a detailed Security Management Operating Concept (SMOC) during Phase 1 of the program. The SMOC describes, at a high level, the elements to be implemented to meet system security and address how this pilot will use the Security Credential Management System (SCMS) for proposed applications. As described in the Operational Readiness Plan, security will be tracked and reported through verification of security and SCMS requirements by inspection and by security compliance inspection of each component and each interface (data encryption, transport encryption, signature validation, etc.).

3.15 Pretest Checkout

Prior to the test, all components will be checked out individually and as a system to verify their functionality and performance on the track and on road. Prior to the test, several different types of checks will be performed to ensure that the test can be conducted safety, the equipment will operate properly, and that data to support the Performance Measurement and Independent Evaluator will be captured.

3.16 Safety Checklist

There will be multiple vehicles moving at a high rate of speed during tests, which greatly increases the risks for an adverse incident. WYDOT will assign a Safety Officer for the duration of the test, who will have the responsibility for coordinating all elements of the demonstration and the full authority to halt the test at any time for any reason if they believe that there is a safety risk. To further mitigate these risks, the following safety checklist will be exercised immediately prior to the execution of a test.

- Verify that all drivers, and test coordinators have working operational radio's or similar devices for two-way communication to the Safety Officer.
- Verify that safety vests or other approved uniforms for traffic incidents are being worn by all participants and observers who are outside of a vehicle.
- Verify an "all-clear" status of the track prior to initiation of any vehicle lap on the track
- All Observers and Participants are accounted for and are at the appropriate position/location for the test.
- Perform a safety briefing for all Observers and Participants.
- Verify that all vehicles are in full operational condition.
- Verify weather conditions support the demonstration (i.e., no lightning and visibility issues)
- Verify that the appropriate equipment for convenience and safety is available including:
    - Water for participants and observers
    - Bathroom accommodations for participants and observers
    - Fire extinguishers
    - Shelter from adverse weather events
    - Rendezvous point should a site evacuation be needed.

4 Detailed Operational Readiness Test Procedure and Test Case Descriptions

This chapter provides the templates of the different Test Procedures and Test Cases that form part of this ORTP document. For convenience to the reader, this chapter has been divided into independent documents that detail the specifics of the test procedures and test cases, as presented in Table 4-1.

Table 4-1. List of WYDOT CV Pilot Test Procedures and Test Cases by Test Plan Documents

Test Plan Document	Test Procedure	Test Cases
B.1	WV2VMCT – V2V Message Communications	• Integrated with other Test Procedures below
B.2	WV2IMCT-TP -- V2I Message Communications	• WV2IMCT-3 - V2I & End-to-end communication of Environmental Sensor Data
B.3	WI2VMCT-TP -- I2V Message Communications	• WI2VMCT-3 - Simultaneous DSRC Upload/Download of messages and log files
B.4	WFCWT-TP -- Forward Collision Warning	• WFCWT-1 - FCW Stopped Vehicle Ahead *including* o WV2VMCT-1 - V2V exchange of BSMs o WV2IMCT-2 - V2I & End-to-end Communication of BSMs o WV2IMCT-4 - V2I & End-to-end communication of log files • WFCWT-2 - FCW Passing Stopped Vehicle • WFCWT-3 - FCW Steady State • WFCWT-4 - FCW Braking Vehicle Ahead • WFCWT-5 - FCW Stopped Vehicle in a Curve • WFCWT-6 - FCW Passing Stopped Vehicle in a Curve • WFCWT-7 - FCW Obstructed Vehicle Ahead • WFCWT-8 - FCW Slow Moving Vehicle • WFCWT-9 - Simultaneous Message Prioritization
B.5	WI2VSAT-TP -- I2V Situational Awareness	• WI2VSAT-1-REP - Message Display in Travel Lanes – Representative *including* o WI2VMCT-1 - End-to-end & DSRC Delivery of I2V SA TIMs • WI2VSAT-1-Pikalert - Message Display in Travel Lanes - Pikalert • WI2VSAT-1-511 - Message Display in Travel Lanes - 511 • WI2VSAT-1-RCRS - Message Display in Travel Lanes - RCRS • WI2VSAT-1-IC - Message Display in Travel Lanes - IC

Test Plan Document	Test Procedure	Test Cases
		• WI2VSAT-1-CA - Message Display in Travel Lanes - CA • WI2VSAT-1-WTI-Speed - Message Display in Travel Lanes - WTI Speed • WI2VSAT-1-WTI-Restriction - Message Display in Travel Lanes - WTI - Restriction • WI2VSAT-1-WTI-DMS - Message Display in Travel Lanes - DMS • WI2VSAT-1-WTI-Closure - Message Display in Travel Lanes - Closures • WI2VSAT-2 - Message Display in Shoulder Lanes • WI2VSAT-3 - Message Display on Adjacent Service Road • WI2VSAT-4 - I2V SA - Message Display Perpendicular to Travel Lanes • WI2VSAT-5 - Message Display in Travel Lanes sent via Satellite o WI2VMCT-2 - End-to-end & Satellite Delivery of I2V SA TIMs • WI2VSAT-6 - Message Display in Opposing Travel Lanes • WI2VSAT-7 - Simultaneous DSRC and Satellite I2V SA TIMs communications • WI2VSAT-8 - Message Display Start Time • WI2VSAT-9 - Message Display Stop Time

B.6	WDNR-TP -- Distress Notification	• WDNR-1 - Same Direction Distress Notification relay to RSU *including*
		  o WV2VMCT-2 - V2V exchange of DNMs
		  o WV2IMCT-1 - V2I and End-to-end communication of DNMs
		  o WDNT-1 - Manual Distress Notification
		• WDNR-2 - Opposite Direction Distress Notification relay to RSU and Following Vehicle

B.7	WSHKR-TP -- On-road Shakedown	• WSHKR-1 - OBU Shakedown • WSHKR-2 - RSU and Backhaul Communications Shakedown • WSHKR-3 - I-80 Satellite TIM coverage • WSHKR-4 - Verify I80 geofence map
B.8	WINSTQ-TP -- Installation Robustness and Quality Control	• WINSTQ-1 - OBU Installation Robustness • WINSTQ-2 - RSU Installation Robustness • WINSTQ-3 - OBU Installation Quality Control Test Cases • WINSTQ-4 - RSU Installation Quality Control Test Cases
B.9	WSYSAA-TP -- Pilot System Availability and Administration	• WSYSAA-1 - WYDOT CV Pilot System Unavailable Notification • WSYSAA-2 - System Administration Demonstration Test Case

Test Plan Document	Test Procedure	Test Cases
B.10	WEXTSS-TP -- External Systems Support	• WEXTSS-511 - Truck Parking Information Entry and Delivery • WEXTSS-CAM - Pikalert Camera Imagery • WEXTSS-SCMSCRL - WYDOT CV System Misbehavior and CRL support (*Note Misbehavior Report and CRL not currently supported by SCMS) • WEXTSS-VCRL - Vehicle Systems CRL support (*Note CRL not currently supported by SCMS) • WEXTSS-OTA - OBU over the air updates • WEXTSS-RSUFIRM - RSU Firmware update
B.11	WSYSDOC-TP Pilot Components Documentation	• WOBUDOC-1 - Inspection of OBU Certification and Test Documents • WOBUDOC-2 - Inspection of Environmental Sensor Certification and Test Documents • WRSUDOC-1 - Inspection of RSU Certification and Test Documents • WODEDOC-1 - Inspection of ODE Design and Test Documents • WDWDOC-1 - Inspection of DW Design and Test Documents

5 Glossary and Acronyms

Table 5-1 list the terms used in this document and their respective definitions.

Table 5-1. Glossary of Terms.

Term	Definition
Basic Safety Message	Connected V2V safety applications are built around the capability to transmit BSMs, following the Society of Automotive Engineers (SAE) J2735 standard. The BSM is transmitted over DSRC over a range of approximately 300 meters. In general, BSMs are broadcast frequently to provide connected vehicles with data content necessary for the different safety-oriented applications. The BSM is divided into two parts: • Part I, transmitted approximately 10 times per second, contains the core data elements: Message Count, Temporary ID, Time (through a Second Mark), Latitude, Longitude, Elevation, Positional Accuracy, Transmission State, Speed, Heading, Steering Wheel Angle, Acceleration, Brake System Status, and Vehicle Size. • Part II, transmitted less frequently, is added to Part I depending on events (e.g., Anti-lock Braking System (ABS) activated) and contains a variable set of data elements drawn from many optional data elements (availability by vehicle model varies)
Broadcast	Sharing data with no specific destination. All broadcast data is sent unencrypted but is signed with a certificate (based on the Institute of Electrical and Electronics Engineers (IEEE) standard 1609.2).
Data	Data is raw (unorganized and unprocessed) digital messages sent between components. From SAE J2735: Representations of static or dynamic entities in a formalized manner suitable for communication, interpretation, or processing by humans or by machines.
Data Ingest	Obtaining and importing data for use or storage.
Host Vehicle	A connected vehicle that receives messages from a remote vehicle. In this document, the host vehicle is also used to describe the originator of a vehicular transmission of information to an RSU.
Information	Processed data that is organized, structured or presented in a given context to make it useful
Independent Evaluator	USDOT-sponsored evaluators that will focus on measures not covered by the Wyoming team's evaluation, impacts of larger scale CV deployments, and national programmatic aspects of this CV Pilot project, combined with other similar projects being conducted. The IE works to understand how the project outcomes can contribute to the future of the CV Program nationally.
Message	A well-structured set of data elements and data frames that can be sent as a unit between devices to convey some semantic meaning in the context of the applications (adapted from SAE J2735).
On-Board Unit	This represents the package of DSRC radios, computing, sensors and HMI that will be installed on a vehicle. This is similar to the Retrofit Safety Device used in the Safety Pilot Program.
Receive Data	A connected device accepts a data package broadcast or transmitted by another connected device.
Remote Vehicle	A connected vehicle that periodically and dynamically broadcasts a message about its general situation to a host vehicle.
Requirements	Set of information necessary to accomplish one action.
Roadside Units	This represents the package of DSRC radios, computing, communications that will be installed on the roadside on I-80

Term	Definition
WYDOT Road Segment	A road segment is defined as a link in Traffic Management Data Dictionary (TMDD) v3.03c: a roadway or transit right-of-way between two nodes. WYDOT has implemented road segments to fully cover I-80 in both directions.
Transmit	Sharing data directed to a specific receiver. In the case of transmission between Systems, all transmitted data is signed and encrypted, where required, based on SAE J2945/1.
Transportation Management Center	Center that collects information and informs the public about changing travel conditions.
WGS-84	Latest revision of the standard for use in cartography, geodesy, and navigation including by global positioning systems (GPS).

Table 5-2. Acronym List.

Acronym/ Abbreviation	Definition
ABS	Anti-lock Braking System
BSM	Basic Safety Message
DB	Data Broker
DW	Data Warehouse
CA	Construction Administration
CAN bus	Controller Area Network bus
ConOps	Concept of Operations
CRL	Certificates Revocation List
CV	Connected Vehicle
CVOP	Commercial Vehicle Operator Portal
CVRIA	Connected Vehicle Reference Implementation Architecture
DMS	Dynamic Message Signs
DN	Distress Notification
DOT	Department of Transportation
DSRC	Dedicated Short Range Communications
E2E	End-to-end
ESS	Environmental Sensor Station
FCW	Forward Collision Warning
FHWA	Federal Highway Administration
GIS	Geographic Information System
GPS	Global Positioning System
HMI	Human-Machine Interface
I2V	Infrastructure-to-vehicle
I-80	Interstate 80
IC	Incident Console
ICD	Interface Control Document
IE	Independent Evaluator
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IRB	Institutional Review Board
ISO	International Organization for Standardization

Acronym/ Abbreviation	Definition
ITIS	Integrated Transport Information System
ITS	Intelligent Transportation System
LTS	Location and Time Service
MAP	Mapping for Intersection
MoU	Memorandum of Understanding
NCAR	National Center for Atmospheric Research
NWS	National Weather Service
OBU	On-Board Unit
ODE	Operational Data Environment
OSADP	Open Source Application Development Portal
RCRS	Road Condition Reporting System
RSU	Roadside Units
RWH	Road Weather Hazard
RWIS	Road Weather Information System
SAE	Society of Automotive Engineers
SCMS	Security Credential Management System
SDW	Situation Data Warehouse
SET-IT	Systems Engineering Tool for Intelligent Transportation
SPaT	Signal Phase and Timing
SSP	Satellite Service Provider
SWIW	Spot Weather Impact Warning
SyRS	System Requirements Specification
TIM	Traveler Information Message
TMC	Transportation Management Center
TMDD	Traffic Management Data Dictionary
TPI	Third-Party Interface
TRAC	Transportation Reports and Action Console
UoW	University of Wyoming
V2I	Vehicle-to-infrastructure
V2V	Vehicle-to-vehicle
VSL	Variable Speed Limit
WHP	Wyoming Highway Patrol
WYDOT	Wyoming Department of Transportation
WTI	Wyoming Traveler Information system
WZW	Work Zone Warning

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FHWA-JPO-17-472B

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Connected Vehicle Pilot Deployment Program Phase 2

Operational Readiness Plan – WYDOT CV Pilot

Attachment B - Operational Readiness Test Plan

Appendix A - Requirements Verification Methodology

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Final Report — July 30, 2018
FHWA-JPO-17-472B

U.S. Department of Transportation

Produced by DTFH6116H00027

U.S. Department of Transportation

Notice

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA-JPO-17-472B		

4. Title and Subtitle Connected Vehicle Pilot Deployment Program Phase 2, Operational Readiness Plan – WYDOT CV Pilot Attachment B - Operational Readiness Test Plan Appendix A - Requirements Verification Methodology	**5. Report Date** Final 3/16/2018 **6. Performing Organization Code**
7. Author(s) Denny Stephens (Vital Assurance), Tony English (Trihydro), Nayel Ureña Serulle (ICF), Deepak Gopalakrishna (ICF), Vince Garcia (Wyoming DOT)	**8. Performing Organization Report No.** Task 2G Operational Readiness Test and Demonstration Planning Report Number T2G.02.01
9. Performing Organization Name and Address Wyoming DOT, 5300 Bishop Boulevard, Cheyenne, WY 82009 ICF International, 1725 Eye St NW, Washington DC, 20006 Trihydro Corporation, 1252 Commerce Drive, Laramie, WY 82070 Vital Assurance, 175 S. Third St., Suite 200, Columbus, OH 43215	**10. Work Unit No. (TRAIS)** **11. Contract or Grant No.** DTFH6116H00027
12. Sponsoring Agency Name and Address U.S Department of Transportation 1200 New Jersey Ave, SE Washington, DC 20590	**13. Type of Report and Period Covered** Operational Readiness Plan, 09/01/2016 to 3/16/2018 **14. Sponsoring Agency Code**

15. Supplementary Notes
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16. Abstract

The Wyoming Department of Transportation's (WYDOT) Connected Vehicle (CV) Pilot Deployment Program is intended to develop a suite of applications that utilize vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communication technology to reduce the impact of adverse weather on truck travel in the I-80 corridor. These applications support a flexible range of services from advisories, roadside alerts, parking notifications and dynamic travel guidance. Information from these applications are made available directly to the equipped fleets or through data connections to fleet management centers (who will then communicate it to their trucks using their own systems). The pilot will be conducted in three Phases. Phase 1 includes the planning for the CV pilot including the concept of operations development. Phase 2 is the design, development, and testing phase. Phase 3 includes a real-world demonstration of the applications developed as part of this pilot.

This document is Appendix A of the WYDOT CV Pilot Operational Test Plan which is Attachment B to the Operational Readiness Plan (ORP) for The WYDOT CV Pilot project for the United States Department of Transportation's (USDOT) CV program. The purpose of this document is to detail which methodology will be used to verify each system requirement.

17. Key Words	18. Distribution Statement
Connected Vehicle Technology, I-80 Corridor, Road Weather, Truck Safety, System Architecture	This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
None	None	280	NA

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

Acknowledgements

The Operational Readiness Plan development team would like to thank USDOT and Noblis for their technical assistance throughout the development of this document.

1 Requirements Verification Methodology Table

This document is one of two appendices (A and B) that characterize the Requirements Verification Methodology planned for the WYDOT CV Pilot. Table 1-1 lists the system requirements from the *Connected Vehicle Pilot Deployment Program Phase 1, System Requirements Specification (SyRS)*, with Phase 2 updates, sorted by requirement. For each requirement, the table describes

- Requirement ID and Name from the SyRS
- Requirement Description from the SyRS
- Requirement Verification Method (Inspection, Demonstration, Test, or Analysis)
- Parent Requirements whose verification depend upon the current requirement for verification (i.e. current requirement is a “child” of the listed Parent Requirements)
- Child Requirements which must be verified for successful verification of the current requirement (i.e. current requirement is a “parent” of the listed Child Requirements)
- Verification Test Case ID and Name in which the requirement will be verified
    - (Including Integrated Test Case ID for concurrent Cases)
- Requirement Verification Methodology which describes the process by which the requirement will be verified after completion of the test case
- Test Engineer Verification and Remarks to be filled in upon verification of the requirement

In some cases, some requirements are satisfied by the verification of subrequirements. This column lists the subrequirements and the test cases in which subrequirements will be satisfied.

Table 1-1. Requirements Verification Methodology Sorted by Requirement

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
SCMS-REQ-1 -- Wyoming CV System (WCVS) SCMS Use	The Wyoming CV System shall interface with the USDOT SCMS based on the requirements in the current version of the Security Credential Management System Proof-of-Concept Implementation EE Requirements and Specifications Supporting SCMS Software (available at https://wiki.campllc.org/display/SCP/SCMS+CV+Pilots+Documentation).	I		SCMS-REQ-1.1 SCMS-REQ-1.2 SCMS-REQ-1.3 SCMS-REQ-1.4 RSU-REQ-3 ODE-REQ-4	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: SCMS-REQ-1.1-WI2VSAT-1-REP SCMS-REQ-1.2-WI2VSAT-1-REP SCMS-REQ-1.3-WI2VSAT-1-REP SCMS-REQ-1.4-WI2VSAT-1-REP RSU-REQ-3-WRSUDOC-1 ODE-REQ-4-WODEDOC-1	Requirement Verification Confirmed by:
SCMS-REQ-1.1 -- SCMS Wyoming CV System Certificates	The Wyoming CV System shall download certificates from the USDOT SCMS.	I	SCMS-REQ-1		WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated with WI2VSAT-1-REP)	* Perform Test Case WI2VMCT-1(WI2VSAT-1-REP) * Inspect Wyoming CV System SCMS logs * Confirm Wyoming CV System downloads certificates from the USDOT SCMS. * Confirmation shows the	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						Wyoming CV System downloads certificates from the USDOT SCMS, thereby verifying the requirement is satisfied.	
SCMS-REQ-1.2 -- SCMS Wyoming CV System Misbehavior Reporting	The Wyoming CV System shall send misbehavior reports after they are published to the USDOT SCMS within 24 hours.	I	SCMS-REQ-1		WEXTSS-SCMSCRL -- WYDOT CV System and Vehicle System Misbehavior and CRL support	* Perform Test Case WEXTSS-SCMSCRL * Inspect Wyoming CV System SCMS Logs * Confirm Wyoming CV System detects misbehavior by Remote Vehicle * Confirm Wyoming CV System sends misbehavior reports to the USDOT SCMS within 24 hours after detection, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
SCMS-REQ-1.3 -- SCMS Wyoming CV System Certificates Revocation List (CRL)	The Wyoming CV System shall download the CRL from the USDOT SCMS.	I	SCMS-REQ-1		WEXTSS-SCMSCRL -- WYDOT CV System and Vehicle System Misbehavior and CRL support	* Perform Test Case WEXTSS-SCMSCRL * Inspect Wyoming CV System SCMS Logs * Confirm Wyoming CV System downloads the CRL from the USDOT SCMS, thereby verifying	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						the requirement is satisfied	
SCMS-REQ-1.4 -- SCMS Wyoming CV System Rejection	The Wyoming CV System shall reject messages received from any vehicles on the current CRL.	I	SCMS-REQ-1		WEXTSS-SCMSCRL -- WYDOT CV System and Vehicle System Misbehavior and CRL support	* Perform Test Case WEXTSS-SCMSCRL * Inspect Wyoming CV System SCMS Logs * Confirm Wyoming CV System rejects messages received from Remote Vehicle on the current CRL, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
SCMS-REQ-2 -- Vehicle System SCMS Use	The Vehicle System used in the Wyoming Pilot shall be certified from a USDOT authorized testing facility based on the current version of the Security Credential Management System Proof-of-Concept Implementation EE Requirements and Specifications Supporting SCMS Software (available at https://wiki.campllc.org/display/SCP/SCMS+CV+Pilots+Documentation).	I		SCMS-REQ-2.1 SCMS-REQ-2.2 SCMS-REQ-2.3 SCMS-REQ-2.4	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: SCMS-REQ-2.1-WV2IMCT-2(WFCWT-1) SCMS-REQ-2.2-WEXTSS-SCMSCRL SCMS-REQ-2.3-WEXTSS-SCMSCRL SCMS-REQ-2.4-WEXTSS-SCMSCRL	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
SCMS-REQ-2.1 -- SCMS Vehicle System Certificates	The Vehicle System shall download certificates from the USDOT SCMS.	I	SCMS-REQ-2		WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-1)	* Conduct Test WV2IMCT-2(WFCWT-1) * Inspect Vehicle System SCMS logs * Confirm Vehicle System downloads certificates from the USDOT SCMS, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
SCMS-REQ-2.2 -- SCMS Vehicle System Misbehavior Reporting	The Vehicle System shall send misbehavior reports after they are defined to the USDOT SCMS	I	SCMS-REQ-2		WEXTSS-SCMSCRL -- WYDOT CV System and Vehicle System Misbehavior and CRL support	* Perform Test Case WEXTSS-SCMSCRL * Inspect Vehicle System SCMS Logs * Confirm Vehicle System detects misbehavior by Remote Vehicle * Confirm Vehicle System sends misbehavior reports to the USDOT SCMS, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
SCMS-REQ-2.3 -- SCMS Vehicle System Certificates Revocation List (CRL)	The Vehicle System shall download and utilize the CRL from the USDOT SCMS.	I	SCMS-REQ-2		WEXTSS-SCMSCRL -- WYDOT CV System and Vehicle System Misbehavior and CRL support	* Perform Test Case WEXTSS-SCMSCRL * Inspect Vehicle System SCMS Logs * Confirm Vehicle System downloads the CRL from the USDOT SCMS,	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						thereby verifying the requirement is satisfied	
SCMS-REQ-2.4 -- SCMS Vehicle System Rejection	The Vehicle System shall reject messages received from any vehicles on the current CRL	I	SCMS-REQ-2		WEXTSS-SCMSCRL -- WYDOT CV System and Vehicle System Misbehavior and CRL support	* Perform Test Case WEXTSS-SCMSCRL * Inspect Vehicle System SCMS Logs * Confirm Vehicle System rejects messages received from Remote Vehicle on the current CRL, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
SDW-REQ-1 -- Data Provided to the SDW	The Wyoming CV System shall transmit traveler information messages (TIMs) generated by the system to the SDW within five minutes of generation. TIMs are formatted as defined in J2735 – 5.16 Message: MSG_TravelerInformation Message (TIM).	I			WI2VSAT-5 -- *Message Display in Travel Lanes sent via Satellite	* Perform Test Case WI2VSAT-5 * Inspect DB Logs and locate 1 or more instances of formation of TIMs Record * Time each located TIM was generated by DB * Time each located TIM was sent to SDW Compute * Time difference between generation and distribution Confirm and Verify * Time difference less than 5 minutes, confirms the Wyoming CV System	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						transmits traveler information messages (TIMs) generated by the system to the SDW within five minutes of generation, thereby verifying the requirement is satisfied. (Note: WYDOT Team does not have access to SDW logs to verify TIM was received and what time TIM it was received by SDW.)	
SDC-REQ-1 -- Data Provided to the SDC	The Wyoming CV System shall transmit information to the Secure Data Commons.	I		ODE-REQ-3.6 DW-REQ-2.2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: ODE-REQ-3.6-WV2IMCT-2(WFCWT-1) DW-REQ-2.2-WI2VMCT-1(WI2VSAT-1-REP)	Requirement Verification Confirmed by:
RDE-REQ-1 -- Data Provided to the RDE	The Wyoming CV System shall transmit information to the Research Data Exchange.	I		ODE-REQ-3.7 DW-REQ-2.3	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						corresponding Test Cases:	
LTS-REQ-1 -- WCVS Time	The Wyoming CV System shall acquire time as specified below.	I		LTS-REQ-1.1 LTS-REQ-1.2 RSU-REQ-4 ODE-REQ-5	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: LTS-REQ-1.1 - WI2VSAT-1-REP LTS-REQ-1.2 - WI2VSAT-1-REP RSU-REQ-4-WRSUDOC-1 ODE-REQ-5-WODEDOC-1	Requirement Verification Confirmed by:
LTS-REQ-1.1 -- WCVS LTS Time	The Wyoming CV System shall acquire time from the LTS interface in accordance with Section 5.10.1 of the ICD.	I	LTS-REQ-1		WI2VSAT-1-REP -- Message Display in Travel Lanes	* Perform Test Case WI2VSAT-1-REP * Inspect DB Logs and locate 1 or more instances of formation of TIMs * Determine time TIM was formulated * Identify located TIMs and inspect time and compare to independent time source * Confirm message contains correct time	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						message was sent, verifying requirement is satisfied.	
LTS-REQ-1.2 -- WCVS Time Synchronization	The Wyoming CV System shall receive time synchronization information from a Stratum 2 NTP source, as described in Section 5.12.1 of the ICD.	I	LTS-REQ-1		WI2VSAT-1-REP -- Message Display in Travel Lanes	* Perform Test Case WI2VSAT-1-REP * Inspect DB Logs and locate 1 or more instances of formation of TIMs * Determine time TIM was formulated * Identify located TIMs and inspect time and compare to independent time source * Confirm message contains correct time message was sent, verifying requirement is satisfied.	Requirement Verification Confirmed by:
LTS-REQ-2 -- WCVS LTS Time Standard	The Wyoming CV System shall use Coordinated Universal Time (UTC) time for logged data (e.g., events logs and environmental data) based on the format defined in J2735 section 6.19 and epoch of January 1st 1970.	I			WI2VSAT-1-REP -- Message Display in Travel Lanes	Perform Test Case WI2VSAT-1-REP * Inspect event logs and locate 1 or more instances of events * Inspect event(s) located and determine reported time(s) * Confirm time reported is Coordinated Universal	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						Time (UTC), verifying requirement is satisfied.	
LTS-REQ-3 -- WCVS LTS Location	The Wyoming CV System shall acquire location from the LTS interface in accordance with J2945/1 section 6.2.1.	I			WI2VSAT-1-REP -- Message Display in Travel Lanes	* Perform Test Case WI2VSAT-1-REP * Inspect RSU Logs and locate 1 or more instances of TIMs sent * Inspect TIMs and compare location to independent location source * Confirm message contains correct location, verifying requirement is satisfied.	Requirement Verification Confirmed by:
LTS-REQ-4 -- VS LTS Time	The Vehicle System shall acquire time from the LTS interface in accordance with Section 5.3.1 of the ICD.	I	MV-REQ-7 HP-REQ-3 IT-REQ-4 RFV-REQ-3		WFCWT-1 -- FCW Stopped Vehicle Ahead	Perform Test Case WFCWT-1 * Inspect vehicle system logs and locate 1 or more instances of formation of BSMs * Determine time BSM was formulated * Identify located BSMs and inspect time and compare * Confirm message contains correct time message was sent,	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						verifying requirement is satisfied.	
LTS-REQ-5 -- VS LTS Time Standard	The Vehicle System shall use Coordinated Universal Time (UTC) time for logged data (e.g., events logs and environmental data) based on the format defined in J2735 section 6.19 and epoch of January 1st 1970.	I			WFCWT-1 -- FCW Stopped Vehicle Ahead	* Perform Test Case WFCWT-1 * Inspect event logs and locate 1 or more instances of events * Inspect event(s) located and determine reported time(s) * Confirm time reported is Coordinated Universal Time (UTC), verifying requirement is satisfied.	Requirement Verification Confirmed by:
LTS-REQ-6 -- VS LTS Location	The Vehicle System shall acquire location from the LTS interface in accordance with J2945/1 section 6.2.1.	I	MV-REQ-8 HP-REQ-4 IT-REQ-5 RFV-REQ-4		WFCWT-1 -- FCW Stopped Vehicle Ahead	* Perform Test Case WFCWT-1 * Inspect OBU logs and locate 1 or more instances of BSMs sent * Inspect BSMs and determine location * Confirm message contains correct location, verifying requirement is satisfied.	Requirement Verification Confirmed by:
511-REQ-1 -- 511App	The Wyoming CV System shall receive parking status data from Wyoming 511 App.	I	WCVS-REQ-7.1 DB-REQ-1	511-REQ-1.1 511-REQ-1.2 511-REQ-1.3 511-REQ-1.4	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the	Requirement Verification

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
Parking Data Collection				511-REQ-1.5 511-REQ-1.6		corresponding Test Cases: 511-REQ-1.1-WEXTSS-511 511-REQ-1.2-WEXTSS-511 511-REQ-1.3-WEXTSS-511 511-REQ-1.4-WEXTSS-511 511-REQ-1.5-WEXTSS-511 511-REQ-1.6-WEXTSS-511	Confirmed by:
511-REQ-1.1 -- Availability	The Wyoming CV System shall categorize parking availability for the facility of interest as follows: i) Full – No parking availability, ii) Spaces available, or iii) Only a few spaces available.	I	511-REQ-1		WEXTSS-511 -- Truck Parking Information Entry and Delivery	* Perform Test Case WEXTSS-511 * Inspect DB Logs * Locate 1 or more instances of receipt of Parking Status Updates from the WYDOT 511 App (via WYDOT 511 System) * Confirm parking status updates show Full or Available * Confirmation shows the Wyoming CV System categorizes parking availability for the facility of interest as follows: i)	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						Full – No parking availability or ii) Available – Parking is available at this location, thereby verifying the requirement is satisfied.	
511-REQ-1.2 -- Default	The Wyoming CV System shall set parking availability default to available if not provided.	I	511-REQ-1		WEXTSS-511 -- Truck Parking Information Entry and Delivery	* Perform Test Case WEXTSS-511 * Inspect DB Logs * Locate 1 or more instances of receipt of Parking Status Updates from the WYDOT 511 App (via WYDOT 511 System) * For case where driver does not enter parking availability, confirm parking status updates show "Available". * Confirmation shows The Wyoming CV System sets parking availability default to available if not provided, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
511-REQ-1.3 -- Time	The Wyoming CV System shall timestamp parking availability reports.	I	511-REQ-1		WEXTSS-511 -- Truck Parking	* Perform Test Case WEXTSS-511 * Inspect DB Logs	Requirement Verification

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
					Information Entry and Delivery	* Locate 1 or more instances of receipt of Parking Status Updates from the WYDOT 511 App (via WYDOT 511 System) * Confirm each instance is timestamped. * Confirmation shows the Wyoming CV System timestamps parking availability reports, thereby verifying the requirement is satisfied.	Confirmed by:
511-REQ-1.4 -- Location	The Wyoming CV System shall associate parking availability with a parking facility on I-80.	I	511-REQ-1		WEXTSS-511 -- Truck Parking Information Entry and Delivery	* Perform Test Case WEXTSS-511 * Inspect DB Logs * Locate 1 or more instances of receipt of Parking Status Updates from the WYDOT 511 App (via WYDOT 511 System) * Confirm each instance is associated with a parking facility on I-80. * Confirmation shows the Wyoming CV System associates parking availability with a parking facility on I-80, thereby	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						verifying the requirement is satisfied.	
511-REQ-1.5 -- Protocol	The Wyoming CV System shall receive information, based on HTTP protocol, from the 511App.	I	511-REQ-1		WEXTSS-511 -- Truck Parking Information Entry and Delivery	* Perform Test Case WEXTSS-511 * Inspect DB Logs * Locate 1 or more instances of receipt of Parking Status Updates from the WYDOT 511 App (via WYDOT 511 System) * Inspect 511 logs and verify HTTP Protocol * Confirmation shows the Wyoming CV System receives information, based on HTTP protocol, from the 511App, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
511-REQ-1.6 -- Schema	The Wyoming CV System shall receive information based on the parking schema defined by WYDOT (WYDOT Truck Parking Map – as of 07/2016).	I	511-REQ-1		WEXTSS-511 -- Truck Parking Information Entry and Delivery	* Perform Test Case WEXTSS-511 * Inspect DB Logs * Locate 1 or more instances of receipt of Parking Status Updates from the WYDOT 511 App (via WYDOT 511 System) * Inspect WYDOT Truck Parking Map and confirm	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						information received is based upon parking schema defined by WYDOT Truck Parking Map. * Confirmation shows the Wyoming CV System receives information based on the parking schema defined by WYDOT (WYDOT Truck Parking Map – as of 07/2016), thereby verifying the requirement is satisfied.	
511-REQ-2 -- Timeframe	The Wyoming CV System shall receive Parking availability data from the WYDOT 511 application within thirty minutes of generation.	I			WEXTSS-511 -- Truck Parking Information Entry and Delivery	* Perform Test Case WEXTSS-511 * Inspect DB Logs * Locate 1 or more instances of receipt of Parking Status Updates from the WYDOT 511 App (via WYDOT 511 System) * Verify each instance is timestamped when sent. * Verify each instance is timestamped when received by DB. * Confirm parking availability data is	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						received within 30 minutes of generation. * Confirmation shows the Wyoming CV System receives Parking availability data from the WYDOT 511 application within thirty minutes of generation, thereby verifying the requirement is satisfied.	
TPI-REQ-1 -- TPI Data	The Wyoming CV System shall transmit traffic condition information to the WYDOT TPI, as described in Section 5.36.1 of the ICD.	I	WCVS-REQ-7.2 DB-REQ-2		WI2VSAT-1-IC -- Message Display in Travel Lanes - IC	* Conduct Test Case WI2VSAT-1-IC. * Inspect DW logs. * Confirm DW sends incident information to TPI. * DW distribution of incident information to TPI confirms the Wyoming CV System transmits traffic condition information to the WYDOT TPI, as described in Section 5.36.1 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
TRAC-REQ-1 -- TRAC Updates	The Wyoming CV System shall transmit CV pilot events to the TRAC.	I	WCVS-REQ-7.2 DB-REQ-2	TRAC-REQ-1.1 TRAC-REQ-1.2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: TRAC-REQ-1.1-WDNR-1 TRAC-REQ-1.2-Multiple Subrequirement Test Cases	Requirement Verification Confirmed by:
TRAC-REQ-1.1 -- Distress Notification	The Wyoming CV System shall transmit received distress notifications to TRAC. Distress notifications are defined in WCVS-REQ-1.3.	I	TRAC-REQ-1		WDNR-1 -- Same direction Distress Notification relay to RSU	* Perform Test Case WDNR-1 * Inspect Relay Vehicle OBU Logs and confirm receipt of DNM from Distressed Vehicle * Inspect DB logs and locate and confirm receipt of DNM from Relay Vehicle * Inspect TRAC logs and confirm 1 confirm receipt of DNM from DB * TRAC Display of Distress Notifications verifies Wyoming CV System transmits received distress notifications to TRAC, thereby verifying	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						the requirement is satisfied.	
TRAC-REQ-1.1.1 -- Transmission Time	They Wyoming CV System shall transmit distress notifications to TRAC within five minutes of its generation in the system.	I	TRAC-REQ-1.1		WDNR-1 -- Same direction Distress Notification relay to RSU	* Perform Test Case WDNR-1 * Inspect Relay Vehicle OBU Logs and confirm receipt of DNM from Distressed Vehicle * Inspect DB Logs and locate and confirm receipt of DNM from Relay Vehicle and the time received by the DB * Inspect TRAC logs and confirm receipt of DNM from DB and the time received by the TRAC * Compute time between receipt by the DB and receipt by the TRAC * TRAC log of Distress Notifications within 5 minutes verifies Wyoming CV System transmits distress notifications to TRAC within five minutes of its generation in the system, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						(Note: the DNM is generated by the vehicle system, rather than the Wyoming CV system. "Generation in the system" is interpreted as "received by the DB".)	
TRAC-REQ-1.2 -- Segment Alerts	The Wyoming CV System shall transmit segment-level alerts, defined in WCVS-REQ-4, to TRAC.	I	TRAC-REQ-1	TRAC-REQ-1.2.2 TRAC-REQ-1.2.1	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: TRAC-REQ-1.2.1-WI2VSAT-1-REP TRAC-REQ-1.2.2-WI2VSAT-1-Pikalert	Requirement Verification Confirmed by:
TRAC-REQ-1.2.2 -- Segment Alerts-Pikalert	The Wyoming CV System shall transmit Pikalert segment-level alerts, defined in WCVS-REQ-4, to TRAC	I	TRAC-REQ-1.2		WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	* Perform Test Case WI2VSAT-1-Pikalert * Inspect DB logs. * Verify generation of TIMs for alerts for Spot Weather Impact Warning * Inspect TRAC logs and verify receipt of each of the corresponding alerts, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
TRAC-REQ-1.2.1 -- Transmission Time	The Wyoming CV System shall transmit alerts to TRAC within five minutes of its generation in the system.	I	TRAC-REQ-1.2		WI2VSAT-1-REP -- Message Display in Travel Lanes	* Perform Test Case WI2VSAT-1-REP * Inspect DB logs. * Verify receipt of information from System * Verify generation of TIMs for alerts and time TIM was generated * Inspect TRAC logs and verify receipt of the corresponding alerts within five minutes of its generation in the system. * TRAC log of TIM within 5 minutes verifies the Wyoming CV System transmits alerts to TRAC within five minutes of its generation in the system, thereby verifying requirement.	Requirement Verification Confirmed by:
RCRS-REQ-1 -- RCRS Data Sharing	The Wyoming CV System shall receive road condition information from the RCRS.	I	WCVS-REQ-7.1 WCVS-REQ-3 DB-REQ-1	RCRS-REQ-1.1 RCRS-REQ-1.2 RCRS-REQ-1.3 RCRS-REQ-1.4 RCRS-REQ-1.5 RCRS-REQ-1.6	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: RCRS-REQ-1.1 - WI2VSAT-1-RCRS RCRS-REQ-1.2 -	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						WI2VSAT-1-RCRS RCRS-REQ-1.3 - WI2VSAT-1-RCRS RCRS-REQ-1.4 - WI2VSAT-1-RCRS RCRS-REQ-1.5 - WI2VSAT-1-RCRS RCRS-REQ-1.6 - WI2VSAT-1-RCRS	
RCRS-REQ-1.1 -- Road Condition	The Wyoming CV System shall receive road condition information from the RCRS following the 8 Code System.	I	RCRS-REQ-1		WI2VSAT-1-RCRS -- Message Display in Travel Lanes - RCRS	* Perform Test Case WI2VSAT-1-RCRS * Inspect DB Logs and locate 1 or more instances of receipt of road condition information from the RCRS * Confirm information follows the 8 Code System. * Receipt of RCRS information following the 8 codes system confirms the Wyoming CV System receives road condition information from the RCRS following the 8 Code System, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
RCRS-REQ-1.2 -- Weather	The Wyoming CV System shall receive atmospheric information from the RCRS following the 9 Code System.	I	RCRS-REQ-1		WI2VSAT-1-RCRS -- Message Display in Travel Lanes - RCRS	* Perform Test Case WI2VSAT-1-RCRS * Inspect DB Logs and locate 1 or more instances of receipt of atmospheric information from the RCRS * Confirm information follows the 9 Code System. * Receipt of RCRS information following the 9 codes system confirms the Wyoming CV System receive atmospheric information from the RCRS following the 9 Code System, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
RCRS-REQ-1.3 -- Other Road Condition	The Wyoming CV System shall receive other road information from RCRS following the 10 Code System.	I	RCRS-REQ-1		WI2VSAT-1-RCRS -- Message Display in Travel Lanes - RCRS	* Perform Test Case WI2VSAT-1-RCRS * Inspect DB Logs and locate 1 or more instances of receipt of other road information from the RCRS * Confirm information follows the 10 Code System.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						* Receipt of RCRS information following the 10 codes system confirms The Wyoming CV System receives other road information from RCRS following the 10 Code System, thereby verifying the requirement is satisfied.	
RCRS-REQ-1.4 -- Report Time	The Wyoming CV System shall receive reports from RCRS containing a timestamp of when the operator entered the information into the app.	I	RCRS-REQ-1		WI2VSAT-1-RCRS -- Message Display in Travel Lanes - RCRS	* Perform Test Case WI2VSAT-1-RCRS * Inspect DB Logs and locate 1 or more instances of receipt of road condition information from the RCRS * Verify reports from RCRS contain a timestamp of when the operator entered the information into the app * Timestamp of when the operator entered the information into the app confirms the Wyoming CV System receives reports from RCRS containing a timestamp of when the operator entered the	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						information into the app, thereby verifying the requirement is satisfied.	
RCRS-REQ-1.5 -- Location	The Wyoming CV System shall receive reports from RCRS containing a location reference of when the operator entered the information into the app	I	RCRS-REQ-1		WI2VSAT-1-RCRS -- Message Display in Travel Lanes - RCRS	* Perform Test Case WI2VSAT-1-RCRS * Inspect DB Logs and locate 1 or more instances of receipt of road condition information from the RCRS * Confirm reports from RCRS contain a location reference of when the operator entered the information into the app. * Location reference confirms The Wyoming CV System receives reports from RCRS containing a location reference of when the operator entered the information into the app, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
RCRS-REQ-1.6 -- Transmit Time	The Wyoming CV System shall receive reports from RCRS containing a timestamp of when the report	I	RCRS-REQ-1		WI2VSAT-1-RCRS -- Message Display in Travel Lanes - RCRS	* Perform Test Case WI2VSAT-1-RCRS * Inspect DB Logs and locate 1 or more instances	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	was transmitted to the TMC. The transmitting timestamp may be different from the reporting time					of receipt of road condition information from the RCRS * Verify reports from RCRS contain a timestamp of when the report was transmitted to the TMC * Timestamp of when the report was transmitted to the TMC confirms the Wyoming CV System receives reports from RCRS containing a timestamp of when the report was transmitted to the TMC, thereby verifying the requirement is satisfied.	
WTI-REQ-1 -- WTI Inputs	The Wyoming CV System shall transmit CV Pilot event information to the WTI.	I	WCVS-REQ-7.1 DB-REQ-1	WTI-REQ-1.1 WTI-REQ-1.2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WTI-REQ-1.1-Multiple Subrequirement Test Cases	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						WTI-REQ-1.2-WI2VSAT-1-Pikalert	
WTI-REQ-1.1 -- Current Segment Alerts	The Wyoming CV System shall transmit current segment-specific alerts, defined in WCVS-REQ-4, to the WTI.	I	WTI-REQ-1	WTI-REQ-1.1.1	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WTI-REQ-1.1.1-WI2VSAT-1-Pikalert	Requirement Verification Confirmed by:
WTI-REQ-1.1.1 -- Transmission Time	They Wyoming CV System shall transmit alerts within five minutes of its generation in the system to the WTI.	I	WTI-REQ-1.1		WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	* Perform Test Case WI2VSAT-1-Pikalert * Inspect DB logs. * Verify receipt of information from System * Verify generation of TIMs for alerts and time TIM was generated * Inspect WTI logs and verify receipt of the corresponding alerts within five minutes of its generation in the system. * WTI log of TIM within 5 minutes verifies the Wyoming CV System transmits alerts within five minutes of its generation in the system to the WTI,	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						thereby verifying requirement.	
WTI-REQ-1.2 -- Forecast Segment Alerts	The Wyoming CV System shall transmit forecast segment-specific alerts, defined in WCVS-REQ-5, to the WTI.	I	WTI-REQ-1	WTI-REQ-1.2.1 WTI-REQ-1.2.2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WTI-REQ-1.2.1-WI2VSAT-1-Pikalert WTI-REQ-1.2.2-WI2VSAT-1-Pikalert	Requirement Verification Confirmed by:
WTI-REQ-1.2.1 -- Forecast Time	The Wyoming CV System shall transmit forecast reports to WTI for pre-specified forecast windows determined by WYDOT (6, 12, 24, 48, 72 hours).	I	WTI-REQ-1.2		WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	* Perform Test Case WI2VSAT-1-Pikalert. * Inspect Pikalert Logs and verify output of customizable forecast windows, such as 12, 24, 48, and 72 hours. * Inspect WTI logs and verify receipt of customizable forecast windows, such as 12, 24, 48, and 72 hours. * Receipt confirms the Wyoming CV System transmits forecast reports to WTI for pre-specified forecast windows	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						determined by WYDOT (6, 12, 24, 48, 72 hours). thereby verifying the requirement is satisfied.	
WTI-REQ-1.2.2 -- Forecast Update	The Wyoming CV System shall update its forecast reports in WTI at WYDOT-determined intervals (every 12 hours for example).	I	WTI-REQ-1.2		WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs and verify output of forecast updates at WYDOT-determined intervals. * Inspect WTI logs and verify output of forecast updates at WYDOT-determined intervals. * Output confirms that the Wyoming CV System updates its forecast reports in WTI at WYDOT-determined intervals (every 12 hours for example), thereby verifying requirement is satisfied.	Requirement Verification Confirmed by:
WTI-REQ-2 -- WTI Outputs	The Wyoming CV System shall receive the current information for corridor roadway segments available from the WTI within five	I	WCVS-REQ-7.2 DB-REQ-2	WTI-REQ-2.1 WTI-REQ-2.2 WTI-REQ-2.3 WTI-REQ-2.4	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	minutes of generation. Roadway segments are defined by WYDOT as sections of roadway between variable mileposts.					Cases: WTI-REQ-2.1-WI2VSAT-1-WTI-Speed WTI-REQ-2.2-WI2VSAT-1-WTI-Restriction WTI-REQ-2.3-WI2VSAT-1-WTI-DMS WTI-REQ-2.4-WI2VSAT-1-WTI-Closure	
WTI-REQ-2.1 -- Posted Speed	The Wyoming CV System shall receive notification that current posted speed for a segment is changed	I	WTI-REQ-2		WI2VSAT-1-WTI-Speed -- Message Display in Travel Lanes - WTI Speed	* Perform Test Case WI2VSAT-1-WTI-Speed. * Inspect WTI Logs and verify output of current information for corridor roadway segments. * Verify receipt of notification that current posted speed for the segment has changed * Receipt confirms that the Wyoming CV System receives notification that current posted speed for the segment is changed, thereby verifying the requirement	Requirement Verification Confirmed by:
WTI-REQ-2.2 -- Vehicle Restrictions	The Wyoming CV System shall receive the notification of vehicle restrictions that	I	WTI-REQ-2	WTI-REQ-2.2.1 WTI-REQ-2.2.2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements	Requirement Verification

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	have been set for a roadway segment					when performing the corresponding Test Cases: WTI-REQ-2.2.1-WI2VSAT-1-WTI-Restriction WTI-REQ-2.2.2-WI2VSAT-1-WTI-Restriction	Confirmed by:
WTI-REQ-2.2.1 -- Restriction Information	The Wyoming CV System shall receive details on the restriction in effect for affected segments. Restrictions can consist of one or more of the following: • Width restriction, • Height restriction, • Weight restrictions, • High-Profile restrictions, • Chain Law Level 1, • Chain Law Level 2	I	WTI-REQ-2.2		WI2VSAT-1-WTI-Restriction -- Message Display in Travel Lanes - WTI Restriction	* Perform Test Case WI2VSAT-1-WTI-Restriction. * Inspect WTI Logs and verify output of current information for corridor roadway segments. * Confirm receipt of notification of details on the restriction in effect for affected segments * Receipt confirms the Wyoming CV System receives details on the restriction in effect for affected segments, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
WTI-REQ-2.2.2 -- Restriction Start Time	Wyoming CV System shall receive the start time of restrictions in effect for segments.	I	WTI-REQ-2.2		WI2VSAT-1-WTI-Restriction -- Message Display in Travel Lanes - WTI Restriction	* Perform Test Case WI2VSAT-1-WTI-Restriction. * Inspect WTI Logs and verify output of current information for corridor roadway segments. * Confirm receipt of the start time of restrictions in effect for segments * Receipt confirms the Wyoming CV System receives the start time of restrictions in effect for segments, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WTI-REQ-2.3 -- Posted Messages	The Wyoming CV System shall receive the notification of DMS messages that have been set in the corridor	I	WTI-REQ-2		WI2VSAT-1-WTI-DMS -- Message Display in Travel Lanes - DMS	* Perform Test Case WI2VSAT-1-WTI-DMS * Inspect WTI Logs and verify output of current information for corridor roadway segments * Confirm receipt of the notification of DMS messages that have been set in the corridor * Receipt confirms the Wyoming CV System receives the notification of	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						DMS messages that have been set in the corridor, thereby verifying the requirement is satisfied.	
WTI-REQ-2.3.1 -- Message Information	Wyoming CV System shall receive the content of the posted DMS message	I	WTI-REQ-2.3		WI2VSAT-1-WTI-DMS -- Message Display in Travel Lanes - DMS	* Perform Test Case WI2VSAT-1-WTI-DMS. * Inspect WTI Logs and verify output of current information for corridor roadway segments. * Verify receipt of receive the content of the posted DMS message * Receipt confirms Wyoming CV System receives the content of the posted DMS message, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WTI-REQ-2.4 -- Posted Closures	The Wyoming CV System shall receive the notification of closures that have been set for a roadway segment	I	WTI-REQ-2	WTI-REQ-2.4.1 WTI-REQ-2.4.2 WTI-REQ-2.4.3	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WTI-REQ-2.4.1-WI2VSAT-1-WTI-Closure WTI-REQ-2.4.2-WI2VSAT-1-WTI-Closure	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						WTI-REQ-2.4.3-WI2VSAT-1-WTI-Closure	
WTI-REQ-2.4.1 -- Closure Beginning	The Wyoming CV System shall receive notification of the beginning point of the closure.	I	WTI-REQ-2.4		WI2VSAT-1-WTI-Closure -- Message Display in Travel Lanes - Closures	* Perform Test Case WI2VSAT-1-WTI-Closure. * Inspect WTI Logs and verify output of current information for corridor roadway segments. * Verify receipt of notification of the beginning point of the closure. * Receipt confirms the Wyoming CV System receives notification of the beginning point of the closure, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WTI-REQ-2.4.2 -- Closure End	The Wyoming CV System shall receive notification of the ending point of the closure.	I	WTI-REQ-2.4		WI2VSAT-1-WTI-Closure -- Message Display in Travel Lanes - Closures	* Perform Test Case WI2VSAT-1-WTI-Closure. * Inspect WTI Logs and verify output of current information for corridor roadway segments. * Verify receipt of notification of the ending point of the closure. * Receipt confirms the	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						Wyoming CV System receives notification of the ending point of the closure, thereby verifying the requirement is satisfied.	
WTI-REQ-2.4.3 -- Closure Start Time	The Wyoming CV System shall receive notification of the starting time of the closure.	I	WTI-REQ-2.4		WI2VSAT-1-WTI-Closure -- Message Display in Travel Lanes - Closures	* Perform Test Case WI2VSAT-1-WTI-Closure. * Inspect WTI Logs and verify output of current information for corridor roadway segments. * Verify receipt of notification of the starting time of the closure. * Receipt confirms the Wyoming CV System receives notification of the starting time of the closure, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
CVOP-REQ-1 -- CVOP Inputs	The Wyoming CV System shall transmit CV Pilot event information to the CVOP.	I	WCVS-REQ-7.2 DB-REQ-2	CVOP-REQ-1.1 CVOP-REQ-1.2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: CVOP-REQ-1.1-Multiple	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						Subrequirement Test Cases CVOP-REQ-1.2- WI2VSAT-1-Pikalert	
CVOP-REQ-1.1 -- Current Segment Alerts	The Wyoming CV System shall transmit current segment-specific alerts, defined in WCVS-REQ-4, to the CVOP.	I	CVOP-REQ-1	CVOP-REQ-1.1.1	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: CVOP-REQ-1.1.1- WI2VSAT-1-Pikalert	Requirement Verification Confirmed by:
CVOP-REQ-1.1.1 -- Transmission Time	They Wyoming CV System shall transmit alerts within five minutes of its generation in the system to the CVOP.	I	CVOP-REQ-1.1		WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	* Perform Test Case WI2VSAT-1-Pikalert * Inspect DB logs. * Verify receipt of information from System * Verify generation of TIMs for alerts and time TIM was generated * Inspect CVOP logs and verify receipt of the corresponding alerts within five minutes of its generation in the system. * CVOP log of TIM within 5 minutes verifies the Wyoming CV System transmits alerts within five	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						minutes of its generation in the system to the CVOP, thereby verifying requirement.	
CVOP-REQ-1.2 -- Forecast Segment Alerts	The Wyoming CV System shall transmit forecast segment-specific alerts, defined in WCVS-REQ-5, to the CVOP.	I	CVOP-REQ-1	CVOP-REQ-1.2.1 CVOP-REQ-1.2.2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: CVOP-REQ-1.2.1-WI2VSAT-1-Pikalert CVOP-REQ-1.2.2-WI2VSAT-1-Pikalert	Requirement Verification Confirmed by:
CVOP-REQ-1.2.1 -- Forecast Time	The Wyoming CV System shall transmit forecast reports to the CVOP for pre-specified forecast windows determined by WYDOT (6, 12, 24, 48, 72 hours).	I	CVOP-REQ-1.2		WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	Verified by WI2VSAT-1-Pikalert, inspection of Logs. * Perform Test Case WI2VSAT-1-Pikalert. * Inspect Pikalert Logs and verify output of customizable forecast windows, such as 12, 24, 48, and 72 hours. * Inspect CVOP logs and verify receipt of customizable forecast windows, such as 12, 24, 48, and 72 hours.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						* Receipt confirms the Wyoming CV System transmits forecast reports to CVOP for pre-specified forecast windows determined by WYDOT (6, 12, 24, 48, 72 hours). thereby verifying the requirement is satisfied.	
CVOP-REQ-1.2.2 -- Forecast Update	The Wyoming CV System shall update its forecast reports in CVOP at WYDOT-determined intervals (every 12 hours for example).	I	CVOP-REQ-1.2		WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs and verify output of forecast updates at WYDOT-determined intervals. * Inspect CVOP logs and verify output of forecast updates at WYDOT-determined intervals. * Output confirms that the Wyoming CV System updates its forecast reports in CVOP at WYDOT-determined intervals (every 12 hours for example), thereby verifying requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
IC-REQ-1 -- IC Data Sharing	The Wyoming CV System shall receive timestamped incident information from the IC.	I	WCVS-REQ-7.1 DB-REQ-1		WI2VSAT-1-IC -- Message Display in Travel Lanes - IC	* Perform Test Case WI2VSAT-1-IC * Inspect DB Logs * Confirm receipt of work zone information from the IC * Confirm incident information is timestamped. * Receipt confirms the Wyoming CV System receives timestamped incident information from the IC, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
IC-REQ-2 -- Protocol	The Wyoming CV System shall receive incident information, based on HTTP protocol, from the IC. The HTTP protocol used will be based on the six part specifications RFC 7230-RFC 7235.	I			WI2VSAT-1-IC -- Message Display in Travel Lanes - IC	* Perform Test Case WI2VSAT-1-IC * Inspect DB Logs * Confirm receipt of work zone information from the IC * Verify transmittal is based upon HTTP Protocol * Receipt confirms the Wyoming CV System receives incident information, based on HTTP protocol, from the	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						IC, thereby verifying the requirement is satisfied.	
IC-REQ-3 -- Schema	The Wyoming CV System shall receive incident information from WYDOT IC, as described in Section 5.31.1 of the ICD.	I			WI2VSAT-1-IC -- Message Display in Travel Lanes - IC	* Perform Test Case WI2VSAT-1-IC * Inspect DB Logs * Confirm receipt of work zone information from the IC * Receipt confirms the Wyoming CV System receives incident information from WYDOT IC, as described in Section 5.32.1 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
IC-REQ-4 -- Transmission	The Wyoming CV System shall receive Road Incident data from WYDOT Incident Console within five minutes of generation	I			WI2VSAT-1-IC -- Message Display in Travel Lanes - IC	* Perform Test Case WI2VSAT-1-IC * Inspect CA Logs and verify transmission of work zone information from the IC * Determine time work zone information was available. * Inspect DB Logs and verify receipt of work zone information from the IC * Determine time work	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						zone information was received by DB * Compute latency of delivery. * Receipt within 5 minutes confirms the Wyoming CV System receives incident information from WYDOT IC within five minutes of generation, thereby verifying the requirement is satisfied.	
CA-REQ-1 -- CA Data Sharing	The Wyoming CV System shall receive timestamped work zone information from the CA.	I	WCVS-REQ-7.1 DB-REQ-1		WI2VSAT-1-CA -- Message Display in Travel Lanes - CA	* Perform Test Case WI2VSAT-1-CA * Inspect DB Logs * Confirm receipt of work zone information from the CA * Confirm work zone information is timestamped. * Receipt confirms the Wyoming CV System receives timestamped work zone information from the CA, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
CA-REQ-2 -- Protocol	The Wyoming CV System shall receive work zone information, based on HTTP protocol, from the CA.	I			WI2VSAT-1-CA -- Message Display in Travel Lanes - CA	* Perform Test Case WI2VSAT-1-CA * Inspect DB Logs * Confirm receipt of work zone information from the CA * Verify transmittal is based upon HTTP Protocol * Receipt confirms the Wyoming CV System receives work zone information, based on HTTP protocol, from the CA, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
CA-REQ-3 -- Schema	The Wyoming CV System shall receive work zone information from WYDOT CA, as described in Section 5.32.1 of the ICD.	I			WI2VSAT-1-CA -- Message Display in Travel Lanes - CA	* Perform Test Case WI2VSAT-1-CA * Inspect DB Logs and * Confirm receipt of work zone information from the CA * Receipt confirms the Wyoming CV System receives work zone information from WYDOT CA, as described in Section 5.32.1 of the ICD,	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						thereby verifying the requirement is satisfied.	
CA-REQ-4 -- Transmission	The Wyoming CV System shall receive work zone data from WYDOT Construction Administrator within thirty minutes of generation.	I			WI2VSAT-1-CA -- Message Display in Travel Lanes - CA	* Perform Test Case WI2VSAT-1-CA * Inspect CA Logs and verify transmission of work zone information from the CA * Determine time work zone information was available. * Inspect DB Logs and verify receipt of work zone information from the CA. * Determine time work zone information was received by DB. * Compute latency of delivery. * Receipt within 30 minutes confirms the Wyoming CV System receives work zone data from WYDOT Construction Administrator within thirty minutes of generation, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
ITSM-REQ-1 -- WYDOT ITS Alerts	The Wyoming CV System shall send alerts, defined in WCVS-REQ-16, to the WYDOT ITS Maintenance team within five minutes of a system becoming unavailable.	I	WCVS-REQ-7.2 DB-REQ-2	WCVS-REQ-16	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-16-WSYSAA-1	Requirement Verification Confirmed by:
WI-REQ-1 -- External Data Acquisition	The Wyoming CV System shall collect weather information from external sources, as defined in the Section 4.1 - Data Ingest Module Requirements of the Motorist Alert and Warning Application (NCAR, 2014)	I	WCVS-REQ-3 PA-REQ-1		WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	* Perform Test Case WI2VSAT-1-Pikalert with Spot Weather Impact Warning alert from Pikalert. * Inspect Pikalert Logs * Confirm receipt of weather information from external sources, as defined in SyRS Section 4.1 * Receipt confirms the Wyoming CV System collects weather information from external sources, as defined in the Section 4.1 * Data Ingest Module Requirements of the Motorist Alert and Warning Application (NCAR, 2014), thereby	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						verifying the requirement is satisfied.	
WI-REQ-2 -- Fixed Data Acquisition	The Wyoming CV System shall receive road weather information system (RWIS) data from the WYDOT RWIS Server as defined in Section 4.1 – Data Ingest Module Requirements of the Motorist Alert and Warning Application (NCAR 2014).	I	WCVS-REQ-3 PA-REQ-1		WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	* Perform Test Case WI2VSAT-1-Pikalert with Spot Weather Impact Warning alert from Pikalert. * Inspect Pikalert Logs * Confirm receipt of road weather information system (RWIS) data from the WYDOT RWIS Server * Receipt confirms the Wyoming CV System receives road weather information system (RWIS) data from the WYDOT RWIS Server as defined in Section 4.1 – Data Ingest Module Requirements of the Motorist Alert and Warning Application (NCAR 2014), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WCVS-REQ-1 -- Collect CV Data	The Wyoming CV System shall collect data from the Vehicle System.	I	WCVS-REQ-3 ODE-REQ-1	WCVS-REQ-1.1 WCVS-REQ-1.2 WCVS-REQ-1.3	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements	Requirement Verification

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						when performing the corresponding Test Cases: WCVS-REQ-1.1-WV2IMCT-2 WCVS-REQ-1.2-WV2IMCT-2 WCVS-REQ-1.3-WDNR-1	Confirmed by:
WCVS-REQ-1.1 -- Collect BSM Data	The Wyoming CV System shall collect Basic Safety Message Parts I and II (as defined in J2945/1) from the Vehicle System consistent with Section 6.3.8 (BSM Scheduling and Congestion Control) of J2945/1	I	WCVS-REQ-1		WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-1)	* Perform Test Case WV2IMCT-2(WFCWT-1) * Inspect OBU Logs and identify 1 or more instances of BSMs sent to RSUs * Inspect RSU logs and identify corresponding 1 or more instances of BSMs received * Inspect ODE Logs and identify corresponding 1 or more instances of BSMs received * Inspect Pikalert logs and identify corresponding 1 or more instances BSMs received Confirmation shows Wyoming CV System collects Basic Safety Message Parts I and II (as	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						defined in J2945/1) from the Vehicle System consistent with Section 6.3.8 (BSM Scheduling and Congestion Control) of J2945/1, thereby verifying the requirement is satisfied. (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	
WCVS-REQ-1.2 -- Collect Environmental Sensor Data	The Wyoming CV System shall collect environment sensor data using secure copy (SCP) from the Vehicle System consistent with secure shell (SSH).	I	WCVS-REQ-1		WV2IMCT-3 -- V2I & End-to-end communication of Environmental Sensor Data	-Perform Test Case WV2IMCT-3 * Inspect HMI Logs and identify 1 or more instances of environmental sensor data copied to ODE * Inspect ODE logs and identify corresponding 1 or more instances of environmental sensor data copied from OBU to ODE	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						* Confirmation shows Wyoming CV System collects environment sensor data using secure copy (SCP) from the Vehicle System consistent with secure shell (SSH), thereby verifying the requirement is satisfied. * (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	
WCVS-REQ-1.3 -- Collect Distress Messages	The Wyoming CV System shall collect distress messages using the Traveler Information Message (as defined in section 5.16 of J2735) from the Vehicle System consistent with Section 3.5.8 (Traveler Information Requirements) of J3067	I	WCVS-REQ-1		WV2IMCT-1 -- V2I and End-to-end communication of DNMs (Integrated with WDNR-1)	* Perform Test Case WV2IMCT-1(WDNR-1) * Inspect Relay Vehicle OBU Logs and confirm receipt of DNM from Distressed Vehicle * Inspect ODE Logs and identify corresponding instance of received DNM * Receipt of DNMs confirms Wyoming CV	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						System collects distress messages using the Traveler Information Message (as defined in section 5.16 of J2735) from the Vehicle System consistent with Section 3.5.8 (Traveler Information Requirements) of J3067, thereby verifying the requirement is satisfied. * (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	
WCVS-REQ-2 -- Validate Data	The Wyoming CV System shall provide validation- and sanitization-related functions of CV Data as defined in Section 3.1.4.1 of the SDD.	I		ODE-REQ-2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: ODE-REQ-2-WODEDOC-1	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
WCVS-REQ-3 -- Ingest Data for Road Weather information	The Wyoming CV System shall use one or more of the following sources of data to generate road weather information: • Collected CV Information defined in WCVS-REQ-1. • Segment road and weather conditions from the WYDOT RCRS in RCRS-REQ-1. • Weather conditions from weather interfaces defined in WI-REQ-1 and WI-REQ-2.	I		RCRS-REQ-1 WI-REQ-1 WI-REQ-2 WCVS-REQ-1	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: RCRS-REQ-1-WI2VSAT-1-RCRS WI-REQ-1-WI2VSAT-1-Pikalert WI-REQ-2-WI2VSAT-1-Pikalert WCVS-REQ-1-WV2IMCT-2&WDNR-1	Requirement Verification Confirmed by:
WCVS-REQ-4 -- Contents of Alerts and Advisories	The Wyoming CV System shall generate alerts and advisories of roadway hazard conditions as defined in the following requirements.	I	PA-REQ-3	WCVS-REQ-4.1 WCVS-REQ-4.2 WCVS-REQ-4.3 WCVS-REQ-4.4 WCVS-REQ-4.5 WCVS-REQ-4.6	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-4.1-WI2VSAT-1-Pikalert WCVS-REQ-4.2-WI2VSAT-1-Pikalert WCVS-REQ-4.3-WI2VSAT-1-Pikalert WCVS-REQ-4.4-WI2VSAT-1-CA WCVS-REQ-4.5-WI2VSAT-1-IC	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						WCVS-REQ-4.6-WI2VSAT-1-511	
WCVS-REQ-4.1 -- Precipitation Hazard	The Wyoming CV System shall generate a precipitation type and intensity report every 5 minutes, as specified in Section 3.1.4.2 of the SDD.	I	WCVS-REQ-4		WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs and verify output of precipitation type and intensity every 5 minutes * Inspect DB logs and verify generation of TIMs for alerts from Pikalert (Spot Weather Impact Warning) * Inspect TIM and verify output of precipitation type and intensity * Confirmation shows Wyoming CV System generates a precipitation type and intensity report every 5 minutes, as specified in Section 3.1.4.2 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WCVS-REQ-4.2 -- Road Condition Hazard	The Wyoming CV System shall generate a pavement state and slickness flag report every 5 minutes, depending	I	WCVS-REQ-4		WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs and verify output of a	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	on input data, as specified in Section 3.1.4.2 of the SDD.					pavement state and slickness flag report every 5 minutes * Inspect DB logs and verify generation of TIMs for alerts from Pikalert (Spot Weather Impact Warning) * Inspect TIM and verify output of a pavement state and slickness flag * Confirmation shows Wyoming CV System generates a pavement state and slickness flag report every 5 minutes, as specified in Section 3.1.4.2 of the SDD, thereby verifying the requirement is satisfied.	
WCVS-REQ-4.3 -- Visibility Hazard	The Wyoming CV System shall generate a visibility report, along with the condition causing it, every 5 minutes, as specified in Section 3.1.4.2 of the SDD.	I	WCVS-REQ-4		WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs and verify output of a visibility report, along with the condition causing it, every 5 minutes * Inspect DB logs and verify generation of TIMs for alerts from Pikalert	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						(Spot Weather Impact Warning) * Inspect TIM and verify output of a visibility report, along with the condition causing it * Confirmation shows Wyoming CV System generates a visibility report, along with the condition causing it, report every 5 minutes, as specified in Section 3.1.4.2 of the SDD, thereby verifying the requirement is satisfied.	
WCVS-REQ-4.4 -- Work Zone Hazard	The Wyoming CV System shall generate a work zone report within 5 minutes of receiving work zone information from the Construction Administration (defined in CA-REQ-1), as specified in Section 3.1.5.4 of the SDD.	I	WCVS-REQ-4		WI2VSAT-1-CA -- Message Display in Travel Lanes - CA	* Perform Test Case WI2VSAT-1-CA * Inspect DB logs and verify generation of TIMs for work zone report within 5 minutes of receiving work zone information * Inspect TIM and verify output of a work zone report * Confirmation shows Wyoming CV System generates a work zone report within 5 minutes of	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						receiving work zone information from the Construction Administration (defined in CA-REQ-1), as specified in Section 3.1.5.4 of the SDD, thereby verifying the requirement is satisfied.	
WCVS-REQ-4.5 -- Incident Hazard	The Wyoming CV System shall generate an incident report within 5 minutes of receiving incident notifications from the Incident Console (defined in IC-REQ-1), as specified in Section 3.1.4.3 of the SDD.	I	WCVS-REQ-4		WI2VSAT-1-IC -- Message Display in Travel Lanes - IC	* Perform Test Case WI2VSAT-1-IC * Inspect DB logs and verify generation of TIMs for an incident report within 5 minutes of receiving incident notifications from the Incident Console * Inspect TIM and verify output of an incident report * Confirmation shows Wyoming CV System generates an incident report within 5 minutes of receiving incident notifications from the Incident Console (defined in IC-REQ-1), as specified in Section 3.1.4.3 of the	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						SDD, thereby verifying the requirement is satisfied.	
WCVS-REQ-4.6 -- Parking	The Wyoming CV System shall generate a parking report within 5 minutes of receiving parking availability notification, as specified in Section 3.1.4.3 of the SDD.	I	WCVS-REQ-4		WI2VSAT-1-511 -- Message Display in Travel Lanes - 511	* Perform Test Case WI2VSAT-1-511 * Inspect DB logs and verify generation of TIMs for a parking report within 5 minutes of receiving parking availability notification * Inspect TIM and verify output of a parking report * Confirmation shows Wyoming CV System generates a parking report within 5 minutes of receiving parking availability notification, as specified in Section 3.1.4.3 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WCVS-REQ-5 -- Forecast Conditions	The Wyoming CV System shall generate forecasts of conditions as defined in the following requirements	I		WCVS-REQ-5.1 WCVS-REQ-5.2 WCVS-REQ-5.3 WCVS-REQ-5.4	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-5.1-	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						WI2VSAT-1-Pikalert WCVS-REQ-5.2-WI2VSAT-1-Pikalert WCVS-REQ-5.3-WI2VSAT-1-Pikalert WCVS-REQ-5.4-WI2VSAT-1-Pikalert	
WCVS-REQ-5.1 -- Atmospheric Forecasts	The Wyoming CV System shall produce atmospheric weather forecasts, at a minimum, for (a) atmospheric temperature, (b) probability of precipitation, (c) wind speed, and (d) wind direction	I	WCVS-REQ-5		WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs and confirm output of atmospheric weather forecasts. * Inspect DB logs and confirm generation of TIMs for alerts from Pikalert (Spot Weather Impact Warning) * Inspect TIM and confirm output of atmospheric weather forecasts for (a) atmospheric temperature, (b) probability of precipitation, (c) wind speed, and (d) wind direction * Confirmation shows Wyoming CV System produces atmospheric weather forecasts, at a	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						minimum, for (a) atmospheric temperature, (b) probability of precipitation, (c) wind speed, and (d) wind direction, thereby verifying the requirement is satisfied.	
WCVS-REQ-5.2 -- Road Weather Forecasts	The Wyoming CV System shall produce road weather forecasts, at a minimum, for (a) pavement temperature, and (b) subsurface temperature	I	WCVS-REQ-5		WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs and confirm output of atmospheric weather forecasts. * Inspect DB logs and confirm generation of TIMs for alerts from Pikalert (Spot Weather Impact Warning) * Inspect TIM and confirm output of road weather forecasts for (a) pavement temperature, and (b) subsurface temperature * Confirmation shows Wyoming CV System produces road weather forecasts, at a minimum, for (a) pavement temperature, and (b)	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						subsurface temperature, thereby verifying the requirement is satisfied.	
WCVS-REQ-5.3 -- Forecast Time	The Wyoming CV System shall generate forecast reports for customizable forecast windows. The windows of interest will be determined by WYDOT (6, 12, 24, 48 hours for example).	I	WCVS-REQ-5		WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs and confirm output of atmospheric weather forecasts. * Inspect DB logs and confirm generation of TIMs for alerts from Pikalert (Spot Weather Impact Warning) * Inspect TIM and confirm output of generates forecast reports for customizable forecast windows * Confirmation shows Wyoming CV System generates forecast reports for customizable forecast windows, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WCVS-REQ-5.4 -- Forecast Update	The Wyoming CV System shall generate forecast updates for customizable	I	WCVS-REQ-5		WI2VSAT-1-Pikalert -- Message Display in	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs	Requirement Verification

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	intervals. The update frequency will be determined by WYDOT and may vary based on time of year (every 3 hours for example in winter to 12 hours during summer).				Travel Lanes - Pikalert	and confirm output of atmospheric weather forecasts. * Inspect DB logs and confirm generation of TIMs for alerts from Pikalert (Spot Weather Impact Warning) * Inspect TIM and confirm output of forecast updates for customizable intervals * Confirmation shows Wyoming CV System generates forecast updates for customizable intervals, thereby verifying the requirement is satisfied	Confirmed by:
WCVS-REQ-6 -- Associate Alerts and Forecast to Segments	The Wyoming CV System shall associate each alert and forecast to one or more road segments on I-80. Roadway segments are defined by WYDOT as sections of roadway between variable mileposts.	I			WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs and verify each alert and forecast is associated with one or more road segments on I-80. * Inspect DB logs and verify generation of TIMs for alerts from Pikalert (Spot Weather Impact Warning)	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						* Inspect TIMs and verify each alert and forecast is associated with one or more road segments on I-80. * Confirmation shows Wyoming CV System associate each alert and forecast to one or more road segments on I-80, thereby verifying the requirement is satisfied.	
WCVS-REQ-7 -- External Brokerage with WYDOT Interfaces	The Wyoming CV System shall transfer data with WYDOT systems as defined in WCVS-REQ-7.1 and WCVS-REQ-7.2.	I		WCVS-REQ-7.1 WCVS-REQ-7.2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-7.1-Multiple Test Cases WCVS-REQ-7.2-Multiple Test Cases	Requirement Verification Confirmed by:
WCVS-REQ-7.1 -- Receive from WYDOT External Interfaces	The Wyoming CV System shall receive data from WYDOT systems as defined in 511-REQ-1, RCRS-REQ-1, WTI-REQ-2, IC-REQ-1, and CA-REQ-1.	I	WCVS-REQ-7	DB-REQ-1	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases:	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						DB-REQ-1-Multiple WI2VSAT-1-Test Cases	
WCVS-REQ-7.2 -- Distribute to WYDOT External Interfaces	The Wyoming CV System shall distribute information to WYDOT systems as defined in TPI-REQ-1, TRAC-REQ-1, WTI-REQ-1, CVOP-REQ-1, and ITSM-REQ-1.	I	WCVS-REQ-7 DB-REQ-2	DB-REQ-2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: DB-REQ-2-Multiple WI2VSAT-1-Test Cases	Requirement Verification Confirmed by:
WCVS-REQ-8 -- Internal Brokerage	The Wyoming CV System shall support internal brokerage of data as defined in RSU-REQ-1, RSU-REQ-2, ODE-REQ-1, ODE-REQ-3, PA-REQ-2, PA-REQ-4, DB-REQ-4, DB-REQ-5, DB-REQ-6, DB-REQ-7, DW-REQ-1, DW-REQ-2, DW-REQ-4, HSM-REQ-1, HSM-REQ-2, HSM-REQ-3, and HSM-REQ-4.	I	DW-REQ-4	RSU-REQ-1 RSU-REQ-2 ODE-REQ-1 ODE-REQ-3 ODE-REQ-7 PA-REQ-2 DB-REQ-4 DB-REQ-5 DB-REQ-6 DB-REQ-7 DW-REQ-1 DW-REQ-2 HSM-REQ-1 HSM-REQ-2 HSM-REQ-3 HSM-REQ-4	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: RSU-REQ-1-WV2IMCT-2 RSU-REQ-2-WV2IMCT-2 ODE-REQ-1-WV2IMCT-2 ODE-REQ-1.1-WV2IMCT-2 ODE-REQ-3-WV2IMCT-1,2,3 ODE-REQ-7-WV2IMCT-1 PA-REQ-2-WV2IMCT-2 DB-REQ-4-WI2VSAT-1-Pikalert DB-REQ-5-WI2VSAT-1-REP	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						DB-REQ-6-WV2IMCT-1 DB-REQ-7-WI2VSAT-1-Pikalert DW-REQ-1-Multiple WI2VSAT-1-Test Cases DW-REQ-2-Multiple WI2VSAT-1-Test Cases HSM-REQ-1-WI2VMCT-1(WI2VSAT-1-REP) HSM-REQ-2-WI2VMCT-1(WI2VSAT-1-REP) HSM-REQ-3-WI2VMCT-1(WI2VSAT-1-REP) HSM-REQ-4-WI2VMCT-1(WI2VSAT-1-REP)	
WCVS-REQ-9 -- Create TIM	The Wyoming CV System shall create a Traveler Information Message (TIM) formatted as defined in J2735 – 5.16 Message: MSG_TravelerInformation Message (TIM).	I	ODE-REQ-8		WI2VSAT-1-REP -- Message Display in Travel Lanes	* Perform test Case WI2VSAT-1-REP * Inspect DB Logs and confirm generation of TIMs * Inspect DB Logs and confirm output and distribution of TIM * Confirmation shows Wyoming CV System creates a Traveler Information Message (TIM) formatted as defined in J2735 – 5.16 Message: MSG_TravelerInformation	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						Message (TIM), thereby verifying the requirement is satisfied. * (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	
WCVS-REQ-10 -- Distribute TIM	The Wyoming CV System shall distribute signed TIMs to the Vehicle System and the Situational Data Warehouse (SDW).	I	RSU-REQ-2	WCVS-REQ-10.1 WCVS-REQ-10.2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-10.1-WI2VSAT-1-REP WCVS-REQ-10.2-WI2VSAT-1-5	Requirement Verification Confirmed by:
WCVS-REQ-10.1 -- Distribute TIM to VS	The Wyoming CV System shall distribute signed TIM to the Vehicle System consistent with Section 3.5.8 (Traveler Information Requirements) of J3067	I	WCVS-REQ-10 ODE-REQ-3.1		WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated with WI2VSAT-1-REP)	* Perform Test Case WI2VMCT-1(WI2VSAT-REP) * Inspect DB logs and verify generation of TIMs. * Inspect DB Logs and	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						verify output and distribution of TIM to Vehicle Systems via DSRC. * Confirmation shows Wyoming CV System distributes TIM to the Vehicle System consistent with Section 3.5.8 (Traveler Information Requirements) of J3067, thereby verifying the requirement is satisfied. * (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	
WCVS-REQ-10.2 -- Distribute TIM to SDW	The Wyoming CV System shall distribute signed TIM to the SDW consistent with Section 3.5.8 (Traveler Information Requirements) of J3067. The SDW may not be available going forward. This	I	WCVS-REQ-10 ODE-REQ-3.2	SDW-REQ-1	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	requirement is for general compliance with the national communication of TIMs and is one way that the Wyoming pilot can get TIMs to third parties for broader distribution. If the SDW becomes unavailable, the pilot can directly send TIMs to the third parties for distribution. The SDW is not required for the Wyoming pilot.					Cases: SDW-REQ-1-WI2VSAT-5	
WCVS-REQ-11 -- Store VS Data	The Wyoming CV System shall store processed data collected by the Vehicle Systems and retain it for the duration of the CV Pilot. Data Processing is defined in ODE-REQ-2.	I		WCVS-REQ-11.1 WCVS-REQ-11.2 WCVS-REQ-11.3	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-11.1-WV2IMCT-2 WCVS-REQ-11.2-WV2IMCT-2 WCVS-REQ-11.3-WDNR-1	Requirement Verification Confirmed by:
WCVS-REQ-11.1 -- Store BSM	The Wyoming CV System shall store processed BSM Parts I and II data received from the Vehicle System. As	I	WCVS-REQ-11		WV2IMCT-2 -- V2I & End-to-end Communication of	* Perform Test Case WV2IMCT-2(WFCWT-1) * Inspect ODE logs and confirm receipt of BSM	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	the BSM will be previously validated, only core data elements will be stored (defined in sections 6.8, 6.147, 6.128, and 6.133 of J2735).				BSMs (Integrated with WFCWT-1)	Part 1 and 2 from OBU. * Inspect DW logs and confirm receipt of BSM Part 1 and 2 from OBU for storage. * Receipt of BSM by DW confirms the Wyoming CV System stores processed BSM Parts I and II data received from the Vehicle System, thereby verifying the requirement is satisfied.	
WCVS-REQ-11.2 -- Store Environment Sensor Data	The Wyoming CV System shall store processed environment sensor data consistent with Section 5.19.2 of the ICD.	I	WCVS-REQ-11		WV2IMCT-3 -- V2I & End-to-end communication of Environmental Sensor Data	* Perform Test Case WV2IMCT-3. * Inspect ODE logs and verify receipt (copy) of environmental sensor data from OBU. * Inspect DW logs and verify receipt (copy) of environmental sensor data from OBU for storage. * Receipt of environmental sensor data by DW confirms the Wyoming CV System stores processed environment sensor data consistent with Section 5.19.2 of the ICD, thereby	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						verifying the requirement is satisfied.	
WCVS-REQ-11.3 -- Store Distress Messages	The Wyoming CV System shall store processed distress messages using the Traveler Information Message (as defined in section 5.16 of J2735) received from the Vehicle System consistent with Section 3.5.8 (Traveler Information Requirements) of J3067. As the distress message will be previously validated, only core data will be stored (defined in sections 5.16, and 6.142 of J2735).	I	WCVS-REQ-11		WV2IMCT-1 -- V2I and End-to-end communication of DNMs (Integrated with WDNR-1)	* Perform Test Case WV2IMCT-1(WDNR-1) * Inspect Relay Vehicle OBU Logs and confirm receipt of DNM from Distressed Vehicle * Inspect DW logs and verify receipt of identified DNM from OBU for storage. * Receipt of DNMs by DW confirms Wyoming CV System stores processed distress messages using the Traveler Information Message (as defined in section 5.16 of J2735) received from the Vehicle System consistent with Section 3.5.8 (Traveler Information Requirements) of J3067, thereby verifying the requirement is satisfied. * (Note: WYDOT Team assumes that communications interoperability between	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	
WCVS-REQ-12 -- Store Generated Alerts/Advisories	The Wyoming CV System shall store generated road weather alerts and advisories (defined WCVS-REQ-4) and retained for the duration of the CV Pilot.	I		DW-REQ-1.1	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: DW-REQ-1.1-WI2VSAT-1	Requirement Verification Confirmed by:
WCVS-REQ-13 -- Store TIM	The Wyoming CV System shall store TIMs distributed to the Vehicle System and the Situational Data Warehouse (SDW) and retain it for the duration of the CV Pilot.	I		DW-REQ-1.3	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: DW-REQ-1.3-WI2VSAT-1-REP	Requirement Verification Confirmed by:
WCVS-REQ-14 -- Store System Monitoring Data	The Wyoming CV System shall store system monitoring data, as defined by WCVS-REQ-16 Monitored Functions, and retain it for the duration of the CV Pilot.	I		DW-REQ-1.4	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: DW-REQ-1.4-WSYSAA-1	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
WCVS-REQ-15 -- Notifications	The Wyoming CV System shall notify designated personnel within five minutes of a monitored function becoming unavailable	I		WCVS-REQ-16	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-16-WSYSAA-1	Requirement Verification Confirmed by:
WCVS-REQ-16 -- Monitored Functions	The Wyoming CV System shall monitor the functions described in WCVS-REQ-16.1 through WCVS-REQ-16.4.	I	WCVS-REQ-15 ITSM-REQ-1	WCVS-REQ-16.1 WCVS-REQ-16.2 WCVS-REQ-16.3 WCVS-REQ-16.4	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-16.1-WSYSAA-1 WCVS-REQ-16.2-WSYSAA-1 WCVS-REQ-16.3-WSYSAA-1 WCVS-REQ-16.4-WSYSAA-1	Requirement Verification Confirmed by:
WCVS-REQ-16.1 -- Sub-System Availability	The Wyoming CV System shall monitor the Sub-systems for availability of ping services running. The WYDOT maintenance team will be sent a notification after a device, web service or	I	WCVS-REQ-16		WSYSAA-1 -- WYDOT CV Pilot System Monitoring and Availability	* Perform test Case WSYSAA-1 * Inspect Logs to determine time subsystems were disabled for testing * Inspect Logs to	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	running service is non-responsive for five minutes.					determine time ITS Maintenance Team was notified * Confirm that *Wyoming CV System monitors the Sub-systems for availability of ping services running. *WYDOT maintenance team is sent a notification after a device, web service or running service is non-responsive for five minutes. Thereby verifying the requirement is satisfied	
WCVS-REQ-16.2 -- Sus-System Performance	The Wyoming CV System shall monitor the system's ability to transmit information in a timely manner. This will be done by monitoring message input queues age of oldest entry not processed. If the messages are not processed within five minutes the WYDOT maintenance team will be notified.	I	WCVS-REQ-16		WSYSAA-1 -- WYDOT CV Pilot System Monitoring and Availability	* Perform test Case WSYSAA-1 * Inspect Logs to determine system's ability to transmit information in a timely manner * Inspect Logs to determine time ITS Maintenance Team was notified * Confirm that *Wyoming CV System monitors the system's ability to transmit	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						information in a timely manner. This will be done by monitoring message input queues age of oldest entry not processed. *If the messages are not processed within five minutes the WYDOT maintenance team is notified. Thereby verifying the requirement is satisfied	
WCVS-REQ-16.3 -- Availability for Interfaces	The Wyoming CV System shall monitor the external interfaces for availability of ping services running. The WYDOT maintenance team will be sent a notification after a device, web service or running service is non-responsive for five minutes.	I	WCVS-REQ-16		WSYSAA-1 -- WYDOT CV Pilot System Monitoring and Availability	* Perform test Case WSYSAA-1 * Inspect Logs to confirm the system monitors the external interfaces for availability of ping services running * Inspect Logs to determine time ITS Maintenance Team was notified * Confirm that *Wyoming CV System monitors the external interfaces for availability of ping services running. *WYDOT maintenance team is sent a notification	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						after a device, web service or running service is non-responsive for five minutes. Thereby verifying the requirement is satisfied	
WCVS-REQ-16.4 -- Availability for Data Storage	The Wyoming CV System shall monitor available data storage of ping services running. The WYDOT maintenance team will be sent a notification after a device, web service or running service is non-responsive for five minutes. Notification will also be sent for disk space under 10% availability.	I	WCVS-REQ-16		WSYSAA-1 -- WYDOT CV Pilot System Monitoring and Availability	* Perform test Case WSYSAA-1 * Inspect Logs to confirm the monitors available data storage of ping services running * Inspect Logs to determine time ITS Maintenance Team was notified * Confirm that *Wyoming CV System monitors available data storage of ping services running. *WYDOT maintenance team is sent a notification after a device, web service or running service is non-responsive for five minutes. *Notification will also be sent for disk space under 10% availability.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						Thereby verifying the requirement is satisfied	
WCVS-REQ-17 -- Archive Data	The Wyoming CV System shall provide the TMC administrator the ability to archive data used by the CV pilot by writing CV data to the WYDOT Data Warehouse, data written to the Data Warehouse is automatically archived per existing TMC best practices.	I			WI2VSAT-1-REP -- Message Display in Travel Lanes	* Perform Test Case WI2VSAT-1-REP. * Inspect TIM in DW and confirm storage of alert by DW. * Inspect DW Logs and confirm archive of TIM * Inspect TMC archives and confirm archive of BSM, TIM, and DNM messages * Confirmation shows Wyoming CV System provides the TMC administrator the ability to archive data used by the CV pilot by writing CV data to the WYDOT Data Warehouse, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WCVS-REQ-18 -- Management and Performance Policy	The Wyoming CV System's infrastructure-related elements shall manage the policy for data collection and performance data following requirements defined in	I		MNG-REQ-1	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases:	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	Appendix B.4 RSU Performance Data of the SyRS.					MNG-REQ-1-WRSUDOC-1	
WCVS-REQ-20 -- Manage Safe Communications	The Wyoming CV System's infrastructure-related elements shall conform to the core safety communications requirements defined in Appendix B.2 V2I Core Safety Communication Requirements of the SyRS.	I		CSC-REQ-3 CSC-REQ-4 CSC-REQ-5	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: CSC-REQ-3-WRSUDOC-1 CSC-REQ-4-WRSUDOC-1 CSC-REQ-5-WRSUDOC-1	Requirement Verification Confirmed by:
WCVS-REQ-21 -- Manage CV Equipment	The Wyoming CV System shall provide the TMC administrator the ability to add/edit/delete equipment from the internal inventory list	I			WSYSAA-2 -- System Administration Demonstration Test Case	* Perform Test Case WSYSAA-2 * Inspect the System Logs and confirm * Adding equipment to internal inventory list * Editing equipment in internal inventory list * Deleting equipment in internal inventory list. * Confirmation shows the Wyoming CV System provides the TMC administrator the ability to	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						add/edit/delete equipment from the internal inventory list, thereby verifying the requirement is satisfied.	
WCVS-REQ-22 -- Test WCVS Equipment	The Wyoming CV System shall provide the TMC administrator the ability to test the RSUs by allowing a series of Python testing scripts to be run on an RSU and results of the test returned to the user.	I			WSYSAA-2 -- System Administration Demonstration Test Case	* Perform Test Case WSYSAA-2 * Inspect the System Logs and confirm * Testing the RSUs by allowing a series of Python testing scripts to be run on an RSU. * Confirmation shows the Wyoming CV System provides the TMC administrator the ability to test the RSUs by allowing a series of Python testing scripts to be run on an RSU and results of the test returned to the user, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WCVS-REQ-23 -- Track WCVS Equipment	The Wyoming CV System shall provide the TMC administrator the geolocation of RSUs.	I			WSYSAA-2 -- System Administration Demonstration Test Case	* Perform Test Case WSYSAA-2 * Inspect the System Logs and confirm * The geolocation of all RSUs.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						* Confirmation shows the Wyoming CV System provide the TMC administrator the geolocation of RSUs, thereby verifying the requirement is satisfied.	
WCVS-REQ-24 -- Update WCVS Equipment	The Wyoming CV System shall provide the TMC administrator the ability to push out updates to the RSU firmware.	I			WSYSAA-2 -- System Administration Demonstration Test Case	* Perform Test Case WSYSAA-2 * Inspect the System Logs and confirm * The ability to push out updates to the RSU firmware. * Confirmation shows the Wyoming CV System provide the TMC administrator the ability to push out updates to the RSU firmware, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WCVS-REQ-25 -- Update VS Equipment	The Wyoming CV System shall provide the TMC administrator the ability to push out OTA updates to the OBU firmware.	I		ODE-REQ-6	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases:	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						ODE-REQ-6-WEXTSS-OTA	
VS-REQ-1 -- Receive BSM	The Vehicle System shall receive Basic Safety Message (as defined in SAE J2945/1) over DSRC from other connected vehicles consistent with Section 6.3.8 of SAE J2945/1 (BSM Scheduling and Congestion Control).	I			WV2VMCT-1 -- V2V exchange of BSMs (Integrated with WFCWT-1)	* Perform Test Case WFCWT-1 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped remote vehicle ahead * Confirm issuance of imminent danger alert * Issuance of imminent danger alert verifies Vehicle System receives Basic Safety Message (as defined in SAE J2945/1) over DSRC from other connected vehicles consistent with Section 6.3.8 of SAE J2945/1 (BSM Scheduling and Congestion Control), thereby verifying requirement. (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						developers verifies consistent implementation of standards formats and specifications.)	
VS-REQ-2 -- Receive TIM	The Vehicle System shall wirelessly receive a packet containing traveler information from the Wyoming CV System. Each packet may contain one or more individual traveler information message as defined in Section 5.16 of SAE J2735.	I		VS-REQ-2.1 VS-REQ-2.2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-2.1-WI2VMCT-1 VS-REQ-2.2-WI2VMCT-2	Requirement Verification Confirmed by:
VS-REQ-2.1 -- Receive TIM through DSRC	The Vehicle System shall wirelessly receive a packet containing traveler information from the Wyoming CV System through DSRC	I	VS-REQ-2 RFV-REQ-1 MV-REQ-4 HP-REQ-2 IT-REQ-1		WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated with WI2VSAT-1-REP)	* Perform Test Case WI2VMCT-1(WI2VSAT-REP) * Inspect DB Logs and locate 1 or more instances of formation of TIMs. * Inspect OBU logs and locate corresponding instances of TIMs received by OBU via DSRC. * Confirmation shows the Vehicle System wirelessly receives a packet containing traveler	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						information from the Wyoming CV System through DSRC, thereby verifying the requirement is satisfied.	
VS-REQ-2.2 -- Receive TIM through Satellite	The Vehicle System shall wirelessly receive a packet containing traveler information from the Wyoming CV System (via the Situational Data Warehouse) through satellite.	I	VS-REQ-2 RFV-REQ-2 MV-REQ-5 IT-REQ-2		WI2VMCT-2 -- End-to-end & Satellite Delivery of I2V SA TIMs (Integrated with WI2VSAT-5)	* Perform Test Case WI2VMCT-2(WI2VSAT-5) * Inspect DB Logs and locate 1 or more instances of formation of TIMs. * Inspect OBU logs and locate corresponding instances of TIMs received by OBU via satellite. * Confirmation shows the Vehicle System wirelessly receives a packet containing traveler information from the Wyoming CV System (via the Situational Data Warehouse) through satellite , thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
VS-REQ-3 -- Receive	The Vehicle System shall wirelessly receive a packet containing distress	I			WV2VMCT-2 -- V2V exchange of DNMs	* Perform Test Case WV2VMCT-2 * Inspect Distressed	Requirement Verification

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
Distress Information	information from other connected vehicles over DSRC. Distress information is a high priority messages based on the received distress broadcast (defined in J3067 3.5.9.2.1), but has the content of the TIM (defined in J2735 5.16 Part III advisory ITIS data elements 6.1 from J2540-2 Accidents and Incidents).				(Integrated with WDNR-1)	Vehicle OBU Logs and 1 or more instances of DN TIMs sent to Relay Vehicle * Inspect Relay Vehicle logs and identify corresponding instances of DN TIMs received from Distressed Vehicle	Confirmed by:
VS-REQ-4 -- Collect Vehicle Data	The Vehicle System shall have the capability to collect vehicle information from the host vehicle and the driver as stated below	I		VS-REQ-4.1 VS-REQ-4.2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-4.1-WV2IMCT-2 VS-REQ-4.2-WV2IMCT-2	Requirement Verification Confirmed by:
VS-REQ-4.1 -- Collect Vehicle Status Data	The Vehicle System shall have the capability to collect vehicle status information from the host vehicle, as stated in Section 5.4.2 of the ICD.	I	VS-REQ-4 MV-REQ-2		WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-1)	* Perform Test Case WV2IMCT-2(WFCWT-1) * Inspect OBU Logs and identify 1 or more instances of BSMs sent to RSUs * Inspect BSMs and identify CAN data elements, identified as	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						"yes/CAN" in WYDOT ICD Table 7 1: BSM Message Fields * Confirmation shows the Vehicle System has the capability to collect vehicle status information from the host vehicle, as stated in Section 542 of the ICD, thereby verifying the requirement is satisfied.	
VS-REQ-4.2 -- Collect Dimension Data	The Vehicle System shall have the capability to collect information from the host vehicle driver. The VS will maintain these values across power cycles and OTA updates. The data will be included in BSMs broadcasted by the Vehicle System. The list of fields which must be input are shown in Table 7-1 of the ICD, where column #1 contains the value "yes/driver".	I	VS-REQ-4 VS-REQ-32.8	VS-REQ-4.2.1 VS-REQ-4.2.2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-4.2.1-WV2IMCT-2(WFCWT-1) VS-REQ-4.2.2-WV2IMCT-2(WFCWT-1)	Requirement Verification Confirmed by:
VS-REQ-4.2.1 -- Vehicle	The Vehicle System shall have the capability to collect vehicle dimension from the	I	VS-REQ-4.2		WV2IMCT-2 -- V2I & End-to-end Communication of	* Perform Test Case WV2IMCT-2(WFCWT-1) * Inspect OBU Logs and	Requirement Verification

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
Dimension Data	host vehicle driver through the Human Machine Interface.				BSMs (Integrated with WFCWT-1)	identify 1 or more instances of BSMs sent to RSUs * Inspect BSMs and identify vehicle dimension data elements, identified in WYDOT ICD Table 7 1: BSM Message Fields * Confirmation shows the Vehicle System has the capability to collect vehicle dimension from the host vehicle driver through the Human Machine Interface, thereby verifying the requirement is satisfied.	Confirmed by:
VS-REQ-4.2.2 -- Vehicle Trailer Data	The Vehicle System shall have the capability to collect information from the host vehicle driver regarding the dimensions of attached trailers, including capability to indicate that no trailer is present, through the Human Machine Interface.	I	VS-REQ-4.2		WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-1)	* Perform Test Case WV2IMCT-2(WFCWT-1) * Inspect OBU Logs and identify 1 or more instances of BSMs sent to RSUs * Inspect BSMs and identify vehicle trailer data elements, identified in WYDOT ICD Table 7 1: BSM Message Fields * Confirmation shows the Vehicle System has the capability to collect	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						information from the host vehicle driver regarding the dimensions of attached trailers, including capability to indicate that no trailer is present, through the Human Machine Interface, thereby verifying the requirement is satisfied.	
VS-REQ-5 -- External Environment Sensor Data	The Vehicle System shall collect additional environmental sensor data from host vehicles equipped with external environmental sensors. Additional data collected from external environmental sensors is shown in Table 7-4 of the Interface Control Document.	I			WV2IMCT-3 -- V2I & End-to-end communication of Environmental Sensor Data	* Perform Test Case WV2IMCT-3 * Inspect HMI Logs and identify 1 or more instances of environmental sensor data copied to ODE * Inspect ODE logs and identify corresponding 1 or more instances of environmental sensor data copied from OBU to ODE * Confirmation shows the Vehicle System collects additional environmental sensor data from host vehicles equipped with external environmental sensors, thereby verifying	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						the requirement is satisfied.	
VS-REQ-5.1 -- External Environment Sensor Data Configuration	The collection of sensor data by the Vehicle System shall be configurable as specified in Section 3.2.5.1 of the SDD.	I			WV2IMCT-3 -- V2I & End-to-end communication of Environmental Sensor Data	* Perform Test Case WV2IMCT-3. * Inspect ODE Logs and locate and verify 1 or more instances of receipt of Environmental Sensor Data. * Inspect SDD and confirm configuration of Environmental Sensor Data * Inspect Environmental Sensor Data and confirm collection of sensor data by the Vehicle System is configurable * Confirmation shows the collection of sensor data by the Vehicle System is configurable as specified in Section 3251 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
VS-REQ-5.2 -- External Environment	The application shall support a data management mechanism, specified in Section 3.2.5.1 of the SDD.	I			WV2IMCT-3 -- V2I & End-to-end communication of	* Perform Test Case WV2IMCT-3. * Inspect ODE Logs and locate and verify 1 or	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
Sensor Data Management					Environmental Sensor Data	more instances of receipt of Environmental Sensor Data. * Inspect SDD and confirm data management mechanism * Inspect Environmental Sensor Data and confirm application supports a data management mechanism * Confirmation shows the application supports a data management mechanism, specified in Section 3251 of the SDD, thereby verifying the requirement is satisfied.	
VS-REQ-6 -- FCW Stopped Vehicles	The Vehicle System shall ingest BSM Parts I and II data received from remote vehicles to identify stopped remote vehicles directly ahead in the same lane and direction of travel (defined in J2945/1 section 4.2.4.2 (a)). Data ingest is defined as obtaining and importing data for use or storage.	I			Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: FCWP-REQ-1 - Test Case WFCWT-1 FCWP-REQ-2 - Test Case WFCWT-1 FCWP-REQ-6 - Test Case WFCWT-5	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						FCWP-REQ-7 - Test Case WFCWT-5 FCWP-REQ-8 - Test Case WFCWT-6	
VS-REQ-7 -- FCW Decelerating/Slow Moving Vehicles	The Vehicle System shall ingest BSM Parts I and II data received from remote vehicles to identify decelerating or slower moving remote vehicles directly ahead in the same lane and direction of travel (defined in J2945/1 section 4.2.4.2 (c)). Data ingest is defined as obtaining and importing data for use or storage	I			Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: FCWP-REQ-5 - Test Case WFCWT-4 FCWP-REQ-9 - Test Case WFCWT-8 FCWP-REQ-10 - Test Case WFCWT-8	Requirement Verification Confirmed by:
VS-REQ-8 -- FCW Stopped and Obstructed Vehicles	The Vehicle System shall ingest BSM Parts I and II data received from remote vehicles to identify stopped and obstructed remote vehicles directly ahead in the same lane and direction of travel (defined in J2945/1 section 4.2.4.2 (d)). Data ingest is defined as obtaining and importing data for use or storage	I			WFCWT-7 -- FCW Stopped and Obstructed Remote Vehicle Ahead	* Perform Test Case WFCWT-7 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped and obstructed remote vehicle ahead * Confirm issuance of advisory alert * Issuance of advisory alert confirms Vehicle System ingests BSM data	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						received from remote vehicles to identify stopped and obstructed remote vehicles directly ahead in the same lane and direction of travel, thereby verifying requirement. (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	
VS-REQ-9 -- FCW Rear-End Crash	The Vehicle System shall ingest BSM Parts I and II data received from remote vehicles to identify imminent danger of a rear-end crash with a remote vehicle in its lane of travel (defined in J2945/1 section 4.2.4.3). Data ingest is defined as obtaining and importing data for use or storage.	I		VS-REQ-9.1 VS-REQ-9.2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-9.1 - Test Case WFCWT-5 VS-REQ-9.2 - Test Case WFCWT-5	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
VS-REQ-9.1 -- Rear-End Crash in Straight Road	The Vehicle System shall identify imminent danger of a rear-end crash with a remote vehicle lead vehicle in its lane of travel in a straight roadway geometry.	I	VS-REQ-9		WFCWT-1 -- FCW Stopped Vehicle Ahead	* Perform Test Case WFCWT-1 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped remote vehicle ahead * Confirm issuance of imminent danger alert * Issuance of imminent danger alert verifies Vehicle System identifies imminent danger of a rear-end crash with a remote vehicle lead vehicle in its lane of travel in a straight roadway geometry, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
VS-REQ-9.2 -- Rear-End Crash in Curved Road	The Vehicle System shall identify imminent danger of a rear-end crash with a remote vehicle lead vehicle in its lane of travel in a curved roadway geometry.	I	VS-REQ-9		WFCWT-5 -- FCW Stopped Vehicle in a Curve	* Perform Test Case WFCWT-5 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped remote vehicle ahead * Confirm issuance of imminent danger alert * Issuance of imminent danger alert verifies	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						Vehicle System identifies imminent danger of a rear-end crash with a remote vehicle lead vehicle in its lane of travel in a curved roadway geometry, thereby verifying the requirement is satisfied.	
VS-REQ-10 -- FCW No Warning	The Vehicle System shall ingest BSM Parts I and II data received from remote vehicles to identify when there is no need to display a warning on the HMI of the host vehicle. Data ingest is defined as obtaining and importing data for use or storage.	I		VS-REQ-10.1 VS-REQ-10.2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-10.1 - WVCWT-3 VS-REQ-10.2 - WVCWT-2 FCWP-REQ-3 - WVCWT-2 FCWP-REQ-4 - WVCWT-3	Requirement Verification Confirmed by:
VS-REQ-10.1 -- Safely Following a Vehicle	The Vehicle System shall identify when no imminent danger of a rear-end crash is present with a remote vehicle in its lane of travel in common roadway geometries.	I	VS-REQ-10		WFCWT-3 -- FCW Steady State	* Perform Test Case WFCWT-3 * Inspect Host Vehicle OBU Event Logs, determine location, speed, and heading path of Host Vehicle. * Determine travel lane of Host Vehicle	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						* Inspect Remote Vehicle OBU Event Logs, determine location, speed, and heading path of Remote Vehicle. * Determine travel lane of Remote Vehicle. * Inspect Host and Remote Vehicle Event Logs and identify time period when Host follows Remote at 35 mph at a distance of 5 to 8 meters for 60 seconds or more. * Inspect Host Vehicle OBU Event Logs and verify that alert was not issued during this time. * Inspect Host Vehicle HMI Logs and verify that alert was not issued during this time. * Absence of alert verifies the Vehicle System identifies when no imminent danger of a rear-end crash is present with a remote vehicle in its lane of travel in common roadway geometries,	

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						thereby verifying the requirement is satisfied. (Note: As a system integrator, WYDOT Team tests to verify basic functionalities are present in vendor supplied systems, but does not have the resources to verify all conditions defined by "common roadway geometries".)	
VS-REQ-10.2 -- Passing a Stopped Vehicle	The Vehicle System shall identify when no imminent danger of a rear-end crash is present with a remote vehicle that is stopped and not in its lane of travel in common roadway geometries.	I	VS-REQ-10		WFCWT-2 -- FCW Passing Stopped Vehicle	* Perform Test Case WFCWT-2 * Inspect Host Vehicle OBU Event Logs, determine location, speed, and heading path of Host Vehicle. * Inspect Remote Vehicle OBU Event Logs, determine location, speed, and heading path of Remote Vehicle. * Verify vehicles are not in the same travel lane. * Inspect Host Vehicle OBU Event Logs and verify that alert was not issued.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						* Inspect Host Vehicle HMI Logs and verify that alert was not issued. * Absence of alert verifies the Vehicle System identifies when no imminent danger of a rear-end crash is present with a remote vehicle that is stopped and not in its lane of travel in common roadway geometries, thereby verifying the requirement is satisfied. (Note: As a system integrator, WYDOT Team tests to verify basic functionalities are present in vendor supplied systems, but does not have the resources to verify all conditions defined by "common roadway geometries".)	
VS-REQ-11 -- SA TIM-Advisories	The Vehicle System shall ingest received TIMs to identify advisories (Part III content choice ITIS.ITIScodesAndText defined in J2735 section	I			WI2VSAT-1-WTI-Speed -- Message Display in Travel Lanes - WTI Speed	* Perform test Case WI2VSAT-1-WTI-Speed * Inspect OBU Logs * Confirm receipt of 1 or more TIMs by OBU. * Confirm message	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	6.142). Data ingest is defined as obtaining and importing data for use or storage					display in travel lanes * Confirmation shows the Vehicle System ingests received TIMs to identify advisories (Part III content choice ITIS.ITIScodesAndText defined in J2735 section 6.142), thereby verifying the requirement is satisfied. (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	
VS-REQ-12 -- SA TIM-Speed Limit	The Vehicle System shall ingest received TIMs to identify speed limits (Part III content choice speedLimit defined in J2735 section 6.142). Data ingest is defined as obtaining and importing data for use or storage	I			WI2VSAT-1-WTI-Speed -- Message Display in Travel Lanes - WTI Speed	* Perform test Case WI2VSAT-1-WTI-Speed * Inspect OBU Logs * Confirm receipt of 1 or more TIMs by OBU. * Confirm receipt of TIMs identifying speed limits from WTI (Variable Speed Limit)	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						* Confirm message display in travel lanes. * Confirmation shows the Vehicle System ingests received TIMs to identify speed limits (Part III content choice speedLimit defined in J2735 section 6.142), thereby verifying the requirement is satisfied. (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	
VS-REQ-13 -- SA TIM-Exit Services	The Vehicle System shall ingest received TIMs to identify Exit Services (Part III content choice exitService defined in J2735 section 6.142). This is used to provide parking information if necessary. Data ingest is defined as obtaining and	I			WI2VSAT-1-511 -- Message Display in Travel Lanes - 511	* Perform test Case WI2VSAT-1-511 * Inspect OBU Logs * Confirm receipt of 1 or more TIMs by OBU. * Confirm receipt of TIMs identifying truck parking availability from 511 (Truck Parking)	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	importing data for use or storage					* Confirm message display in travel lanes. * Confirmation shows the Vehicle System ingests received TIMs to identify Exit Services (Part III content choice exitService defined in J2735 section 6.142), thereby verifying the requirement is satisfied. (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	
VS-REQ-14 -- SA TIM-Region	The Vehicle System shall ingest received TIMs to identify the applicable regions of use geographical path (Part II defined in J2735 section 6.142). Data ingest is defined as obtaining and	I			WI2VSAT-1-REP -- Message Display in Travel Lanes	* Perform Test Case WI2VSAT-1-REP * Confirm issuance of advisories and alerts at the location specified in the TIM. * Confirmation shows the Vehicle System ingests received TIMs to identify	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	importing data for use or storage					the applicable regions of use geographical path (Part II defined in J2735 section 6142), thereby verifying the requirement is satisfied.	
VS-REQ-15 -- Distress Notification ID	The Vehicle System shall identify received distress notifications. Distress information is a high priority messages loosely based on the mayday broadcast (defined in J3067 3.5.9.2.1), but has the content of the TIM (defined in J2735 5.16 Part III advisory ITIS data elements 6.1 from J2540_2 Accidents and Incidents).	I		VS-REQ-15.1	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-15.1 - WDNR-2	Requirement Verification Confirmed by:
VS-REQ-15.1 -- Log	The Vehicle System shall log received distress notifications to include the DNM.	I	VS-REQ-15		WDNR-1 -- Same direction Distress Notification relay to RSU	* Perform Test Case WDNR-1 * Inspect Relay Vehicle OBU Logs and identify instance of DNM received from Distressed Vehicle * Identification of receipt of DNMs in Relay Vehicle OBU confirms Vehicle System logs received distress notifications to	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						include the DNM, thereby verifying the requirement is satisfied.	
VS-REQ-16 -- Create Distress Notification	The Vehicle System shall have the ability to generate a distress notification.	I		VS-REQ-16.1	NA - Feature not currently implemented.	NA - Feature not currently implemented.	Requirement Verification Confirmed by:
VS-REQ-16.1 -- System-Generated Distress Notification	The Vehicle System shall have the ability to self-generate a distress notification when the vehicle Event Status reports airbag deployment or disabled vehicle code. Vehicle Status data is specified in Section 5.4.2 of the ICD.	I	VS-REQ-16		NA - Feature not currently implemented.	NA - Feature not currently implemented.	Requirement Verification Confirmed by:
VS-REQ-16.2 -- Driver-Generated Distress Notification	The Vehicle System shall have the ability to generate a distress notification when the vehicle operator selects the distress notification activation alternative in the HMI.	I			WDNR-1 -- Same direction Distress Notification relay to RSU	* Perform Test Case WDNR-1 * Inspect Distressed Vehicle OBU logs and confirm Distress Notification is activated 1 or more times. * Inspect Distressed Vehicle OBU Logs and identify instance of DNMs broadcast * Inspect Relay Vehicle OBU Logs and identify	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						instance of DNM received from Distressed Vehicle * Receipt of DNMs by Relay Vehicle confirms Vehicle System has the ability to generate a distress notification when the vehicle operator selects the distress notification activation alternative in the HMI, thereby verifying the requirement is satisfied.	
VS-REQ-17 -- DNM-Region	The Vehicle System shall ingest received DNMs to identify the applicable regions of use geographical path (Part II defined in J2735 section 6.142). Data ingest is defined as obtaining and importing data for use or storage.	I			WDNR-2 -- Opposite direction Distress Notification relay to RSU and Following Vehicle	* Perform Test Case WDNR-2 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Same Direction Following Vehicle OBU Event Logs, determine time, location, speed, and heading path of when first Distress Notification Message received. * Determine if Same Direction Following Vehicle is traveling in the	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						same direction as the Distressed Vehicle. * Inspect Same Direction Following Vehicle HMI Logs and determine if the Distress Notification Cautions indicate if the distressed vehicle is in the same direction of travel as the receiving vehicle was displayed to the driver. * Confirm Distress Notification Cautions indicate if the distressed vehicle is in the same direction of travel verifies that the Vehicle System ingests received DNMs to identify the applicable regions of use geographical path (Part II defined in J2735 section 6.142), thereby verifying the requirement is satisfied.	
VS-REQ-18 -- DN PSID	The Vehicle System shall use a unique high priority Provider Service Identifier (PSID) for the distress	I			WDNR-1 -- Same direction Distress Notification relay to RSU	* Perform Test Case WDNR-1 * Inspect Relay Vehicle OBU logs and confirm receipt of Distress	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	notification application as per IEEE 1609.12.					Notification. * Confirm use of unique high priority PSID * Use of unique high priority PSID verifies the Vehicle System uses a unique high priority Provider Service Identifier (PSID) for the distress notification application as per IEEE 1609.12. * (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	
VS-REQ-19 -- WZW TIM	The Vehicle System shall ingest received TIMs to identify work zone warnings (Part III content choice workZone defined in J2735 section 6.142). Data ingest is defined as obtaining and	I			WI2VSAT-1-CA -- Message Display in Travel Lanes - CA	* Perform Test Case WI2VSAT-1-CA * Inspect OBU logs. * Confirm receipt of TIMs by OBU * Confirm receipt of TIMs identifying alerts from CA (Work Zone Warning) * Confirmation shows the	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	importing data for use or storage.					Vehicle System ingests received TIMs to identify work zone warnings (Part III content choice workZone defined in J2735 section 6.142), thereby verifying the requirement is satisfied.	
VS-REQ-20 -- WZW TIM-Region	The Vehicle System shall ingest received TIMs to identify the applicable regions of use geographical path (Part II defined in J2735 section 6.142). Data ingest is defined as obtaining and importing data for use or storage.	I			WI2VSAT-1-CA -- Message Display in Travel Lanes - CA	* Perform Test Case WI2VSAT-1-CA * Inspect OBU logs. * Confirm receipt of TIMs by OBU * Confirm receipt of TIMs identifying alerts from CA (Work Zone Warning) * Confirm message begins and ends display at correct geofence milepost * Confirmation shows the Vehicle System ingests received TIMs to identify the applicable regions of use geographical path (Part II defined in J2735 section 6.142), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
VS-REQ-21 -- SWIW TIM	The Vehicle System shall ingest received TIMs to identify advisories for wind and weather conditions (Part III content choice advisories defined in J2735 section 6.142 for ITIS - data elements 6.54 Weather Conditions and 6.55 Winds defined in J2540_2). Data ingest is defined as obtaining and importing data for use or storage.	I			WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	* Perform test Case WI2VSAT-1-Pikalert with Spot Weather Impact Warning alert from Pikalert. * Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm receipt of TIMs identifying Spot Weather Impact Warning alert from Pikalert * Confirmation shows the Vehicle System ingests received TIMs to identify advisories for wind and weather conditions (Part III content choice advisories defined in J2735 section 6.142 for ITIS * data elements 6.54 Weather Conditions and 6.55 Winds defined in J2540_2), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
VS-REQ-22 -- SWIW TIM-Region	The Vehicle System shall ingest received TIMs to identify the applicable regions of use geographical path	I			WI2VSAT-1-Pikalert -- Message Display in	* Perform test Case WI2VSAT-1-Pikalert with Spot Weather Impact Warning alert from	Requirement Verification

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	(Part II defined in J2735 section 6.142). Data ingest is defined as obtaining and importing data for use or storage.				Travel Lanes - Pikalert	Pikalert. * Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm receipt of TIMs identifying Spot Weather Impact Warning alert from Pikalert * Confirm message begins and ends display at correct geofence milepost * Confirmation shows the Vehicle System ingests received TIMs to identify advisories for wind and weather conditions (Part III content choice advisories defined in J2735 section 6.142 for ITIS * data elements 6.54 Weather Conditions and 6.55 Winds defined in J2540_2), thereby verifying the requirement is satisfied.	Confirmed by:
VS-REQ-23 -- IVAA Rank	The Vehicle System shall provide prioritized in-vehicle alerts based on the rank order presented in Table 4-1	I			WFCWT-9 -- Simultaneous Message Prioritization	* Perform Test Case WFCWT-9 * Verify I2V SA Message displays within 8 meters of beginning of specified	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	of the SyRS, with the highest rank on top.					geofence. * Verify DN TIM message displays at specified distance from distressed vehicle, prioritized over I2V SA message. * Verify that, as host vehicle approaches remote vehicle, FCW imminent danger warning is issued, prioritized over I2V SA and DN TIM, in time for driver to avoid collision. * Prioritized delivery of I2V SA Message, DN TIM, and FCW imminent danger alert verifies the Vehicle System provides prioritized in-vehicle alerts based on the rank order presented in Table 4-1 of the SyRS, with the highest rank on top, thereby verifying the requirement is satisfied.	
VS-REQ-24 -- IVAA Level	The Vehicle System shall have three levels of alert, as	I			WFCWT-9 -- Simultaneous Message Prioritization	* Perform Test Case WFCWT-9 * Verify I2V SA Message displays within 8 meters of	Requirement Verification

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	described in Table 4-2 of the SyRS.					beginning of specified geofence. * Verify DN TIM message displays at specified distance from distressed vehicle, prioritized over I2V SA message. * Verify that, as host vehicle approaches remote vehicle, FCW imminent danger warning is issued, prioritized over I2V SA and DN TIM, in time for driver to avoid collision. * Prioritized delivery of I2V SA Message, DN TIM, and FCW imminent danger alert verifies the Vehicle System has three levels of alert, as described in Table 4-2 of the SyRS, thereby verifying the requirement is satisfied.	Confirmed by:
VS-REQ-25 -- IVAA Priority Alert	The Vehicle System shall provide only the highest priority alert to the vehicle	I			WFCWT-9 -- Simultaneous Message Prioritization	* Perform Test Case WFCWT-9 * Verify I2V SA Message displays within 8 meters of beginning of specified	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	operator when more than one alert is currently active					geofence. * Verify DN TIM message displays at specified distance from distressed vehicle, prioritized over I2V SA message. * Verify that, as host vehicle approaches remote vehicle, FCW imminent danger warning is issued, prioritized over I2V SA and DN TIM, in time for driver to avoid collision. * Prioritized delivery of I2V SA Message, DN TIM, and FCW imminent danger alert verifies the Vehicle System provides only the highest priority alert to the vehicle operator when more than one alert is currently active, thereby verifying the requirement is satisfied.	
VS-REQ-26 -- IVAA FCW	The Vehicle System shall alert the vehicle operator for forward collision warning based on the warning	I			WFCWT-1 -- FCW Stopped Vehicle Ahead	* Perform Test Case WFCWT-1 * Inspect Host Vehicle OBU Logs	Requirement Verification

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	distance calculation algorithm in section 3.1 of the Connected Commercial Vehicles—Retrofit Safety Device Kit Project Safety Applications and Development Plan (FHWA-JPO-14-106) and guidance for FCW Time-to Collision, Advisories and Alerts provided in SyRS Section 6.1.1. This could be an inform message, warning 1 or warning 2 based on the calculated deceleration rate required. During the design phase a deceleration rate will be selected for a warning 1 and for warning 2 based on vehicle type and weight.					* Confirm detection of stopped remote vehicle ahead * Confirm issuance of imminent danger alert * Issuance of imminent danger alert verifies the Vehicle System alerts the vehicle operator for forward collision warning based on the warning distance calculation algorithm in section 3.1 of the Connected Commercial Vehicles—Retrofit Safety Device Kit Project Safety Applications and Development Plan (FHWA-JPO-14-106) and guidance for FCW Time-to Collision, Advisories and Alerts provided in SyRS Section 6.1.1, thereby verifying the requirement is satisfied. (Note: As a system integrator, WYDOT Team tests to verify basic functionalities are present	Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						in vendor supplied systems, but does not have the resources to verify detailed implementation of algorithms.)	
VS-REQ-27 -- IVAA DN	The Vehicle System shall alert the vehicle operator for a distress message when the direction of travel of the host vehicle moving toward the distressed vehicle and is within five miles of the location of a distressed vehicle using an inform message. Distress Notification functionality is described in Section 2.6.3 of the SyRS.	I			Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: DNP-REQ-5 - WDNR-1 DNP-REQ-6 - WDNR-1 DNP-REQ-7 - WDNR-2 DNP-REQ-8 - WDNR-2	Requirement Verification Confirmed by:
VS-REQ-28 -- IVAA SA-Advisory	The Vehicle System shall alert the vehicle operator for a situational awareness advisory using an inform message when the host vehicle is traveling towards the segment where the situational awareness applies.	I			WI2VSAT-1-REP -- Message Display in Travel Lanes	* Perform Test Case WI2VSAT-1-REP * Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm issuance of advisories and alerts at the location specified in the TIM. * Confirmation shows the	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						Vehicle System alerts the vehicle operator for a situational awareness advisory using an inform message when the following conditions are met: i) Host vehicle is traveling towards the segment where the situational awareness applies; ii) Host vehicle meets the criteria for the advisory, thereby verifying the requirement is satisfied.	
VS-REQ-29 -- IVAA SA-VSL	The Vehicle System shall inform the vehicle operator of the current speed limit of the variable speed limit zone the vehicle is within using an inform message. Additionally, when the host vehicle is traveling towards and within one mile of a variable speed limit zone, the Vehicle System shall inform the vehicle operator of the speed limit using an inform message.	I			WI2VSAT-1-WTI-Speed -- Message Display in Travel Lanes - WTI Speed	* Perform Test Case WI2VSAT-1-WTI-Speed * Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm receipt of TIMs identifying speed limits from WTI (Variable Speed Limit) * Confirm issuance of advisories and alerts at the location specified in the TIM. * Confirmation shows the Vehicle System informs	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						the vehicle operator of the current speed limit of the variable speed limit zone the vehicle is within using an inform message. Additionally, when the host vehicle is traveling towards and within one mile of a variable speed limit zone, the Vehicle System informs the vehicle operator of the speed limit using an inform message, thereby verifying the requirement is satisfied.	
VS-REQ-30 -- IVAA SWIW	The Vehicle System shall alert the vehicle operator of a spot weather incident when the host vehicle is traveling toward and within five miles of the incident's location using an inform message as defined in Section 2.6.5 of the SyRS.	I			WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	* Perform test Case WI2VSAT-1-Pikalert * Inspect OBU logs. * Confirm receipt of TIMs by OBU. -Confirm receipt of TIMs identifying Spot Weather Impact Warning alert from Pikalert * Confirm issuance of advisories and alerts at the location specified in the TIM. * Confirmation shows the	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						Vehicle System alerts the vehicle operator of a spot weather incident when the host vehicle is traveling toward and within five miles of the incident's location using an inform message as defined in Section 2.6.5 of the SyRS, thereby verifying the requirement is satisfied.	
VS-REQ-31 -- IVAA WZW	The Vehicle System shall alert the vehicle operator of a work zone, based on the information defined in requirement CA-REQ-3, when host vehicle is traveling towards and within two miles of the location of a work zone using an inform message as defined in Section 2.6.4 of the SyRS.	I			WI2VSAT-1-CA -- Message Display in Travel Lanes - CA	* Perform Test Case WI2VSAT-1-CA * Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm receipt of TIMs identifying alerts from CA (Work Zone Warning) * Confirm issuance of advisories and alerts at the location specified in the TIM. * Confirmation shows the Vehicle System alerts the vehicle operator of a work zone, based on the information defined in requirement CA-REQ-3, when host vehicle is	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						traveling towards and within two miles of the location of a work zone using an inform message as defined in Section 2.6.4 of the SyRS, thereby verifying the requirement is satisfied.	
VS-REQ-32 -- HMI Characteristics	All Vehicle Sub-Systems shall contain a HMI that conforms to the following characteristics.	I		VS-REQ-32.1 VS-REQ-32.2 VS-REQ-32.3 VS-REQ-32.4 VS-REQ-32.5 VS-REQ-32.6 VS-REQ-32.7 VS-REQ-32.8	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-32.1-WOBUDOC-1 VS-REQ-32.2-WOBUDOC-1 VS-REQ-32.3-WOBUDOC-1 VS-REQ-32.4-WOBUDOC-1 VS-REQ-32.5-WOBUDOC-1 VS-REQ-32.6-WOBUDOC-1 VS-REQ-32.7-WOBUDOC-1	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						VS-REQ-32.8-WOBUDOC-1	
VS-REQ-32.1 -- HMI-Location	The location where the devices will be mounted/installed shall be selected so that they do not obstruct the line of sight of the driver nor distract the driver from the primary task of driving.	I	VS-REQ-32		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm the location where the devices will be mounted/installed is selected so that they do not obstruct the line of sight of the driver nor distract the driver from the primary task of driving. * Confirmation shows the location where the devices will be mounted/installed be selected so that they do not obstruct the line of sight of the driver nor distract the driver from the primary task of driving, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
VS-REQ-32.2 -- HMI-Distraction	The HMI shall minimize the 'eyes off the road' time when presenting information for an application	I	VS-REQ-32		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm the HMI minimizes the 'eyes off the road' time when presenting information for an application	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						* Confirmation shows the HMI minimize the 'eyes off the road' time when presenting information for an application, thereby verifying the requirement is satisfied.	
VS-REQ-32.3 -- HMI-Readability	The HMI shall provide messages that can be read from the driver's normal seating position	I	VS-REQ-32		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm the HMI provide messages that can be read from the driver's normal seating position. * Confirmation shows the HMI provide messages that can be read from the driver's normal seating position, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
VS-REQ-32.4 -- Visual and Auditory Interface	The HMI shall include both a visual and auditory interface for sharing traveler information	I	VS-REQ-32	VS-REQ-32.4.1 VS-REQ-32.4.2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-32.4.1-WOBUDOC-1	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						VS-REQ-32.4.2-WOBUDOC-1	
VS-REQ-32.4.1 -- Visual Consistency	The HMI shall maintain a consistent structure across applications with respect to presenting information to drivers and inputs to the system.	I	VS-REQ-32.4		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm the HMI maintain a consistent structure across applications with respect to presenting information to drivers and inputs to the system. * Confirmation shows the HMI maintain a consistent structure across applications with respect to presenting information to drivers and inputs to the system, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
VS-REQ-32.4.2 -- Audio Signals	Auditory signals shall be loud enough to overcome masking sounds from road noise, the cab environment, and other equipment.	I	VS-REQ-32.4		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm the auditory signals be loud enough to overcome masking sounds from road noise, the cab environment, and other equipment. * Confirmation shows	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						auditory signals be loud enough to overcome masking sounds from road noise, the cab environment, and other equipment, thereby verifying the requirement is satisfied.	
VS-REQ-32.5 -- Customizations	HMI characteristics shall be customizable to reflect driver preferences. Preferences that shall be customizable are: • Volume • Brightness • Contrast text size • Display contrast • Mounting eye position	I	VS-REQ-32		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm HMI characteristics are customizable to reflect driver preferences. * Confirmation shows HMI characteristics be customizable to reflect driver preferences, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
VS-REQ-32.6 -- System Status	The HMI shall provide system status information to drivers. Information included in the system status includes power status, system settings, status of applications availability, and pending update status	I	VS-REQ-32	VS-REQ-32.6.1 VS-REQ-32.6.2 VS-REQ-32.6.3 VS-REQ-32.6.4	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-32.6.1-WOBUDOC-1 VS-REQ-32.6.2-	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						WOBUDOC-1 VS-REQ-32.6.3-WOBUDOC-1 VS-REQ-32.6.4-WOBUDOC-1	
VS-REQ-32.6.1 -- Power Status	The HMI shall notify the driver of the power status of device with the screen graphics (e.g., off, powering up and online).	I	VS-REQ-32.6		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm the HMI notifies the driver of the power status of device with the screen graphics (e.g., off, powering up and online). * Confirmation shows the HMI notifies the driver of the power status of device with the screen graphics (e.g., off, powering up and online), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
VS-REQ-32.6.2 -- System Settings	The HMI shall allow the driver to see the system settings of the device with screen graphics. (e.g., version, brightness, volume font size).	I	VS-REQ-32.6		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm The HMI allows the driver to see the system settings of the device with screen graphics. (e.g., version, brightness, volume font size).	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						* Confirmation shows the HMI allow the driver to see the system settings of the device with screen graphics (e.g., version, brightness, volume font size), thereby verifying the requirement is satisfied.	
VS-REQ-32.6.3 -- Application Availability	The HMI shall allow the driver to see application availability with screen graphics (e.g., failed, operating, disabled).	I	VS-REQ-32.6		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm the HMI allows the driver to see application availability with screen graphics (e.g., failed, operating, disabled).* Perform Test Case WOBUDOC-1 * Confirmation shows the HMI allows the driver to see application availability with screen graphics (e.g., failed, operating, disabled), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
VS-REQ-32.6.4 -- Pending Update Status	The HMI shall allow the driver see pending updates for the device with screen graphics	I	VS-REQ-32.6		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm the HMI allows the driver see pending	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	(e.g., applications, firmware, operating system).					updates for the device with screen graphics (e.g., applications, firmware, operating system).* Perform Test Case WOBUDOC-1 * Confirmation shows the HMI allows the driver see pending updates for the device with screen graphics (e.g., applications, firmware, operating system), thereby verifying the requirement is satisfied.	
VS-REQ-32.7 -- Distress Notification	The HMI shall include a distress button to allow a driver to notify the Vehicle System that the driver has initiated a distress condition. This button enables the distress notification application as defined in section 2.6.3 of the SyRS.	I	VS-REQ-32		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm the HMI includes a distress button to allow a driver to notify the Vehicle System that the driver has initiated a distress condition. * Confirmation shows the HMI includes a distress button to allow a driver to notify the Vehicle System that the driver has initiated a distress condition	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
VS-REQ-32.8 -- Non-Distress Information	The HMI shall allow the driver to input data, as defined in VS-REQ-4.2	I	VS-REQ-32	VS-REQ-4.2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-4.2-WV2IMCT-2	Requirement Verification Confirmed by:
VS-REQ-33 -- BCVI Messages	The Vehicle System shall wirelessly broadcast over DSRC a basic safety message (BSM) to other connected devices.	I			WV2VMCT-1 -- V2V exchange of BSMs (Integrated with WFCWT-1)	* Perform Test Case WV2VMCT-1(WFCWT-1) * Inspect Host Vehicle OBU Logs and identify 1 or more instances of BSMs sent from Host Vehicle to Remote Vehicle * Inspect Remote Vehicle OBU logs and identify corresponding receipt of BSMs * Confirmation shows the Vehicle System wirelessly broadcasts over DSRC a basic safety message (BSM) to other connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
VS-REQ-34 -- BCVI Distress	The Vehicle System shall wirelessly broadcast distress	I		VS-REQ-34.1 VS-REQ-34.2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements	Requirement Verification

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	messages to other connected devices.					when performing the corresponding Test Cases: VS-REQ-34.1 - WDNR-2 VS-REQ-34.2 - WDNR-1	Confirmed by:
VS-REQ-34.1 -- Received Distress	The Vehicle System shall broadcast distress notifications (over DSRC), received from remote vehicles, for five miles from the location where the distressed vehicle is located.	I	VS-REQ-34		WDNR-2 -- Opposite direction Distress Notification relay to RSU and Following Vehicle	* Perform Test Case WDNR-2 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Opposing Direction Relay Vehicle OBU Event Logs, determine time, location, speed, and heading path of Opposing Direction Relay Vehicle when first Distress Notification Message was broadcast. * Inspect Opposing Direction Relay Vehicle OBU Event Logs, determine time, location, speed, and heading path of Opposing Direction Relay Vehicle when Distress Notification ceased to be broadcast.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						* Compute Distance between first and last Distress Notification broadcast. * Confirm the Vehicle System broadcasts distress notifications (over DSRC), received from Relay Vehicles, for approximately five miles from the location where the distressed vehicle is located, thereby verifying the requirement is satisfied.	
VS-REQ-34.2 -- Generated Distress	The Vehicle System, in distress (described in Section 2.6 of the SyRS), shall broadcast distress notifications over DSRC, until the vehicle event code that triggered the distress notification is reset or power is lost (whichever comes first).	I	VS-REQ-34		WDNR-1 -- Same direction Distress Notification relay to RSU	* Perform Test Case WDNR-1 * Inspect Distress Vehicle OBU logs and confirm Distress Notification is activated 1 or more times. * Inspect Distress Vehicle OBU Logs and identify 1 or more instances of DNMs broadcast. * Shut Off OBU and Restart. * Confirm OBU ceases broadcast of DNM. * Termination of broadcast	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						confirms the Vehicle System, in distress (as defined in Section 2.6.3), broadcasts distress notifications (over DSRC), until the vehicle event code that triggered the distress notification is reset or power is lost (whichever comes first), thereby verifying the requirement is satisfied. (Note: The trigger event code is reset by cycling power on the OBU.)	
VS-REQ-35 -- BCVI General Broadcast Requirements	The Vehicle System shall use the general broadcast requirements defined in Appendix A.4 Broadcast Traveler Information of the SyRS.	I			WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm the Vehicle System uses the general broadcast requirements defined in Appendix A4 Broadcast Traveler Information of the SyRS. * Confirmation shows the Vehicle System use the general broadcast requirements defined in Appendix A4 Broadcast Traveler Information of the SyRS, thereby verifying	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						the requirement is satisfied.	
VS-REQ-36 -- Transmit Data	The Vehicle System shall transmit data over DSRC.	I		VS-REQ-36.1 VS-REQ-36.2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-36.1-WV2IMCT-3 VS-REQ-36.2-WV2IMCT-4(WFCWT-1)	Requirement Verification Confirmed by:
VS-REQ-36.1 -- Transmit Environmental Data	The Vehicle System shall transmit over DSRC environmental data, defined in Table 7-4 of the SDD, to the Wyoming CV System when available from a vehicle Sub-System.	I	VS-REQ-36 MV-REQ-1		WV2IMCT-3 -- V2I & End-to-end communication of Environmental Sensor Data	* Perform Test Case WV2IMCT-3 * Confirm secure copy to the Wyoming CV System of Environmental Data. * Confirmation shows the Vehicle System transmits over DSRC environmental data, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
VS-REQ-36.2 -- TVI Data Management-Log	The Vehicle System shall transmit log files via secure copy (SCP) to the Wyoming CV System over DSRC that contain event logs data defined in VS-REQ-41.	I	VS-REQ-36		WV2IMCT-4 -- V2I & End-to-end communication of log files (Integrated with WFCWT-1)	* Perform Test Case WV2IMCT-4(WFCWT-1) * Confirm secure copy to the Wyoming CV System of Event Logs. * Confirmation shows the Vehicle System transmits	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						log files via secure copy (SCP) to the Wyoming CV System over DSRC that contain event logs data, thereby verifying the requirement is satisfied.	
VS-REQ-38 -- SLD Information	The Vehicle System shall store information generated by the host vehicle on local storage. Information to be stored is detailed in Table 4-3 of the SyRS.	I			WV2IMCT-1 -- V2I and End-to-end communication of DNMs (Integrated with WDNR-1)	* Perform Test Case WV2IMCT-1(WDNR-1) * Confirm that the Vehicle System store information generated by the host vehicle on local storage. * Confirmation shows the Vehicle System store information generated by the host vehicle on local storage, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
VS-REQ-39 -- SLD Rolling Log	The Vehicle System shall maintain rolling logs for in vehicle generated CV data for 10 seconds. Table 4-4 of the SyRS lists one or more sources of the rolling logs that may be available in a vehicle Sub-System.	I			WV2IMCT-1 -- V2I and End-to-end communication of DNMs (Integrated with WDNR-1)	* Perform Test Case WV2IMCT-1(WDNR-1) * Confirm that the Vehicle System maintain rolling logs for in vehicle generated CV data for 10 seconds. * Confirmation shows the Vehicle System maintain rolling logs for in vehicle	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						generated CV data for 10 seconds, thereby verifying the requirement is satisfied.	
VS-REQ-40 -- SLD Log Format	The event log format shall contain UTC time stamped text or binary data.	I			WV2IMCT-1 -- V2I and End-to-end communication of DNMs (Integrated with WDNR-1)	* Perform Test Case WV2IMCT-1(WDNR-1) * Confirm that the event log format contain UTC time stamped text or binary data * Confirmation shows the event log format contain UTC time stamped text or binary data, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
VS-REQ-41 -- SLD Log Data	The Vehicle System shall create event logs for all interactions with the Wyoming CV System or Vehicle System that is retained until it is sent to the Wyoming CV System or is older than seven (7) days. An interaction is defined as a received message from the Wyoming CV System or the Vehicle System. Each log should contain the	I			WV2IMCT-1 -- V2I and End-to-end communication of DNMs (Integrated with WDNR-1)	* Perform Test Case WV2IMCT-1(WDNR-1) * Confirm that the Vehicle System create event logs for all interactions with the Wyoming CV System or Vehicle System that is retained until it is sent to the Wyoming CV System or is older than seven (7) days. * Confirmation shows the Vehicle System create	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	information in Table 4-5 of the SyRS.					event logs for all interactions with the Wyoming CV System or Vehicle System that is retained until it is sent to the Wyoming CV System or is older than seven (7) days, thereby verifying the requirement is satisfied.	
VS-REQ-42 -- VSM SCMS	The Vehicle System shall use the USDOT SCMS Certificates in accordance with the security and privacy requirements in Section 6.5 of J2945/1	I			WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm Vehicle System use the USDOT SCMS Certificates in accordance with the security and privacy requirements in Section 6.5 of J2945/1. * Confirmation shows the Vehicle System use the USDOT SCMS Certificates in accordance with the security and privacy requirements in Section 65 of J2945/1, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
VS-REQ-43 -- VSM SCMS Encryption	The Vehicle System shall use the USDOT SCMS Certificates to sign and	I			WOBUDOC-1 -- Inspection of OBU	* Perform Test Case WOBUDOC-1 * Confirm Vehicle System	Requirement Verification

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	encrypt messages transmitted. The approved encryption algorithms are defined in IEEE 1609.2 and explained in USDOT SCMS CAMP Wiki Cryptography.				Certification and Test Documents	uses the USDOT SCMS Certificates to sign and encrypt messages transmitted. * Confirmation shows the Vehicle System use the USDOT SCMS Certificates to sign and encrypt messages transmitted, thereby verifying the requirement is satisfied.	Confirmed by:
VS-REQ-44 -- VSM SCMS Sign	The Vehicle System shall use the USDOT SCMS Certificates to sign, but not encrypt, all broadcasted messages.	I			WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm Vehicle System uses the USDOT SCMS Certificates to sign, but not encrypt, all broadcasted messages. * Confirmation shows the Vehicle System use the USDOT SCMS Certificates to sign, but not encrypt, all broadcasted messages, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
VS-REQ-45 -- VSM SCMS Encryption-Log	The Vehicle System shall use the USDOT SCMS Certificates to encrypt log files stored locally using the Public Key Encryption defined in USDOT SCMS CAMP Wiki Cryptography. Password protection is also allowable protection for log files.	I			WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm Vehicle System uses the USDOT SCMS Certificates to encrypt log files stored locally using the Public Key Encryption defined in USDOT SCMS CAMP Wiki Cryptography or confirm password protection is used to protect log files. * Confirmation shows the Vehicle System use the USDOT SCMS Certificates to encrypt log files stored locally using the Public Key Encryption defined in USDOT SCMS CAMP Wiki Cryptography or that password protection is used to protect log files, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
VS-REQ-46 -- VSM SCMS Sign-Log	The Vehicle System shall use the USDOT SCMS Certificates to sign log files stored locally. Password protection is also allowable	I			WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm Vehicle System uses the USDOT SCMS Certificates to sign log	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	for in place of signing log files.					files stored locally or confirm password protection is used to protect log files. * Confirmation shows the Vehicle System use the USDOT SCMS Certificates to sign log files stored locally or password protection is used to protect log files, thereby verifying the requirement is satisfied.	
VS-REQ-47 -- VSM App Availability Log	The Vehicle System shall log local application availability to the local event logs by vehicle type.	I			WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm the Vehicle System logs local application availability to the local event logs by vehicle type. * Confirmation shows the Vehicle System log local application availability to the local event logs by vehicle type, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
VS-REQ-48 -- VSM Updates	The Vehicle System shall support Over-the-Air (OTA) software updates from the Wyoming CV System based on WAVE Service Announcements (WSA).	I	RFV-REQ-7 MV-REQ-6 IT-REQ-3 HP-REQ-7		WEXTSS-OTA -- OBU over the air updates	* Perform Test Case WEXTSS-OTA * Inspect OBU logs and verify that system received and successfully performed update. * Confirmation shows the Vehicle System supports Over-the-Air (OTA) software updates from the Wyoming CV System based on WAVE Service Announcements (WSA), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
VS-REQ-49 -- Architectural	All Vehicle Sub-systems shall follow all core architectural requirements defined in Appendix A.2 OBU Core Architecture Requirements of the SyRS.	I		ARQ-REQ-1	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: ARQ-REQ-1	Requirement Verification Confirmed by:
VS-REQ-50 -- Safety Communication	All Vehicle Sub-systems shall follow all core safety communication requirements defined in Appendix A.3 V2V Core Safety Communication Requirements of the SyRS.	I		CSC-REQ-1 CSC-REQ-2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: CSC-REQ-1-WOBUDOC-	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						1 CSC-REQ-2-WOBUDOC-1	
VS-REQ-51 -- VS Equipment	All Vehicle System equipment shall conform to the characteristics described in Appendix A of the CAP.	I	RFV-REQ-6 IT-REQ-7 MV-REQ-1.1 MV-REQ-10 HP-REQ-5		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm OBU conforms to the characteristics described in Appendix A of the CAP. * Confirmation shows all Vehicle System equipment conforms to the characteristics described in Appendix A of the CAP, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
RSU-REQ-1 -- Collect CV Data	The Roadside Units shall collect data from the Vehicle System, as defined in WCVS-REQ-1.	I	WCVS-REQ-8		Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-1-WV2IMCT-2	Requirement Verification Confirmed by:
RSU-REQ-2 -- Distribute TIM to VS	The Roadside Units shall distribute TIMs received from the ODE to the Vehicle	I	WCVS-REQ-8	WCVS-REQ-10	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the	Requirement Verification

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	System, as defined in WCVS-REQ-10.					corresponding Test Cases: WCVS-REQ-10-WI2VSAT-1-REP	Confirmed by:
RSU-REQ-3 -- SCMS	The Roadside Units shall interface with the USDOT SCMS, as defined in SCMS-REQ-1.	I	SCMS-REQ-1		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm RSU interfaces with the USDOT SCMS, as defined in SCMS-REQ-1 (Section 3.1.1). * Confirmation shows the Roadside Units interface with the USDOT SCMS, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
RSU-REQ-4 -- LTS	The Roadside Units shall interface with the USDOT LTS, as defined in LTS-REQ-1.	I	LTS-REQ-1		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm RSU interfaces with the USDOT LTS, as defined in LTS-REQ-1 (Section 3.2). * Confirmation shows the Roadside Units interface with the USDOT LTS, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
RSU-REQ-6 -- Safety Communication	The Roadside Units shall follow all core safety communication requirements defined in Appendix B.2 V2I Core Safety Communication Requirements of the SyRS.	I		CSC-REQ-3 CSC-REQ-4 CSC-REQ-5	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: CSC-REQ-3-WRSUDOC-1 CSC-REQ-4-WRSUDOC-1 CSC-REQ-5-WRSUDOC-1	Requirement Verification Confirmed by:
RSU-REQ-7 -- Broadcast	The Roadside Units shall broadcast information following all requirements defined in Appendix B.3 RSU Broadcast Traveler Information of the SyRS.	I		BC-REQ-3	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: BC-REQ-3-WRSUDOC-1	Requirement Verification Confirmed by:
RSU-REQ-10 -- Management and Performance	The Roadside Units shall manage the policy for data collection and performance data following all requirements defined in Appendix B.4 RSU Performance Data of the SyRS.	I		MNG-REQ-1	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: MNG-REQ-1-WRSUDOC-1	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
RSU-REQ-11 -- Distribute to ODE	The Roadside Units shall share all collected information with the Operational Data Environment, as described in Section 5.18.1 of the ICD.	I			WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-1)	* Perform Test Case WV2IMCT-2(WFCWT-1) * Inspect RSU logs and identify 1 or more instances of BSMs received from Vehicles * Inspect ODE logs and identify receipt of corresponding BSMs. * Confirmation shows the Roadside Units share all collected information with the Operational Data Environment, as described in Section 5.18.1 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
RSU-REQ-12 -- Receive Update	The Roadside Units shall receive firmware updates from the TMC administrator.	I			WEXTSS-RSUFIRM -- RSU Firmware update	* Perform Test Case WEXTSS-RSUFIRM * Inspect RSU logs and verify that RSU received and successfully performed update. * Confirmation shows the Roadside Units receive firmware updates from the TMC administrator,	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						thereby verifying the requirement is satisfied.	
RSU-REQ-13 -- RSU Equipment	Roadside Unit equipment shall conform to the characteristics described in Appendix A of the CAP.	I			WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm RSU conforms to the characteristics described in Appendix A of the CAP. * Confirmation shows Roadside Unit equipment conforms to the characteristics described in Appendix A of the CAP, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
ODE-REQ-1 -- Collect CV Data	The Operational Data Environment shall collect Vehicle System data, defined in WCVS-REQ-1, from the RSU and/or the Vehicle System.	I	WCVS-REQ-8	WCVS-REQ-1	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-1-WV2IMCT-2	Requirement Verification Confirmed by:
ODE-REQ-2 -- Data Processing	The Operational Data Environment shall provide the VISA-related functions of CV Data as defined in Section 3.1.4.1 of the SDD.	I	WCVS-REQ-2		WODEDOC-1 -- Inspection of ODE Design and Test Documents	WODEDOC-1 Verified by inspection of ODE certification and test documents. * Obtain ODE Certification and test documents from	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						Vendor. * Verify ODE provide VISA-related functions of CV Data as defined in Section 3.1.4.1 of the SDD. * Verify requirement is satisfied.	
ODE-REQ-3 -- Distribute Data	The Operational Data Environment shall distribute processed CV information to other External Interfaces, Systems, and Sub-systems.	I	WCVS-REQ-8	ODE-REQ-3.1 ODE-REQ-3.2 ODE-REQ-3.3 ODE-REQ-3.4 ODE-REQ-3.5 ODE-REQ-3.6 ODE-REQ-3.7	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: ODE-REQ-3.1-WI2VSAT-1-REP ODE-REQ-3.2-WI2VSAT-5 ODE-REQ-3.3-WV2IMCT-2 ODE-REQ-3.4-WV2IMCT-2&WDNR-1 ODE-REQ-3.5-WDNR-1 ODE-REQ-3.6-WV2IMCT-2 ODE-REQ-3.7 WV2IMCT-2	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
ODE-REQ-3.1 -- Distribute TIM to RSU	The Operational Data Environment shall distribute TIMs to the RSU, to be later transmitted to the Vehicle System, as defined WCVS-REQ-10.1.	I	ODE-REQ-3	WCVS-REQ-10.1	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-10.1-WI2VSAT-1-REP	Requirement Verification Confirmed by:
ODE-REQ-3.2 -- Distribute TIM to SDW	The Operational Data Environment shall distribute TIMs to the Situational Data Warehouse, as defined in WCVS-REQ-10.2.	I	ODE-REQ-3	WCVS-REQ-10.2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-10.2-WI2VSAT-5	Requirement Verification Confirmed by:
ODE-REQ-3.3 -- Distribute to Pikalert	The Operational Data Environment shall distribute Environmental Data to the Pikalert System, as described in Section 5.19 of the ICD.	I	ODE-REQ-3		WV2IMCT-3 -- V2I & End-to-end communication of Environmental Sensor Data	* Perform Test Case WV2IMCT-3 * Inspect HMI Logs and identify 1 or more instances of environmental sensor data copied to ODE * Inspect ODE logs and identify corresponding 1 or more instances of environmental sensor data copied from OBU to ODE * Inspect Pikalert logs and	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						identify corresponding 1 or more instances of environmental sensor data received * Confirmation shows the Operational Data Environment distributes Environmental Data to the Pikalert System, as described in Section 5.19 of the ICD, thereby verifying the requirement is satisfied.	
ODE-REQ-3.4 -- Distribute to Data Warehouse	The Operational Data Environment shall distribute all collected and processed information to the Data Warehouse, as described in Section 5.20 of the ICD.	I	ODE-REQ-3	ODE-REQ-3.4.1 ODE-REQ-3.4.2 ODE-REQ-3.4.3	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: ODE-REQ-3.4.1-WV2IMCT-2 ODE-REQ-3.4.2-WDNR-1 ODE-REQ-3.4.3-WV2IMCT-2	Requirement Verification Confirmed by:
ODE-REQ-3.4.1 -- Distribute to Data	The Operational Data Environment shall distribute all collected and processed BSM information to the Data	I	ODE-REQ-3.4		WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-1)	* Perform test case WV2IMCT-2(WFCWT-1) * Inspect DW logs * Confirm receipt of BSMs * Confirmation shows the	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
Warehouse-BSM	Warehouse, as described in Section 5.20 of the ICD.					Operational Data Environment distributes all collected and processed BSM information to the Data Warehouse, as described in Section 5.20 of the ICD, thereby verifying the requirement is satisfied. * Confirmation shows the Operational Data Environment distribute all collected and processed BSM information to the Data Warehouse, as described in Section 520 of the ICD , thereby verifying the requirement is satisfied.	
ODE-REQ-3.4.2 -- Distribute to Data Warehouse-DNM	The Operational Data Environment shall distribute all collected and processed DNM information to the Data Warehouse, as described in Section 5.20 of the ICD.	I	ODE-REQ-3.4		WDNR-1 -- Same direction Distress Notification relay to RSU	* Perform test case WDNR-1 * Inspect DW logs * Confirm receipt of DNMs * Confirmation shows the Operational Data Environment distributes all collected and processed DNM information to the Data Warehouse, as described in Section 5.20	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						of the ICD, thereby verifying the requirement is satisfied.	
ODE-REQ-3.4.3 -- Distribute to Data Warehouse-ES	The Operational Data Environment shall distribute all collected and processed Environmental Sensor information to the Data Warehouse, as described in Section 5.20 of the ICD.	I	ODE-REQ-3.4		WV2IMCT-3 -- V2I & End-to-end communication of Environmental Sensor Data	* Perform Test Case WV2IMCT-3 * Inspect DW logs * Confirm receipt of Environmental Sensor Data * Confirmation shows the Operational Data Environment distributes all collected and processed Environmental Sensor information to the Data Warehouse, as described in Section 5.20 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
ODE-REQ-3.5 -- Distribute to Data Broker	The Operational Data Environment shall distribute distress information to the Data Broker, as described in Section 5.21.1 of the ICD.	I	ODE-REQ-3		WV2IMCT-1 -- V2I and End-to-end communication of DNMs (Integrated with WDNR-1)	* Perform Test Case WV2IMCT-1(WDNR-1) * Inspect ODE Logs and identify 1 or more instances of DNMs received * Inspect DB logs and verify receipt of corresponding 1 or more DNMs	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						* Confirmation shows the Operational Data Environment distributes distress information to the Data Broker, as described in Section 5.21.1 of the ICD, thereby verifying the requirement is satisfied.	
ODE-REQ-3.6 -- Distribute to SDC	The Operational Data Environment shall distribute CV data to the Secure Data Commons, as defined in Section 5.37.1 of the ICD	I	ODE-REQ-3 SDC-REQ-1		WV2IMCT-1 -- V2I and End-to-end communication of DNMs (Integrated with WDNR-1)	* Perform Test Case WV2IMCT-2(WFCWT-1) * Inspect ODE logs * Confirm 1 or more instances of BSMs received. * Confirm corresponding 1 or more instances of BSMs sent to Secure Data Commons * Confirmation shows the Operational Data Environment distributes CV data to the Secure Data Commons, as defined in Section 5.37.1 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
ODE-REQ-3.7 -- Distribute to RDE	The Operational Data Environment shall distribute CV data to the Research Data Exchange, as defined in Section 5.40.1 of the ICD	I	ODE-REQ-3 RDE-REQ-1		WV2IMCT-1 -- V2I and End-to-end communication of DNMs (Integrated with WDNR-1)	* Perform Test Case WV2IMCT-2(WFCWT-1) * Inspect ODE logs * Confirm 1 or more instances of BSMs received. * Confirm corresponding 1 or more instances of BSMs sent to RDE * Confirmation shows the Operational Data Environment distributes CV data to the Research Data Exchange, as defined in Section 5.37.1 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
ODE-REQ-4 -- SCMS	The Operational Data Environment shall interface with the USDOT SCMS, as defined in SCMS-REQ-1.	I	SCMS-REQ-1		WODEDOC-1 -- Inspection of ODE Design and Test Documents	* Perform Test Case WODEDOC-1 * Confirm ODE interfaces with the USDOT SCMS, as defined in SCMS-REQ-1 (Section 3.1.1). * Confirmation shows the Operational Data Environment interface with the USDOT SCMS, as defined in SCMS-REQ-1,	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						thereby verifying the requirement is satisfied.	
ODE-REQ-5 -- LTS	The Operational Data Environment shall interface with the USDOT LTS, as defined in LTS-REQ-1.	I	LTS-REQ-1		WODEDOC-1 -- Inspection of ODE Design and Test Documents	* Perform Test Case WODEDOC-1 * Confirm ODE interfaces with the USDOT LTS, as defined in LTS-REQ-1 (Section 3.2). * Confirmation shows the Operational Data Environment interface with the USDOT LTS, as defined in LTS-REQ-1, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
ODE-REQ-6 -- OBU Update	The Operational Data Environment shall send OTA firmware updates to the OBU.	I	WCVS-REQ-25		WEXTSS-OTA -- OBU over the air updates	* Perform Test Case WEXTSS-OTA * Inspect OBU logs and verify that system received and successfully performed update. * Confirmation shows the Operational Data Environment sends OTA firmware updates to the OBU, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
ODE-REQ-7 -- Receive from Data Broker	The Operational Data Environment shall receive information from the Data Broker, as defined in Section 5.21.2 of the ICD.	I	WCVS-REQ-8		WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated with WI2VSAT-1-REP)	* Perform Test Case WI2VMCT-1(WI2VSAT-1-REP) * Inspect DB Logs and locate 1 or more instances of formation of TIMs. * Inspect ODE logs and locate corresponding 1 or more instances of TIMs received. * Confirmation shows the Operational Data Environment receive information from the Data Broker, as defined in Section 5212 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
ODE-REQ-8 -- Generate TIM for Connected Vehicles	The ODE shall generate traveler information messages (TIMs), as defined in J2735 (5.16 Message: MSG_Traveler Information Message (TIM)).	I		WCVS-REQ-9	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-9-WI2VSAT-1-REP	Requirement Verification Confirmed by:
PA-REQ-1 -- External Weather Data	The Pikalert System shall receive weather information,	I		WI-REQ-1 WI-REQ-2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements	Requirement Verification

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	as defined in WI-REQ-1 and WI-REQ-2.					when performing the corresponding Test Cases: WI-REQ-1-WI2VSAT-1-Pikalert WI-REQ-2-WI2VSAT-1-Pikalert	Confirmed by:
PA-REQ-2 -- Wyoming CV Sub-Systems Data	The Pikalert System shall receive information from other Wyoming CV Sub-systems.	I	WCVS-REQ-8	PA-REQ-2.1 PA-REQ-2.2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: PA-REQ-2.1-WV2IMCT-2 PA-REQ-2.2-WEXTSS-CAM	Requirement Verification Confirmed by:
PA-REQ-2.1 -- ODE Data	The Pikalert System shall receive CV data from the Operational Data Environment as defined in ODE-REQ-3.3	I	PA-REQ-2		WV2IMCT-3 -- V2I & End-to-end communication of Environmental Sensor Data	* Perform Test Case WV2IMCT-3 * Inspect HMI Logs and identify 1 or more instances of environmental sensor data copied to ODE * Inspect ODE logs and identify corresponding 1 or more instances of environmental sensor data copied from OBU to ODE * Inspect Pikalert logs and	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						identify corresponding 1 or more instances of environmental sensor data received * Confirmation shows the Pikalert System receives CV data from the Operational Data Environment as defined in ODE-REQ-3.3, thereby verifying the requirement is satisfied.	
PA-REQ-2.2 -- TMC Data	The Pikalert System shall receive camera imagery from the TMC File Transfer Protocol (FTP) server as described in Section 5.26.1 of the ICD.	I	PA-REQ-2		WEXTSS-CAM -- Pikalert Camera Imagery	* Perform Test Case WEXTSS-CAM. * Inspect Pikalert logs * Confirm retrieval of camera images from TMC and DB via FTP. * Confirmation shows the Pikalert System receives camera imagery from the TMC File Transfer Protocol (FTP) server as described in Section 5.26.1 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
PA-REQ-3 -- Generate Alerts/Advisories and Forecasts	The Pikalert System shall generate alerts, advisories and forecasts, defined in WCVS-REQ-4. Detailed requirements for how the Pikalert System generates alerts are in the reference document “Motorist Alert and Warning Application, Detailed System Requirements, Final Report — Feb 28, 2014”, developed by NCAR for FHWA.	I		WCVS-REQ-4	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-4-including the following WCVS-REQ-4.1-WI2VSAT-1-Pikalert WCVS-REQ-4.2-WI2VSAT-1-Pikalert WCVS-REQ-4.3-WI2VSAT-1-Pikalert WCVS-REQ-4.4-WI2VSAT-1-CA WCVS-REQ-4.5-WI2VSAT-1-IC WCVS-REQ-4.6-WI2VSAT-1-511	Requirement Verification Confirmed by:
PA-REQ-4 -- Distribute Alerts/Advisories and Forecasts	The Pikalert System shall distribute alerts, defined in WCVS-REQ-4 to other Sub-systems.	I		PA-REQ-4.1	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: PA-REQ-4.1	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
PA-REQ-4.1 -- Distribute to DB	The Pikalert System shall transmit generated information to the Data Broker, as described in Section 5.27 of the ICD.	I	PA-REQ-4		WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert logs * Identify 1 or more instances of alerts or advisories generated * Inspect DB logs * Confirm receipt 1 or more instances of alerts or advisories generated by DW * Confirmation shows the Pikalert System transmits generated information to the Data Broker, as described in Section 5.27 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
DB-REQ-1 -- Receive from External Interfaces	The Data Broker shall receive data from WYDOT system as defined in the external interface requirements as defined in 511-REQ-1, RCRS-REQ-1, WTI-REQ-2, IC-REQ-1, and CA-REQ-1.	I	WCVS-REQ-7.1	511-REQ-1 RCRS-REQ-1 WTI-REQ-1 IC-REQ-1 CA-REQ-1	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: 511-REQ-1-WEXTSS-511 RCRS-REQ-1-WI2VSAT-1-RCRS WTI-REQ-2-Multiple WI2VSAT-1-WTI Test	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						Cases IC-REQ-1-WI2VSAT-1-IC CA-REQ-1-WI2VSAT-1-CA	
DB-REQ-2 -- Distribute to External Interfaces	The Data Broker shall distribute information to WYDOT systems as defined in TPI-REQ-1, TRAC-REQ-1, WTI-REQ-1, CVOP-REQ-1, and ITSM-REQ-1.	I	WCVS-REQ-7.2	TPI-REQ-1 TRAC-REQ-1 WTI-REQ-2 CVOP-REQ-1 ITSM-REQ-1	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: TPI-REQ-1-WI2VSAT-1-IC TRAC-REQ-1-Multiple WI2VSAT-1 Test Cases,WDNR-1 WTI-REQ-1-Multiple WI2VSAT-1 Test Cases CVOP-REQ-1-Multiple WI2VSAT-1 Test Cases ITSM-REQ-1-WSYSAA-1	Requirement Verification Confirmed by:
DB-REQ-4 -- Receive from Pikalert	The DB shall receive all generated segment-level information from Pikalert.	I	WCVS-REQ-8	DB-REQ-4.1 DB-REQ-4.2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: DB-REQ-4.1-WI2VSAT-1-Pikalert	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						DB-REQ-4.2-WI2VSAT-1-Pikalert	
DB-REQ-4.1 -- Receive Alerts and Advisories	The DB shall receive all generated segment-level alerts and advisories from Pikalert, as described in Section 5.27.1 of the ICD	I	DB-REQ-4		WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	* Perform Test Case WI2VSAT-1-Pikalert * Inspect DB logs. * Confirm DB receipt of generated segment-level alerts and advisories from Pikalert, as described in Section 5.26.2 of the ICD * Confirmation shows the DB receives all generated segment-level alerts and advisories from Pikalert, as described in Section 5.27.1 of the ICD, thereby verifying the requirement is satisfied. * (Note: For system integration testing, WYDOT Team assumes demonstration of functionality in a single instance verifies functionality for "all" instances.)	Requirement Verification Confirmed by:
DB-REQ-4.2 -- Receive Forecast	The DB shall receive all generated segment-level forecast information from	I	DB-REQ-4		WI2VSAT-1-Pikalert -- Message Display in	* Perform Test Case WI2VSAT-1-Pikalert * Inspect DB logs.	Requirement Verification

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	Pikalert, as described in Section 5.27.2 of the ICD				Travel Lanes - Pikalert	* Confirm DB receipt of generated segment-level forecast information from Pikalert, as described in Section 5.26.3 of the ICD * Confirmation shows the DB receives all generated segment-level forecast information from Pikalert, as described in Section 5.26.3 of the ICD, thereby verifying the requirement is satisfied. * (Note: For system integration testing, WYDOT Team assumes demonstration of functionality in a single instance verifies functionality for "all" instances.)	Confirmed by:
DB-REQ-5 -- Distribute to ODE	The DB shall share TIM information with the ODE, as defined in Section 5.21.2 of the ICD.	I	WCVS-REQ-8		WI2VSAT-1-REP -- Message Display in Travel Lanes	* Perform Test Case WI2VSAT-1-REP * Inspect DB logs. * Confirm 1 or more instances of DB generation of representative TIMs * Inspect ODE Logs * Confirm ODE receipt of	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						1 or more instances of representative DB TIMs * Confirmation shows the DB shares TIM information with the ODE, as defined in Section 5.21.2 of the ICD, thereby verifying the requirement is satisfied.	
DB-REQ-6 -- Receive from ODE	The DB shall receive distress information from the ODE, as defined in Section 5.21.1 of the ICD.	I	WCVS-REQ-8		WV2IMCT-1 -- V2I and End-to-end communication of DNMs (Integrated with WDNR-1)	* Perform Test Case WV2IMCT-1(WDNR-1) * Inspect ODE Logs and identify 1 or more instances of DN TIMs received * Inspect DB logs and verify receipt of corresponding DN TIMs * Confirmation shows the DB receive distress information from the ODE, as defined in Section 5211 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
DB-REQ-7 -- Distribute to Data Warehouse	The DB shall transmit information to the Data Warehouse as defined in Table 5-2 of the SyRS.	I	WCVS-REQ-8		WI2VSAT-1-REP -- Message Display in Travel Lanes	* Perform Test Case WI2VSAT-1-REP * Inspect DB logs. * Confirm 1 or more	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						instances of DB generation of representative TIMs * Inspect DW Logs * Confirm DW receipt of 1 or more instances of representative DB TIMs * Confirmation shows the DB shares TIM information with the ODE, as defined in Section 5.21.2 of the ICD, thereby verifying the requirement is satisfied.	
DB-REQ-8 -- Receive Data from DW	The DB shall receive current TIM information from the DW. Current TIM information is defined in DB-REQ-7.	I			WI2VSAT-1-WTI-Speed -- Message Display in Travel Lanes - WTI Speed	* Perform Test Case WI2VSAT-1-WTI-Speed * Note: When a new TIM is issued to RSUs and Satellite the TIM data is also stored in the Data Warehouse. When an existing TIM needs to be updated, the existing TIM is retrieved from the Data Warehouse, revised, and resent to the RSUs and Satellite, rather than generating a new TIM. * Initiate variable speed limit for corridor roadway	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						segment and specify new speed limit. * Inspect WTI Logs and verify output of specified speed for corridor roadway segments. * Inspect DW Logs * Confirm DW receipt of 1 or more instances of TIMs with specified Speed for corridor roadway segments. * Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm receipt of TIMs specifying new speed limit from WTI (Variable Speed Limit) * Change specified speed for corridor roadway segment in WTI. * Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm receipt of TIMs specifying changed speed limit from WTI (Variable Speed Limit) * Receipt of TIM with	

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						changed speed limit comfirms DB receives current TIM information from the DW, thereby verifying the requirement.	
DB-REQ-9 -- Distribute to SDC	The DB shall manually upload data to the SDC as defined in ICD Section 5.39.1.	I			WI2VSAT-1-REP -- Message Display in Travel Lanes	* Perform Test Case WI2VSAT-1-REP * Inspect DB logs. * Confirm 1 or more instances of DB generation of representative TIMs * Confirm 1 or more instances of manual upload of data to the SDC * Confirmation shows DB manual upload of data to the SDC as defined in ICD Section 5.39.1, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
DW-REQ-1 -- Store Data	The Data Warehouse shall store all data collected and generated by the Wyoming CV System, as defined in DW-REQ-1.1, DW-REQ-1.2, DW-REQ-1.3, and DW-REQ-1.4.	I	WCVS-REQ-8	DW-REQ-1.1 DW-REQ-1.2 DW-REQ-1.3 DW-REQ-1.4	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: DW-REQ-1.1-WI2VSAT-1	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						DW-REQ-1.2-WV2IMCT-2&WDNR-1 DW-REQ-1.3-WI2VSAT-1-REP DW-REQ-1.4-WSYSAA-1	
DW-REQ-1.1 -- Store Alerts/Advisories	The Data Warehouse shall store all generated alerts, advisories and forecasts, as defined in WCVS-REQ-12.	I	DW-REQ-1 WCVS-REQ-12	DW-REQ-1.1.1 DW-REQ-1.1.2 DW-REQ-1.1.3 DW-REQ-1.1.4 DW-REQ-1.1.5 DW-REQ-1.1.6	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: DW-REQ-1.1.1-WI2VSAT-1-Pikalert DW-REQ-1.1.2-WI2VSAT-1-Pikalert DW-REQ-1.1.3-WI2VSAT-1-Pikalert DW-REQ-1.1.4-WI2VSAT-1-CA DW-REQ-1.1.5-WI2VSAT-1-IC DW-REQ-1.1.6-WI2VSAT-1-511	Requirement Verification Confirmed by:
DW-REQ-1.1.1 -- Store Alerts/Advisories-Precipitation Hazard	The Data Warehouse shall store all generated precipitation hazard alerts, advisories and forecasts, as defined in WCVS-REQ-12.	I	DW-REQ-1.1		WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	* Perform Test Case WI2VSAT-1-Pikalert * Inspect DW and verify storage of TIM containing precipitation type and intensity	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						* Confirmation shows Wyoming CV System generates a precipitation type and intensity report every 5 minutes, as specified in Section 3.1.4.2 of the SDD, thereby verifying the requirement is satisfied.	
DW-REQ-1.1.2 -- Store Alerts/Advisories- Road Condition Hazard	The Data Warehouse shall store all generated road condition hazard alerts, advisories and forecasts, as defined in WCVS-REQ-12.	I	DW-REQ-1.1		WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	* Perform Test Case WI2VSAT-1-Pikalert * Inspect DW and verify storage of TIM containing a pavement state and slickness flag * Confirmation shows Wyoming CV System generates a pavement state and slickness flag report every 5 minutes, as specified in Section 3.1.4.2 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
DW-REQ-1.1.3 -- Store Alerts/Advisories-Visibility Hazard	The Data Warehouse shall store all generated visibility hazard alerts, advisories and forecasts, as defined in WCVS-REQ-12.	I	DW-REQ-1.1		WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	* Perform Test Case WI2VSAT-1-Pikalert * Inspect DW and verify storage of TIM containing a visibility report, along	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						with the condition causing it * Confirmation shows Wyoming CV System generates a visibility report, along with the condition causing it, report every 5 minutes, as specified in Section 3.1.4.2 of the SDD, thereby verifying the requirement is satisfied.	
DW-REQ-1.1.4 -- Store Alerts/Advisories-Work Zone Hazard	The Data Warehouse shall store all generated work zone hazard alerts and advisories, as defined in WCVS-REQ-12.	I	DW-REQ-1.1		WI2VSAT-1-CA -- Message Display in Travel Lanes - CA	* Perform Test Case WI2VSAT-1-CA * Inspect DW and verify storage of TIM containing a work zone report * Confirmation shows Wyoming CV System generates a work zone report within 5 minutes of receiving work zone information from the Construction Administration (defined in CA-REQ-1), as specified in Section 3.1.5.4 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
DW-REQ-1.1.5 -- Store Alerts/Advisories-Incident Hazard	The Data Warehouse shall store all generated incident hazard alerts and advisories, as defined in WCVS-REQ-12.	I	DW-REQ-1.1		WI2VSAT-1-IC -- Message Display in Travel Lanes - IC	* Perform Test Case WI2VSAT-1-IC * Inspect DW and verify storage of TIM containing an incident report * Confirmation shows Wyoming CV System generates an incident report within 5 minutes of receiving incident notifications from the Incident Console (defined in IC-REQ-1), as specified in Section 3.1.4.3 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
DW-REQ-1.1.6 -- Store Alerts/Advisories-Parking	The Data Warehouse shall store all generated parking alerts and advisories, as defined in WCVS-REQ-12.	I	DW-REQ-1.1		WI2VSAT-1-511 -- Message Display in Travel Lanes - 511	* Perform Test Case WI2VSAT-1-511 * Inspect DW and verify storage of TIM containing a parking report * Confirmation shows Wyoming CV System generates a parking report within 5 minutes of receiving parking availability notification, as specified in Section 3.1.4.3 of the SDD,	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						thereby verifying the requirement is satisfied.	
DW-REQ-1.2 -- Store Vehicle System Data	The Data Warehouse shall store all data collected by the Vehicle Systems, as defined in WCVS-REQ-11.	I	DW-REQ-1		Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-11-WV2IMCT-2&WDNR-1	Requirement Verification Confirmed by:
DW-REQ-1.3 -- Store TIM	The Data Warehouse shall store all TIMs distributed to the Vehicle System and the Situational Data Warehouse, as defined in WCVS-REQ-13.	I	DW-REQ-1 WCVS-REQ-13		WI2VSAT-1-REP -- Message Display in Travel Lanes	* Perform Test Case WI2VSAT-1-REP * Inspect DB logs and verify generation of TIMs for alerts. * Inspect DB Logs and verify output of alert. * Inspect TIM in DW and verify storage of alert by DW. * Confirmation shows Data Warehouse stores all TIMs distributed to the Vehicle System and the Situational Data Warehouse, as defined in WCVS-REQ-13, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						(Note: Data written to the Data Warehouse is automatically archived per existing TMC best practices.)	
DW-REQ-1.4 -- Store System Monitoring Data	The Data Warehouse shall store all system monitoring data, as defined in WCVS-REQ-14.	I	DW-REQ-1 WCVS-REQ-14		WSYSAA-1 -- WYDOT CV Pilot System Monitoring and Availability	* Perform Test Case WSYSAA-1. * Inspect DW and confirm storage of monitoring data defined in WCVS-REQ-14 by DW. * Confirmation shows Data Warehouse stores all system monitoring data, as defined in WCVS-REQ-14, thereby verifying the requirement is satisfied. (Note: Data written to the Data Warehouse is automatically archived per existing TMC best practices.)	Requirement Verification Confirmed by:
DW-REQ-2 -- Share Data	The Data Warehouse shall provide access to stored information to Wyoming CV Sub-Systems and External Interfaces defined in DW-REQ-2.1, DW-REQ-2.2, DW-REQ-2.3 and DW-REQ-2.4.	I	WCVS-REQ-8	DW-REQ-2.1 DW-REQ-2.2 DW-REQ-2.3 DW-REQ-2.4	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: DW-REQ-2.1-WI2VSAT-	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						1-IC DW-REQ-2.2-WI2VMCT-1 DW-REQ-2.3-WI2VMCT-1 DW-REQ-2.4-WI2VSAT-1-WTI-Speed	
DW-REQ-2.1 -- Share Data with TPI	The Data Warehouse shall transmit information to the TPI, as defined in Section 5.36.1 of the ICD.	I	DW-REQ-2		WI2VSAT-1-IC -- Message Display in Travel Lanes - IC	* Perform Test Case WI2VSAT-1-IC. * Inspect DB Logs and locate 1 or more instances of formation of TIMs. * Inspect Data Warehouse logs and located corresponding 1 or more instances of TIMs received. * Inspect Data Warehouse logs and locate corresponding 1 or more instances of TIM information sent to TPI * Confirmation shows the Data Warehouse transmit information to the TPI, as defined in Section 5361 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
DW-REQ-2.2 -- Share Data with SDC	The Data Warehouse shall transmit information to the Secure Data Commons, as defined in Section 5.38.1 of the ICD.	I	DW-REQ-2 SDC-REQ-1 RDE-REQ-1		WI2VSAT-1-REP -- Message Display in Travel Lanes	* Perform Test Case WI2VMCT-1(WI2VSAT-1-REP) * Inspect DB Logs and locate 1 or more instances of formation of TIMs. * Inspect Data Warehouse logs and located corresponding 1 or more instances of TIMs received. * Inspect Data Warehouse logs and locate corresponding 1 or more instances of TIM information sent to Secure Data Commons * Confirmation shows the Data Warehouse transmit information to the Secure Data Commons, as defined in Section 5.37.1 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
DW-REQ-2.3 -- Share Data with RDE	The Data Warehouse shall transmit information to the RDE, as defined in Section 5.41.1 of the ICD.	I	DW-REQ-2 RDE-REQ-1 RDE-REQ-1		WI2VSAT-1-REP -- Message Display in Travel Lanes	* Perform Test Case WI2VMCT-1(WI2VSAT-1-REP) * Inspect DB Logs and locate 1 or more instances	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						of formation of TIMs. * Inspect Data Warehouse logs and located corresponding 1 or more instances of TIMs received. * Inspect Data Warehouse logs and locate corresponding 1 or more instances of TIM information sent to RDE * Confirmation shows the Data Warehouse transmit information to the RDE, as defined in Section 5411 of the ICD, thereby verifying the requirement is satisfied.	
DW-REQ-2.4 -- Share Data with DB	The DW shall share current TIM information, including starting and stopping milepost, TIM ID, active RSU ID, and RSU TIM index, with the DB. The DW receives TIM information from the DB, as defined in DB-REQ-7	I	DW-REQ-2		WI2VSAT-1-WTI-Speed -- Message Display in Travel Lanes - WTI Speed	* Perform Test Case WI2VSAT-1-WTI-Speed * Note: When a new TIM is issued to RSUs and Satellite the TIM data is also stored in the Data Warehouse. When an existing TIM needs to be updated, the existing TIM is retrieved from the Data Warehouse, revised, and resent to the RSUs and	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						Satellite, rather than generating a new TIM. * Initiate variable speed limit for corridor roadway segment and specify new speed limit. * Inspect WTI Logs and verify output of specified speed for corridor roadway segments. * Inspect DW Logs * Confirm DW receipt of 1 or more instances of TIMs with specified Speed for corridor roadway segments. * Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm receipt of TIMs specifying new speed limit from WTI (Variable Speed Limit) * Change specified speed for corridor roadway segment in WTI. * Inspect DB logs. * Verify receipt of current TIM information, including starting and stopping	

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						milepost, TIM ID, active RSU ID, and RSU TIM index. * Receipt of current TIM information, including starting and stopping milepost, TIM ID, active RSU ID, and RSU TIM index confirms receipt of current information from the DW, thereby verifying the requirement. * Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm receipt of TIMs specifying changed speed limit from WTI (Variable Speed Limit) * Receipt of TIM with changed speed limit confirms DB receives current TIM information from the DW, thereby verifying the requirement.	
DW-REQ-3 -- Data Storage Administration	This requirement addresses administration of data storage. The DW shall perform the following administrative functions:	I		DW-REQ-3.1 DW-REQ-3.1.1 DW-REQ-3.2 DW-REQ-3.2.1 DW-REQ-3.2.2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	Maintain System Data Tables, Administer Data Storage Security, Manage Data System, and Manage Archive.			DW-REQ-3.3 DW-REQ-3.3.1 DW-REQ-3.3.2 DW-REQ-3.3.3 DW-REQ-3.4		Cases: DW-REQ-3.1-WDWDOC-1 DW-REQ-3.1.1-WDWDOC-1 DW-REQ-3.2-WDWDOC-1 DW-REQ-3.2.1-WDWDOC-1 DW-REQ-3.2.2-WDWDOC-1 DW-REQ-3.3-WDWDOC-1 DW-REQ-3.3.1-WDWDOC-1 DW-REQ-3.3.2-WDWDOC-1 DW-REQ-3.3.3-WDWDOC-1 DW-REQ-3.4-WDWDOC-1	
DW-REQ-3.1 -- Maintain System Data Tables	The DW shall maintain (i.e., update data columns for additional data fields as necessary, build views for authorized audiences needing to interact with the data) tables of data coming from connected vehicles and	I	DW-REQ-3		WDWDOC-1 -- Inspection of DW Design and Test Documents	* Perform Test Case WDWDOC-1 * Confirm the DW maintains (e.g., update data columns for additional data fields as necessary, build views for authorized audiences needing to interact with	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	other sources used by the connected vehicle pilot.					the data) tables of data coming from connected vehicles and other sources used by the connected vehicle pilot * Confirmation shows the DW maintain (e.g., update data columns for additional data fields as necessary, build views for authorized audiences needing to interact with the data) tables of data coming from connected vehicles and other sources used by the connected vehicle pilot, thereby verifying the requirement is satisfied.	
DW-REQ-3.1.1 -- CVE Data	The DW shall maintain the tables for CVE Data. This includes space for data from BSM related application data, driver/fleet related data, and performance management data.	I	DW-REQ-3		WDWDOC-1 -- Inspection of DW Design and Test Documents	* Perform Test Case WDWDOC-1 * Confirm the DW maintains the tables for CVE Data. This includes space for data from BSM related application data, driver/fleet related data, and performance management data * Confirmation shows the	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						DW maintain the tables for CVE Data. This includes space for data from BSM related application data, driver/fleet related data, and performance management data, thereby verifying the requirement is satisfied.	
DW-REQ-3.2 -- Manage Data Storage Security	The Data Warehouse shall have a designated TMC data storage administrator who will maintain security for data collected by the CV pilot within compliance of Sections 7(D), 7(E), 7(F), 7(G) and Appendix 11 – SMOC (Section 6.2) of the Institutional Review Board (University of Wyoming, 2016).	I	DW-REQ-3		WDWDOC-1 -- Inspection of DW Design and Test Documents	* Perform Test Case WDWDOC-1 * Confirm the Data Warehouse has a designated TMC data storage administrator who will maintain security for data collected by the CV pilot within compliance of Sections 7(D), 7(E), 7(F), 7(G) and Appendix 11 Section 62 of the Institutional Review Board * Confirmation shows the Data Warehouse has a designated TMC data storage administrator who will maintain security for data collected by the CV pilot within compliance of Sections 7(D), 7(E), 7(F),	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						7(G) and Appendix 11 Section 62 of the Institutional Review Board, thereby verifying the requirement is satisfied.	
DW-REQ-3.2.1 -- User Access	The DW shall be implemented to control granular access to the CV data storage at the column to the table space resolution to people with a need to know and that have been approved by the WYDOT program manager.	I	DW-REQ-3		WDWDOC-1 -- Inspection of DW Design and Test Documents	* Perform Test Case WDWDOC-1 * Confirm the DW is implemented to control granular access to the CV data storage at the column to the table space resolution to people with a need to know and that have been approved by the WYDOT program manager * Confirmation shows the DW is implemented to control granular access to the CV data storage at the column to the table space resolution to people with a need to know and that have been approved by the WYDOT program manager, thereby	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						verifying the requirement is satisfied.	
DW-REQ-3.2.2 -- Unauthorized Access	The DW shall be implemented to notify the TMC administrator of attempted access by unauthorized personnel to the CV data storage to all users that have not been specifically approved by the WYDOT program manager.	I	DW-REQ-3		WDWDOC-1 -- Inspection of DW Design and Test Documents	* Perform Test Case WDWDOC-1 * Confirm the DW is implemented to notify the TMC administrator of attempted access by unauthorized personnel to the CV data storage to all users that have not been specifically approved by the WYDOT program manager * Confirmation shows the DW is implemented to notify the TMC administrator of attempted access by unauthorized personnel to the CV data storage to all users that have not been specifically approved by the WYDOT program manager, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
DW-REQ-3.3 -- Manage Data System	The Data Warehouse shall have a designated TMC data storage administrator who will	I	DW-REQ-3		WDWDOC-1 -- Inspection of DW	* Perform Test Case WDWDOC-1 * Confirm the Data	Requirement Verification

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	manage the data systems for the CV pilot.				Design and Test Documents	Warehouse has a designated TMC data storage administrator who will manage the data systems for the CV pilot * Confirmation shows the Data Warehouse has a designated TMC data storage administrator who will manage the data systems for the CV pilot , thereby verifying the requirement is satisfied.	Confirmed by:
DW-REQ-3.3.1 -- System Back-ups	The DW shall provide the TMC administrator the ability to back up the data, provided by the WYDOT CV System, using WYDOT best practices for data protection, as stated in Section 2.5 of the Data Management Plan (FHWA-JPO-17-470) (Kitchener et al., 2017). This will be done for the development, test, quality assurance and production environments.	I	DW-REQ-3		WDWDOC-1 -- Inspection of DW Design and Test Documents	* Perform Test Case WDWDOC-1 * Confirm the DW provides the TMC administrator the ability to back up the data, provided by the WYDOT CV System, using WYDOT best practices for data protection, as stated in Section 25 of the Data Management Plan * Confirmation shows the DW provide the TMC administrator the ability to back up the data, provided by the WYDOT CV	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						System, using WYDOT best practices for data protection, as stated in Section 25 of the Data Management Plan, thereby verifying the requirement is satisfied.	
DW-REQ-3.3.2 -- Import/Export	The DW shall provide the TMC administrator the ability to perform import/export operation as needed for the CV pilot data.	I	DW-REQ-3		WDWDOC-1 -- Inspection of DW Design and Test Documents	* Perform Test Case WDWDOC-1 * Confirm the DW provides the TMC administrator the ability to perform import/export operation as needed for the CV pilot data * Confirmation shows the DW provides the TMC administrator the ability to perform import/export operation as needed for the CV pilot data, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
DW-REQ-3.3.3 -- Version Control	The DW shall provide the TMC administrator the ability to maintain version control for the data systems in use by the CV pilot.	I	DW-REQ-3		WDWDOC-1 -- Inspection of DW Design and Test Documents	* Perform Test Case WDWDOC-1 * Confirm the DW provides the TMC administrator the ability to maintain version control	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						for the data systems in use by the CV pilot * Confirmation shows the DW provides the TMC administrator the ability to maintain version control for the data systems in use by the CV pilot, thereby verifying the requirement is satisfied.	
DW-REQ-3.4 -- Manage Data Archive	The DW shall provide the TMC administrator the ability to archive data used by the CV pilot data to be retained using WYDOT best practices for data archival, as stated in Section 2.5 of the Data Management Plan (FHWA-JPO-17-470) (Kitchener et al., 2017).	I	DW-REQ-3		WDWDOC-1 -- Inspection of DW Design and Test Documents	* Perform Test Case WDWDOC-1 * Confirm the DW provides the TMC administrator the ability to archive data used by the CV pilot data to be retained using WYDOT best practices for data archival, as stated in Section 25 of the Data Management Plan * Confirmation shows the DW provide the TMC administrator the ability to archive data used by the CV pilot data to be retained using WYDOT best practices for data archival, as stated in	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						Section 25 of the Data Management Plan, thereby verifying the requirement is satisfied.	
DW-REQ-4 -- Receive Data	The Data warehouse shall receive information sent from other Sub-systems.	I		WCVS-REQ-8	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-8-Multiple Test Cases	Requirement Verification Confirmed by:
HSM-REQ-1 -- Receive from ODE	The HSM shall receive unsigned TIMs from the ODE as defined in Section 3.1.4.1 of the SDD.	I	WCVS-REQ-8		WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated with WI2VSAT-1-REP)	* Perform Test Case WI2VMCT-1(WI2VSAT-1-REP) * Inspect Wyoming CV System ODE logs * Confirm Wyoming CV System ODE receives signed TIMs from the HSM. * Confirmation shows the HSM receives unsigned TIMs from the ODE as defined in section 3.1.4.1 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
HSM-REQ-2 -- Share with ODE	The HSM shall provide signed TIMs to the ODE as defined in Section 3.1.4.1 of the SDD.	I	WCVS-REQ-8		WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated with WI2VSAT-1-REP)	* Perform Test Case WI2VMCT-1(WI2VSAT-1-REP) * Inspect Wyoming CV System ODE logs * Confirm Wyoming CV System ODE receives signed TIMs from the HSM. * Confirmation shows the HSM provides signed TIMs to the ODE as defined in section 3.1.4.1 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
HSM-REQ-3 -- Receive from SCMS	The HSM shall receive updated certificates from the SCMS as defined in Section 3.1.3 of the SDD.	I	WCVS-REQ-8		WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated with WI2VSAT-1-REP)	* Perform Test Case WI2VMCT-1(WI2VSAT-1-REP) * Inspect Wyoming CV System ODE logs * Confirm Wyoming CV System ODE receives signed TIMs with up to date certificates from the HSM. * Confirmation shows the HSM receives updated certificates from the SCMS as defined in	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						Section 3.1.3 of the SDD, thereby verifying the requirement is satisfied.	
HSM-REQ-4 -- Share with SCMS	The HSM shall shares authentication data with the SCMS as defined in Section 3.1.3 of the SDD.	I	WCVS-REQ-8		WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated with WI2VSAT-1-REP)	* Perform Test Case WI2VMCT-1(WI2VSAT-1-REP) * Inspect Wyoming CV System ODE logs * Confirm Wyoming CV System ODE receives signed TIMs with up to date certificates from the HSM. * Confirmation shows the HSM shares authentication data with the SCMS as defined in Section 3.1.3 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
MV-REQ-1 -- Environmental Sensors	WYDOT Maintenance Vehicles shall transmit environment information collected through equipped external environmental sensors to the Wyoming CV system. External environmental sensors will provide the information	I		VS-REQ-36.1	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-36.1-WV2IMCT-3	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	detailed in Table 7-4 of the ICD.						
MV-REQ-1.1 -- Environmental Sensor Equipment	Environmental Sensor equipment shall conform to the characteristics described in Appendix A of the CAP	I		VS-REQ-51	WOBUDOC-2 -- Inspection of Environmental Sensor Certification and Test Documents	* Perform Test Case WOBUDOC-2 * Confirm Environmental Sensor equipment conforms to the characteristics described in Appendix A of the CAP. * Confirmation shows Environmental Sensor equipment conforms to the characteristics described in Appendix A of the CAP, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
MV-REQ-2 -- Can Bus	WYDOT Maintenance Vehicles shall provide connection to the Can Bus as part of the Vehicle System. The information extracted from the Can Bus is detailed in Table 7-1 of the ICD, where column #1 contains the value "yes/CAN."	I		VS-REQ-4.1	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-4.1-WV2IMCT-2	Requirement Verification Confirmed by:
MV-REQ-3 -- Static Identifier	WYDOT Maintenance Vehicles' DSRC	I			WV2IMCT-2 -- V2I & End-to-end Communication of	* Perform Test Case WV2IMCT-2(WFCWT-1) * Inspect OBU Logs and	Requirement Verification

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	communications shall have a static identifier.				BSMs (Integrated with WFCWT-1)	identify 1 or more instances of BSMs sent to RSUs * Inspect BSMs and identify static identifier * Confirmation shows the WYDOT Fleet vehicles' DSRC communications have a static identifier, thereby verifying the requirement is satisfied.	Confirmed by:
MV-REQ-4 -- Receive TIM over DSRC	WYDOT Maintenance Vehicles shall receive a packet containing traveler information from the Wyoming CV System over DSRC. Each packet may contain one or more individual traveler information message as defined in Section 5.16 of SAE J2735.	I		VS-REQ-2.1	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-2.1-WI2VMCT-1	Requirement Verification Confirmed by:
MV-REQ-5 -- Receive TIM over Satellite	WYDOT Maintenance Vehicles shall receive a packet containing traveler information from the Wyoming CV System (via the Situational Data Warehouse) over Satellite communication. Each packet may contain one	I		VS-REQ-2.2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-2.2-WI2VMCT-2	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	or more individual traveler information message as defined in Section 5.16 (SAE J2735).						
MV-REQ-6 -- OTA Updates	WYDOT Maintenance Vehicles shall receive software updates OTA, as defined in Section 5.16.2 of the ICD.	I		VS-REQ-48	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-48-WEXTSS-OTA	Requirement Verification Confirmed by:
MV-REQ-7 -- Time	WYDOT Maintenance Vehicles shall obtain time as defined in LTS-REQ-4.	I		LTS-REQ-4	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: LTS-REQ-4-WFCWT-1	Requirement Verification Confirmed by:
MV-REQ-8 -- Location	WYDOT Maintenance Vehicles shall obtain location as defined in LTS-REQ-6.	I		LTS-REQ-6	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: LTS-REQ-6-WFCWT-1	Requirement Verification Confirmed by:
MV-REQ-9 -- General	All vehicle system requirements identified in	I			WOBUDOC-1 -- Inspection of OBU	* Perform Test Case WOBUDOC-1	Requirement Verification

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	Section 4.2 of the SyRS shall apply to this Sub-system.				Certification and Test Documents	* Confirm all vehicle system requirements identified in Section 42 of the SyRS are confirmed for this Sub-system * Confirmation shows all vehicle system requirements identified in Section 42 of the SyRS apply to this Sub-system, thereby verifying the requirement is satisfied.	Confirmed by:
MV-REQ-10 -- OBU Equipment	MV OBU equipment shall conform to the characteristics described in Appendix A of the CAP	I		VS-REQ-51	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-51-WOBUDOC-1	Requirement Verification Confirmed by:
HP-REQ-1 -- General	All vehicle system requirements identified in Section 4.2 of the SyRS shall apply to this Sub-system except: • VS-REQ-4.2 Collect Dimension Data • VS-REQ-5 External Environment Sensor Data	I			WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm all vehicle system requirements identified in Section 42 of the SyRS apply to this Sub-system except: • VS-REQ-4.2 Collect Dimension Data	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	• VS-REQ-5.1 External Environment Sensor Data Configuration • VS-REQ-5.2 External Environment Sensor Data Management • VS-REQ-36.1 Transmit Environmental Data					• VS-REQ-5 External Environment Sensor Data • VS-REQ-5.1 External Environment Sensor Data Configuration • VS-REQ-5.2 External Environment Sensor Data Management • VS-REQ-36.1 Transmit Environmental Data * Confirmation shows all vehicle system requirements identified in Section 42 of the SyRS apply to this Sub-system except: • VS-REQ-4.2 Collect Dimension Data • VS-REQ-5 External Environment Sensor Data • VS-REQ-5.1 External Environment Sensor Data Configuration • VS-REQ-5.2 External Environment Sensor Data Management • VS-REQ-36.1 Transmit Environmental Data, thereby verifying the requirement is satisfied.	

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
HP-REQ-2 -- Receive TIM over DSRC	Highway Patrol vehicles shall receive traveler information from the Wyoming CV System over DSRC. Traveler information may contain one or more packets of traveler information as defined in Section 5.16 of SAE J2735.	I			WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated with WI2VSAT-1-REP)	* Perform Test Case WI2VMCT-1(WI2VSAT-REP) * Inspect DB Logs and locate 1 or more instances of formation of TIMs. * Inspect OBU logs and locate corresponding instances of TIMs received by OBU via DSRC. * Confirmation shows the Vehicle System wirelessly receives a packet containing traveler information from the Wyoming CV System through DSRC, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
HP-REQ-3 -- Time	Highway Patrol vehicles shall obtain time as defined in LTS-REQ-4.	I		LTS-REQ-4	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: LTS-REQ-4-WFCWT-1	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
HP-REQ-4 -- Location	Highway Patrol vehicles shall obtain location as defined in LTS-REQ-6.	I		LTS-REQ-6	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: LTS-REQ-6-WFCWT-1	Requirement Verification Confirmed by:
HP-REQ-5 -- OBU Equipment	Highway Patrol OBU equipment shall conform to the characteristics described in Appendix A of the CAP	I		VS-REQ-51	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-51-WOBUDOC-1	Requirement Verification Confirmed by:
HP-REQ-6 -- Receive TIM over Satellite	Highway Patrol vehicles shall receive a packet containing traveler information from the Wyoming CV System (via the Situational Data Warehouse) over Satellite communication. Each packet may contain one or more individual traveler information message as defined in Section 5.16 of SAE J2735.	I		VS-REQ-2.2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-2.2-WI2VMCT-2	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
HP-REQ-7 -- OTA Updates	Highway Patrol vehicles shall receive software updates OTA, as defined in Section 5.16.2 of the ICD	I		VS-REQ-48	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-48-WEXTSS-OTA	Requirement Verification Confirmed by:
IT-REQ-1 -- Receive TIM over DSRC	Integrated Truck Fleet vehicles shall receive a packet containing traveler information from the Wyoming CV System over DSRC	I		VS-REQ-2.1	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-2.1-WI2VMCT-1	Requirement Verification Confirmed by:
IT-REQ-2 -- Receive TIM over Satellite	Integrated Truck Fleet vehicles shall receive a packet containing traveler information from the Wyoming CV System (via the Situational Data Warehouse) over Satellite communication. Each packet may contain one or more individual traveler information message as defined in Section 5.16 of SAE J2735.	I		VS-REQ-2.2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-2.2-WI2VMCT-2	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
IT-REQ-3 -- OTA Updates	Integrated Truck Fleet vehicles shall receive software updates OTA, as defined in Section 5.16.2 of the ICD.	I		VS-REQ-48	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-48-WEXTSS-OTA	Requirement Verification Confirmed by:
IT-REQ-4 -- Time	Integrated Truck Fleet vehicles shall obtain time as defined in LTS-REQ-4.	I		LTS-REQ-4	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: LTS-REQ-4-WFCWT-1	Requirement Verification Confirmed by:
IT-REQ-5 -- Location	Integrated Truck Fleet vehicles shall obtain location as defined in LTS-REQ-6.	I		LTS-REQ-6	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: LTS-REQ-6-WFCWT-1	Requirement Verification Confirmed by:
IT-REQ-6 -- General	All vehicle system requirements identified in Section 4.2 of the SyRS shall apply to this Sub-system except: • VS-REQ-5 External Environment Sensor Data	I			WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm all vehicle system requirements identified in Section 42 of the SyRS apply to this Sub-system except:	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	• VS-REQ-5.1 External Environment Sensor Data Configuration • VS-REQ-5.2 External Environment Sensor Data Management • VS-REQ-36.1 Transmit Environmental Data					• VS-REQ-5 External Environment Sensor Data • VS-REQ-5.1 External Environment Sensor Data Configuration • VS-REQ-5.2 External Environment Sensor Data Management • VS-REQ-36.1 Transmit Environmental Data * Confirmation shows all vehicle system requirements identified in Section 42 of the SyRS apply to this Sub-system except: • VS-REQ-5 External Environment Sensor Data • VS-REQ-5.1 External Environment Sensor Data Configuration • VS-REQ-5.2 External Environment Sensor Data Management • VS-REQ-36.1 Transmit Environmental Data, thereby verifying the requirement is satisfied.	

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
IT-REQ-7 -- OBU Equipment	Integrated Truck OBU equipment shall conform to the characteristics described in Appendix A of the CAP.	I		VS-REQ-51	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-51-WOBUDOC-1	Requirement Verification Confirmed by:
RFV-REQ-1 -- Receive TIM over DSRC	Retrofit Fleet vehicles shall receive traveler information from the Wyoming CV System over DSRC. Traveler information may contain one or more packets of traveler information as defined in Section 5.16 of SAE J2735.	I		VS-REQ-2.1	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-2.1-WI2VMCT-1	Requirement Verification Confirmed by:
RFV-REQ-2 -- Receive TIM over Satellite	Retrofit Fleet vehicles shall receive a packet containing traveler information from the Wyoming CV System (via the Situational Data Warehouse) over Satellite communication.	I		VS-REQ-2.2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-2.2-WI2VMCT-2	Requirement Verification Confirmed by:
RFV-REQ-3 -- Time	Retrofit Fleet vehicles shall obtain time as defined in LTS-REQ-4.	I		LTS-REQ-4	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						Cases: LTS-REQ-4-WFCWT-1	
RFV-REQ-4 -- Location	Retrofit Fleet vehicles shall obtain location as defined in LTS-REQ-6.	I		LTS-REQ-6	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: LTS-REQ-6-WFCWT-1	Requirement Verification Confirmed by:
RFV-REQ-5 -- General	All vehicle system requirements identified in Section 4.2 of the SyRS shall apply to this Sub-system except the following requirements pertaining to distress notifications and updates: • VS-REQ-3 Receive Distress Information • VS-REQ-4.1 Collect Vehicle Status Data • VS-REQ-5 External Environment Sensor Data • VS-REQ-5.1 External Environment Sensor Data Configuration • VS-REQ-5.2 External Environment Sensor Data Management	I			WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm all vehicle system requirements identified in Section 42 of the SyRS apply to this Sub-system except the following requirements pertaining to distress notifications and updates: • VS-REQ-3 Receive Distress Information • VS-REQ-4.1 Collect Vehicle Status Data • VS-REQ-5 External Environment Sensor Data • VS-REQ-5.1 External Environment Sensor Data Configuration • VS-REQ-5.2 External	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	• VS-REQ-15 Distress Notification ID • VS-REQ-15.1 Log • VS-REQ-16 Create Distress Notification • VS-REQ-16.1 System-Generated Distress Notification • VS-REQ-16.2 Driver-Generated Distress Notification • VS-REQ-17 DNM-Region • VS-REQ-18 DN PSID • VS-REQ-27 IVAA DN • VS-REQ-32.5 Customizations • VS-REQ-32.7 Distress Notification • VS-REQ-34 BCVI Distress • VS-REQ-34.1 Received Distress • VS-REQ-34.2 Generated Distress • VS-REQ-35 BCVI General Broadcast Requirements • VS-REQ-36.1 Transmit Environmental Data					Environment Sensor Data Management • VS-REQ-15 Distress Notification ID • VS-REQ-15.1 Log • VS-REQ-16 Create Distress Notification • VS-REQ-16.1 System-Generated Distress Notification • VS-REQ-16.2 Driver-Generated Distress Notification • VS-REQ-17 DNM-Region • VS-REQ-18 DN PSID • VS-REQ-27 IVAA DN • VS-REQ-32.5 Customizations • VS-REQ-32.7 Distress Notification • VS-REQ-34 BCVI Distress • VS-REQ-34.1 Received Distress • VS-REQ-34.2 Generated Distress • VS-REQ-35 BCVI General Broadcast Requirements	

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						• VS-REQ-36.1 Transmit Environmental Data * Confirmation shows all vehicle system requirements identified in Section 42 of the SyRS apply to this Sub-system except the following requirements pertaining to distress notifications and updates: • VS-REQ-3 Receive Distress Information • VS-REQ-4.1 Collect Vehicle Status Data • VS-REQ-5 External Environment Sensor Data • VS-REQ-5.1 External Environment Sensor Data Configuration • VS-REQ-5.2 External Environment Sensor Data Management • VS-REQ-15 Distress Notification ID • VS-REQ-15.1 Log • VS-REQ-16 Create Distress Notification • VS-REQ-16.1 System-Generated Distress	

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Engineer Verification and Remarks
						Notification • VS-REQ-16.2 Driver-Generated Distress Notification • VS-REQ-17 DNM-Region • VS-REQ-18 DN PSID • VS-REQ-27 IVAA DN • VS-REQ-32.5 Customizations • VS-REQ-32.7 Distress Notification • VS-REQ-34 BCVI Distress • VS-REQ-34.1 Received Distress • VS-REQ-34.2 Generated Distress • VS-REQ-35 BCVI General Broadcast Requirements • VS-REQ-36.1 Transmit Environmental Data, thereby verifying the requirement is satisfied.	
RFV-REQ-6 -- OBU Equipment	RFV OBU equipment shall conform to the characteristics described in Appendix A of the CAP	I		VS-REQ-51	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						Cases: VS-REQ-51-WOBUDOC-1	
RFV-REQ-7 -- OTA Updates	Retrofit Fleet Vehicles shall receive software updates OTA, as defined in Section 5.16.2 of the ICD.	I		VS-REQ-48	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-48-WEXTSS-OTA	Requirement Verification Confirmed by:
FCWP-REQ-1 -- FCW Advisory Alert Performance	The Vehicle System shall issue an advisory FCW alert when the Time-to-Collision is below a configurable threshold for advising the driver of potential for collision with a stopped vehicle ahead in the same lane of travel. Guidance for FCW Time-to Collision, Advisories and Alerts is provided in SyRS Section 6.1.1.	I			WFCWT-1 -- FCW Stopped Vehicle Ahead	* Perform Test Case WFCWT-1 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped remote vehicle ahead * Confirm issuance of advisory alert * Issuance of advisory alert verifies Vehicle System issues an advisory FCW alert when the Time-to-Collision is below a configurable threshold for advising the driver of potential for collision with a stopped	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						vehicle ahead in the same lane of travel, thereby verifying the requirement is satisfied.	
FCWP-REQ-2 -- FCW Imminent Alert Performance	The Vehicle System shall issue an imminent FCW alert when the Time-to-Collision is below a configurable threshold for alerting the driver that there is an imminent threat of forward collision with a stopped vehicle ahead in the same lane of travel and immediate action is required from the driver to avoid the collision. Guidance for FCW Time-to Collision, Advisories and Alerts is provided in SyRS Section 6.1.1.	I			WFCWT-1 -- FCW Stopped Vehicle Ahead	* Perform Test Case WFCWT-1 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped remote vehicle ahead * Confirm issuance of imminent FCW alert * Issuance of imminent FCW verifies Vehicle System issues an imminent FCW alert when the Time-to-Collision is below a configurable threshold for alerting the driver that there is an imminent threat of forward collision with a stopped vehicle ahead in the same lane of travel and immediate action is required from the driver to avoid the collision, thereby	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						verifying the requirement is satisfied.	
FCWP-REQ-3 -- Passing a Stopped Vehicle Performance	The Vehicle System shall not issue an FCW advisory or alert when passing a stopped vehicle in an adjacent lane.	I			WFCWT-2 -- FCW Passing Stopped Vehicle	* Perform Test Case WFCWT-2 * Inspect Host Vehicle OBU Event Logs, determine location, speed, and heading path of Host Vehicle. * Inspect Remote Vehicle OBU Event Logs, determine location, speed, and heading path of Remote Vehicle. * Verify vehicles are not in the same travel lane. * Inspect Host Vehicle OBU Event Logs and verify that alert was not issued. * Inspect Host Vehicle HMI Logs and verify that alert was not issued. * Absence of alert verifies the Vehicle System does not issue an FCW advisory or alert when passing a stopped vehicle in an adjacent lane,	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						thereby verifying the requirement is satisfied.	
FCWP-REQ-4 -- Following a Vehicle Performance	The Vehicle System shall not issue an imminent FCW alert when following a remote vehicle traveling at a constant speed above 30 mph.	I			WFCWT-3 -- FCW Steady State	* Perform Test Case WFCWT-3 * Inspect Host Vehicle OBU Event Logs, determine location, speed, and heading path of Host Vehicle. * Determine travel lane of Host Vehicle * Inspect Remote Vehicle OBU Event Logs, determine location, speed, and heading path of Remote Vehicle. * Determine travel lane of Host Vehicle. * Inspect Host and Remote Vehicle Event Logs and identify time period when Host follows Remote at 35 mph at a distance of 5 to 8 meters for 60 seconds or more. * Inspect Host Vehicle OBU Event Logs and verify that alert was not issued during this time. * Inspect Host Vehicle	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						HMI Logs and verify that alert was not issued during this time. * Absence of alert verifies the Vehicle System does not issue an imminent FCW alert when following a remote vehicle traveling at a constant speed above 30 mph, thereby verifying the requirement is satisfied.	
FCWP-REQ-5 -- Decelerating Vehicle Performance	The Vehicle System shall issue an imminent FCW alert when the Time-to-Collision is below a configurable threshold for alerting the driver that there is an imminent threat of forward collision with a decelerating vehicle ahead in the same lane of travel and immediate action is required from the driver to avoid the collision. Guidance for FCW Time-to Collision, Advisories and Alerts is provided in SyRS Section 6.1.1.	I			WFCWT-4 -- FCW Braking Vehicle Ahead	* Perform Test Case WFCWT-4 * Inspect Host Vehicle OBU Logs * Confirm detection of decelerating remote vehicle ahead * Confirm issuance of imminent FCW alert * Issuance of imminent FCW alert verifies Vehicle System issues an imminent FCW alert when the Time-to-Collision is below a configurable threshold for alerting the driver that there is an imminent threat of forward	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						collision with a decelerating vehicle ahead in the same lane of travel and immediate action is required from the driver to avoid the collision, thereby verifying the requirement is satisfied.	
FCWP-REQ-6 -- FCW Advisory Alert in a Curve Performance	The Vehicle System shall issue an advisory FCW alert when the Time-to-Collision is below a configurable threshold for advising the driver of potential for collision with a stopped vehicle ahead in the same lane of travel in a curve. Guidance for FCW Time-to Collision, Advisories and Alerts is provided in SyRS Section 6.1.1.	I			WFCWT-5 -- FCW Stopped Vehicle in a Curve	* Perform Test Case WFCWT-5 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped remote vehicle ahead * Confirm issuance of advisory FCW alert * Issuance of advisory FCW alert verifies Vehicle System issues an advisory FCW alert when the Time-to-Collision is below a configurable threshold for advising the driver of potential for collision with a stopped vehicle ahead in the same lane of travel in a curve,	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						thereby verifying the requirement is satisfied.	
FCWP-REQ-7 -- FCW Imminent Alert in a Curve Performance	The Vehicle System shall issue an imminent FCW alert when the Time-to-Collision is below a configurable threshold for alerting the driver that there is an imminent threat of forward collision with a stopped vehicle ahead in the same lane of travel in a curve and immediate action is required from the driver to avoid the collision. Guidance for FCW Time-to Collision, Advisories and Alerts is provided in SyRS Section 6.1.1.	I			WFCWT-5 -- FCW Stopped Vehicle in a Curve	* Perform Test Case WFCWT-5 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped remote vehicle ahead * Confirm issuance of FCW Imminent danger alert * Issuance of FCW Imminent danger alert verifies Vehicle System issues an imminent FCW alert when the Time-to-Collision is below a configurable threshold for alerting the driver that there is an imminent threat of forward collision with a stopped vehicle ahead in the same lane of travel in a curve and immediate action is required from the driver to avoid the collision, thereby	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						verifying the requirement is satisfied.	
FCWP-REQ-8 -- Passing a Stopped Vehicle in a Curve Performance	The Vehicle System shall not issue an FCW advisory or alert when passing a stopped vehicle in an adjacent lane in a curve.	I			WFCWT-6 -- FCW Passing Stopped Vehicle in a Curve	* Perform Test Case WFCWT-6 * Inspect Host Vehicle OBU Event Logs, determine location, speed, and heading path of Host Vehicle. * Inspect Remote Vehicle OBU Event Logs, determine location, speed, and heading path of Remote Vehicle. * Verify vehicles are not in the same travel lane. * Inspect Host Vehicle OBU Event Logs and verify that alert was not issued. * Inspect Host Vehicle HMI Logs and verify that alert was not issued. * Absence of alert verifies the Vehicle System does not issue an FCW advisory or alert when passing a stopped vehicle	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						in an adjacent lane in a curve.	
FCWP-REQ-9 -- Slow Moving Vehicle Advisory Alert in a Curve Performance	The Vehicle System shall issue an advisory FCW alert when the Time-to-Collision is below a configurable threshold for advising the driver of potential for collision with a moving vehicle ahead in the same lane of travel in a curve. Guidance for FCW Time-to Collision, Advisories and Alerts is provided in SyRS Section 6.1.1.	I			WFCWT-8 -- FCW Slow Moving Vehicle	* Perform Test Case WFCWT-8 * Inspect Host Vehicle OBU Logs * Confirm detection of slow moving remote vehicle ahead * Confirm issuance of advisory FCW alert * Issuance of advisory FCW alert verifies Vehicle System issues an advisory FCW alert when the Time-to-Collision is below a configurable threshold for advising the driver of potential for collision with a moving vehicle ahead in the same lane of travel in a curve, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
FCWP-REQ-10 -- Slow Moving Vehicle Imminent Alert	The Vehicle System shall issue an imminent FCW alert when the Time-to-Collision is below a configurable threshold for alerting the	I			WFCWT-8 -- FCW Slow Moving Vehicle	* Perform Test Case WFCWT-8 * Inspect Host Vehicle OBU Logs * Confirm detection of	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
in a Curve Performance	driver that there is an imminent threat of forward collision with a moving vehicle ahead in the same lane of travel in a curve and immediate action is required from the driver to avoid the collision. Guidance for FCW Time-to Collision, Advisories and Alerts is provided in SyRS Section 6.1.1.					slow moving remote vehicle ahead * Confirm issuance of FCW Imminent danger alert * Issuance of FCW Imminent danger alert verifies Vehicle System issues an imminent FCW alert when the Time-to-Collision is below a configurable threshold for alerting the driver that there is an imminent threat of forward collision with a moving vehicle ahead in the same lane of travel in a curve and immediate action is required from the driver to avoid the collision, thereby verifying the requirement is satisfied.	
DNP-REQ-1 -- Distress Notification OBU DSRC Performance 1	Remote vehicles shall receive distress notification via DSRC between at least 2 and 300 meters from the distressed vehicle.	I			WDNR-1 -- Same direction Distress Notification relay to RSU	* Perform Test Case WDNR-1 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						* Inspect Relay Vehicle OBU Event Logs, determine location, speed, and heading path of Relay Vehicle when first Distress Notification Message received. * Compute Distance between Distressed and Relay Vehicle at time first Distress Notification Message was received by Relay Vehicle. * Confirm Relay Vehicles receive distress notification via DSRC between at least 2 and 300 meters from the distressed vehicle, thereby verifying the requirement is satisfied.	
DNP-REQ-2 -- Distress Notification OBU DSRC Performance 2	Remote vehicles shall receive distress notification from other remote "relay" vehicles via DSRC between at least 2 and 300 meters from the other remote vehicle.	I			WV2VMCT-2 -- V2V exchange of DNMs (Integrated with WDNR-1)	* Perform Test Case WV2VMCT-2 * Inspect Relay Vehicle OBU Event Logs, determine time, location, speed, and heading path of Relay Vehicle when first Distress Notification Message received.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						* Inspect Distressed Vehicle OBU Event Logs, determine location and heading path of Distressed Vehicle at time that Relay Vehicle received first Distress Notification Message. * Compute Distance between Relay Vehicle and Distressed Vehicle at time first Distress Notification Message was received by Relay Vehicle. * Confirm Relay Vehicles receive distress notification from other remote "relay" vehicles via DSRC between at least 2 and 300 meters from the other Relay Vehicle, thereby verifying the requirement is satisfied.	
DNP-REQ-3 -- Distress Notification RSU DSRC Performance	ODE shall receive Distress Notification Messages (through RSU) from distressed vehicle or remote "relay" vehicles via DSRC from a distance between at	I			WV2IMCT-1 -- V2I and End-to-end communication of DNMs (Integrated with WDNR-1)	* Perform Test Case WV2IMCT-1(WDNR-1) * Inspect Remote Vehicle OBU Event Logs, determine time, location, speed, and heading path of Remote Vehicle when	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	least 2 and 300 meters between vehicles and RSU.					OBU receives an RSU WSA broadcast for the ODE server's IPv6 address, and the OBU copies a log for the DNM to the ODE server. * Inspect ODE Logs, determine time when ODE received first Distress Notification Message. * Determine which RSU received the DNM and its location. * Compute Distance between Remote Vehicle and RSU at time first Distress Notification Message was received by Remote Vehicle 2. * Confirmation shows ODE receive Distress Notification Messages (through RSU) from distressed vehicle or remote "relay" vehicles via DSRC from a distance between at least 2 and 300 meters between vehicles and RSU,	

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						thereby verifying the requirement is satisfied.	
DNP-REQ-4 -- Distress Notification Driver Display Performance	Distress Notification Caution shall be issued to the driver of the receiving vehicle at least at a configurable distance from the distressed vehicle. Note: the configurable distance is to be determined empirically by system engineers during development and testing.	I			WDNR-2 -- Opposite direction Distress Notification relay to RSU and Following Vehicle	* Perform Test Case WDNR-2 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Same Direction Following Vehicle OBU Event Logs, determine time, location, speed, and heading path of when first Distress Notification Message received. * Inspect Same Direction Following Vehicle HMI Logs, and determine time when Distress Notification caution was first issued to driver. * Verify Distress Notification Caution was issued to the driver of the Same Direction Following Vehicle at least at a configurable distance from the distressed vehicle, thereby verifying the	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						requirement is satisfied. (Note: the configurable distance is to be determined empirically by system engineers during development and testing.)	
DNP-REQ-5 -- Distressed Vehicle Distance	Distress Notification Cautions shall indicate the approximate distance to the distressed vehicle.	I			WDNR-2 -- Opposite direction Distress Notification relay to RSU and Following Vehicle	* Perform Test Case WDNR-2 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Same Direction Following Vehicle OBU Event Logs, determine time, location, speed, and heading path of when first Distress Notification Message received. * Inspect Same Direction Following Vehicle HMI Logs, and determine time when Distress Notification caution was first issued to driver. * Compute Distance between Distressed and Same Direction Following Vehicle at time when	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						Distress Notification caution was first issued to driver. * Inspect Same Direction Following Vehicle HMI Logs and verify approximate distance to Distressed Vehicle was displayed to the driver. * Confirm Distress Notification Cautions indicate the approximate distance to the distressed vehicle, thereby verifying the requirement is satisfied.	
DNP-REQ-6 -- Distressed Vehicle Direction of Travel	Distress Notification Cautions shall indicate if the distressed vehicle is in the same direction of travel as the receiving vehicle.	I			WDNR-2 -- Opposite direction Distress Notification relay to RSU and Following Vehicle	* Perform Test Case WDNR-2 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Same Direction Following Vehicle OBU Event Logs, determine time, location, speed, and heading path of when first Distress Notification Message received.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						* Determine if Same Direction Following Vehicle is traveling in the same direction as the Distressed Vehicle. * Inspect Same Direction Following Vehicle HMI Logs and determine if the Distress Notification Cautions indicate if the distressed vehicle is in the same direction of travel as the receiving vehicle was displayed to the driver. * Confirm Distress Notification Cautions indicate if the distressed vehicle is in the same direction of travel as the receiving vehicle, thereby verifying the requirement is satisfied.	
DNP-REQ-7 -- Distressed Vehicle Roadway	Distress Notification Cautions shall be issued to drivers approaching the distressed vehicle on the same roadway.	I			WDNR-2 -- Opposite direction Distress Notification relay to RSU and Following Vehicle	* Perform Test Case WDNR-2 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Same Direction	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						Following Vehicle OBU Event Logs, determine time, location, speed, and heading path of when first Distress Notification Message received. * determine if Same Direction Following Vehicle is traveling in the same direction as the Distressed Vehicle. * Inspect Same Direction Following Vehicle HMI Logs and determine if the Distress Notification Cautions indicate if the distressed vehicle is in the same direction of travel as the receiving vehicle was displayed to the driver. * Confirm Distress Notification Cautions issued to drivers approaching the distressed vehicle on the same roadway, thereby verifying the requirement is satisfied.	
DNP-REQ-8 -- Distress	Distress Notification Cautions shall not be issued to drivers	I			WDNR-2 -- Opposite direction Distress	* Perform Test Case WDNR-2	Requirement Verification

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
Vehicle Passing	after passing the distressed vehicle.				Notification relay to RSU and Following Vehicle	* Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Opposing Direction Relay Vehicle OBU Event Logs, determine time, location, speed, and heading path of Relay Vehicle when Relay Vehicle passed Distressed Vehicle. * Inspect Opposing Direction Relay Vehicle HMI Logs and verify time when Distress Notification ceased display. * Inspect Same Direction Following Vehicle OBU Event Logs, determine time, location, speed, and heading path of Relay Vehicle when Relay Vehicle passed Distressed Vehicle. * Inspect Same Direction Following Vehicle HMI Logs and verify time when Distress Notification	Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						ceased display. * Confirm Distress Notification Cautions were not issued to drivers after passing the distressed vehicle, thereby verifying the requirement is satisfied.	
DNP-REQ-9 -- Remote Vehicle Distress Notification Distance 1	Remote Vehicles receiving the broadcast DNM shall continue to broadcast it for a configurable distance and configurable time. Note: Initially this distance would be set to 5 miles.	I			WDNR-2 -- Opposite direction Distress Notification relay to RSU and Following Vehicle	* Perform Test Case WDNR-2 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Opposing Direction Relay Vehicle OBU Event Logs, determine time, location, speed, and heading path of Opposing Direction Relay Vehicle when first Distress Notification Message was broadcast. * Inspect Opposing Direction Relay Vehicle OBU Event Logs, determine time, location, speed, and heading path of Opposing Direction	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						Relay Vehicle when Distress Notification ceased to be broadcast. * Compute Distance between first and last Distress Notification broadcast. * Confirm Relay Vehicles receiving the broadcast DNM cease to broadcast it for a configurable distance and configurable time, thereby verifying the requirement is satisfied. (Note: Configurable Distance is initially set to 5 miles.)	
DNP-REQ-10 -- Remote Vehicle Distress Notification Distance 2	After broadcasting for the configurable distance or configurable time, a remote Relay Vehicle shall stop broadcasting the DNM and go silent until it receives an RSU WSA broadcast for the ODE server's IPv6 address.	I			WDNR-2 -- Opposite direction Distress Notification relay to RSU and Following Vehicle	* Perform Test Case WDNR-2 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Opposing Direction Relay Vehicle OBU Event Logs, determine time, location, speed, and heading path of Opposing Direction	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						Relay Vehicle when Distress Notification ceased to be broadcast. * Inspect Opposing Direction Relay Vehicle OBU Event Logs, determine time, location, speed, and heading path of Opposing Direction Relay Vehicle when RSU WSA broadcast for the ODE server's IPv6 address was received. * Compute Distance between last Distress Notification broadcast and receipt of RSU WSA broadcast for the ODE server's IPv6. * Confirm that after broadcasting for the configurable distance or configurable time, a remote Relay Vehicle ceases broadcasting the DNM and goes silent until it receives an RSU WSA broadcast for the ODE server's IPv6 address, thereby verifying the	

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						requirement is satisfied. (Note: Configurable Distance is initially set to 5 miles.)	
DNP-REQ-11 -- Remote Vehicle Distress Notification Upload to ODE	When a remote Relay Vehicle receives an RSU WSA broadcast for the ODE server's IPv6 address, the OBU shall copy a log for the DNM to the ODE server.	I			WDNR-1 -- Same direction Distress Notification relay to RSU	* Perform Test Case WDNR-1 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Same Direction Relay Vehicle OBU Event Logs and confirm receipt of an RSU WSA broadcast for the ODE server's IPv6 address. * Inspect Same Direction Relay Vehicle OBU Event Logs and confirm copy of a log for the DNM to the ODE Server. * Inspect ODE logs and confirm copy of a log for the DNM to the ODE Server. * Confirm that when a remote Relay Vehicle receives an RSU WSA broadcast for the ODE	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						server's IPv6 address, the OBU copies a log for the DNM to the ODE server, thereby verifying the requirement is satisfied.	
DNP-REQ-12 -- Remote Vehicle Distress Notification Upload Termination	When a remote Relay Vehicle OBU completes copying copies a log for the DNM to the ODE server, the Relay Vehicle shall stop further broadcasting the DNM and will stop copying it to RSUs to the ODE.	I			WDNR-1 -- Same direction Distress Notification relay to RSU	* Perform Test Case WDNR-1 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Same Direction Relay Vehicle OBU Event Logs, determine time, location, speed, and heading path of Same Direction Relay Vehicle when RSU WSA broadcast for the ODE server's IPv6 address was received and OBU copies a log for the DNM to the ODE server. * Inspect logs to confirm no further broadcast of Distress Notification Messages or OBU copies a log for the DNM log to	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						the ODE. * Confirm that when a remote Relay Vehicle OBU completes copying copies a log for the DNM to the ODE server, the Relay Vehicle ceases further broadcasting the DNM and ceases copying it to RSUs to the ODE, thereby verifying the requirement is satisfied.	
I2VSAP-REQ-1 -- Message Display in Travel Lanes	Situational Awareness Message(s) shall display in vehicles traveling in all travel lanes of the roadway in the direction specified in the I2V SA TIM.	I			WI2VSAT-1-REP -- Message Display in Travel Lanes	* Perform Test Case WI2VSAT-1-REP * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine Roadway and lane of travel of vehicle. * Confirm Situational Awareness Message displays in vehicles traveling in all lanes of the roadway specified in the	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						I2V SA TIM. * Confirmation shows Situational Awareness Message(s) display in vehicles traveling in all travel lanes of the roadway in the direction specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	
I2VSAP-REQ-2 -- Message Display in Shoulder Lanes	Situational Awareness Message(s) shall display in vehicles traveling on shoulders of the roadway in the direction specified in the I2V SA TIM.	I			WI2VSAT-2 -- Message Display in Shoulder Lanes	* Perform Test Case WI2VSAT-2 * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine Roadway and lane of travel of vehicle. * Confirm Situational Awareness Message displays in vehicles traveling on shoulders of the roadway specified in the I2V SA TIM. * Confirmation shows	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						Situational Awareness Message(s) display in vehicles traveling on shoulders of the roadway in the direction specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	
I2VSAP-REQ-3 -- Message Display in Acceleration Lane	Situational Awareness Message(s) shall display in vehicles in entrance acceleration lane of the roadway in the direction specified in the I2V SA TIM.	I			WI2VSAT-2 -- Message Display in Shoulder Lanes	* Perform Test Case WI2VSAT-2 * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine Roadway and lane of travel of vehicle. * Confirm Situational Awareness Message displays in vehicles traveling on entrance acceleration lane (and shoulder) of the roadway specified in the I2V SA TIM. * Confirmation shows	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						Situational Awareness Message(s) display in vehicles in entrance acceleration lane of the roadway in the direction specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	
I2VSAP-REQ-4 -- Message Display Geofence Beginning	Situational Awareness Message(s) shall display within 8 meters, at a speed of 35 miles per hour, of beginning of geofence specified in the I2V SA TIM.	I			WI2VSAT-1-REP -- Message Display in Travel Lanes	* Perform Test Case WI2VSAT-1-REP * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine Roadway and lane of travel of vehicle. * Confirm Situational Awareness Message displays within 8 meters of beginning of geofence specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) display within	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						8 meters, at a speed of 35 miles per hour, of beginning of geofence specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	
I2VSAP-REQ-5 -- Message Display Geofence Ending	Situational Awareness Message(s) shall cease display within 8 meters, at a speed of 35 miles per hour, of end of geofence specified in the I2V SA TIM.	I			WI2VSAT-1-REP -- Message Display in Travel Lanes	* Perform Test Case WI2VSAT-1-REP * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine Roadway and lane of travel of vehicle. * Confirm Situational Awareness Message displays within 8 meters of end of geofence specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) cease display within 8 meters, at a speed of 35 miles per hour, of end of geofence	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	
I2VSAP-REQ-6 -- Message Display in Opposing Travel Lanes	Situational Awareness Message(s) shall not display in vehicles traveling in a direction other than that specified in the I2V SA TIM.	I			WI2VSAT-6 -- Message Display in Opposing Travel Lanes	* Perform Test Case WI2VSAT-6 * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine roadway and lane of travel of vehicle. * Confirm Situational Awareness Message does not display in vehicles traveling in a direction other than that specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) not display in vehicles traveling in a direction other than that specified in the I2V SA	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						TIM, thereby verifying the requirement is satisfied.	
I2VSAP-REQ-7 -- Message Display on Adjacent Service Road	Situational Awareness Message(s) shall not display in vehicles on roadways adjacent to that specified in the I2V SA TIM.	I			WI2VSAT-3 -- Message Display on Adjacent Service Road	* Perform Test Case WI2VSAT-3 * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine roadway and lane of travel of vehicle. * Confirm Situational Awareness Message does not display in vehicles on roadways adjacent to that specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) not display in vehicles on roadways adjacent to that specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
I2VSAP-REQ-8 -- Message Display in Perpendicular to Travel Lanes	Situational Awareness Message(s) shall not display in vehicles on roadways intersecting that specified in the I2V SA TIM.	I			WI2VSAT-4 -- I2V SA * Message Display Perpendicular to Travel Lanes	* Perform Test Case WI2VSAT-4 * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine roadway and lane of travel of vehicle. * Confirm Situational Awareness Message does not display in vehicles traveling on roadways perpendicular to that specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) not display in vehicles on roadways intersecting that specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
I2VSAP-REQ-9 -- Message Display Start Time	Situational Awareness Message(s) shall begin display within 1 second of the time specified in the I2V SA TIM.	I			WI2VSAT-8 -- Message Display Start Time	* Perform Test Case WI2VSAT-8 * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine Roadway and lane of travel of vehicle. * Confirm Situational Awareness Message displays within 1 second of the beginning time specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) begin display within 1 second of the time specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
I2VSAP-REQ-10 -- Message Display Stop Time	Situational Awareness Message(s) shall cease display within 1 second of the time specified in the I2V SA TIM.	I			WI2VSAT-9 -- Message Display Stop Time	* Perform Test Case WI2VSAT-9 * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine Roadway and lane of travel of vehicle. * Confirm Situational Awareness Message ceases display within 1 second of the end display time specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) cease display within 1 second of the time specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
I2VSAP-REQ-11 -- Verify I-80	Vehicle Systems shall be capable of displaying Situational Awareness	I			WSHKR-4 -- Verify I80 geofence map	* Perform Test Case WSHKR-4 * Confirm Message(s)	Requirement Verification

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
Map and Geofences	Message(s) in vehicles traveling in all travel lanes anywhere on I-80 across Wyoming.					display within 8 meters of beginning of specified geofence and cease display within 8 meters of end of specified geofence. * Confirmation shows Vehicle Systems are capable of displaying Situational Awareness Message(s) in vehicles traveling in all travel lanes anywhere on I-80 across Wyoming, thereby verifying the requirement is satisfied.	Confirmed by:
I2VSAP-REQ-12 -- Satellite TIM Coverage	Vehicle Systems shall be capable of receiving I2V SA TIMs via satellite in vehicles traveling on I-80 across Wyoming.	I			WSHKR-3 -- I-80 Satellite TIM coverage	* Perform Test Case WSHKR-3 * Inspect OBU logs * Confirm receipt of TIMs via Satellite. * Confirmation shows Vehicle Systems are capable of receiving I2V SA TIMs via satellite in vehicles traveling on I-80 across Wyoming, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
I2VSAP-REQ-13 -- Simultaneous I2V and V2I DSRC Communications	The WYDOT CV Pilot System shall support simultaneous capture of vehicle system BSMs, capture of vehicle system log files, and broadcast of I2V SA TIMs via DSRC.	I			WI2VMCT-3 -- Simultaneous DSRC Upload/Download of messages and log files.	* Perform Test Case WI2VMCT-3 * Inspect OBU logs * Confirm receipt of broadcast of I2V SA TIMs. * Inspect ODE logs * Confirm receipt of vehicle system BSMs and capture of vehicle system log files * Confirmation shows the WYDOT CV Pilot System supports simultaneous capture of vehicle system BSMs, capture of vehicle system log files, and broadcast of I2V SA TIMs via DSRC, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
I2VSAP-REQ-14 -- Simultaneous DSRC and Satellite TIM Processing	Vehicle Systems shall support processing of identical I2V SA TIMs received via DSRC and satellite without conflict or error.	I			WI2VSAT-7 -- Simultaneous DSRC and Satellite I2V SA TIMs communications	* Perform Test Case WI2VSAT-7 * Inspect OBU logs * Confirm receipt of broadcast of I2V SA TIMs by both DSRC and Satellite. * Inspect HMI logs * Confirm accurate display of TIM driver alerts.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						* Confirmation shows Vehicle Systems support processing of identical I2V SA TIMs received via DSRC and satellite without conflict or error, thereby verifying the requirement is satisfied.	
MCP-REQ-1 -- V2V Exchange of BSMs	Host vehicles shall receive BSM from remote vehicles via DSRC from between at least 2 and 300 meters distance.	I			WINSTQ-3 -- OBU Installation Quality Control	* Perform Test Case WFCWT-1 * Inspect Host Vehicle OBU Logs * Inspect Remote Vehicle OBU logs * Confirm a configurable threshold percentage of BSMs sent are received and logged by host and remote vehicle OBUs, when vehicles are at least 300 meters apart. * Confirm a configurable threshold percentage of BSMs continue to be received and logged until host vehicle stops. * Confirmation that a configurable threshold percentage of BSMs sent are received by host	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						vehicle verifies Host vehicles receive BSM from remote vehicles via DSRC from between at least 2 and 300 meters distance.	
MCP-REQ-2 -- V2I & End-to-end Communication of BSMs	RSUs shall receive BSM from Remote Vehicles via DSRC from between at least 2 and 300 meters distance.	I			WINSTQ-4 -- RSU Installation Quality Control	* Perform Test Case WV2IMCT-2(WFCWT-1) * Confirm BSMs are received and processed by RSU and ODE when vehicle is between at least 2 and 300 meters distance. * Confirmation shows RSUs receive BSM from Remote Vehicles via DSRC from between at least 2 and 300 meters distance, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
MCP-REQ-3 -- OBU Shakedown	The WYDOT CV Pilot System shall support periodic testing to verify functionality and DSRC range performance of WYDOT controlled Pilot vehicles.	I			WSHKR-1 -- OBU Shakedown	* Perform Test Case WSHKR-1 * Confirm OBUs with performance less than 90% of baseline are checked for damage or unit failure.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						* Confirmation shows the WYDOT CV Pilot System support periodic testing to verify functionality and DSRC range performance of WYDOT controlled Pilot vehicles, thereby verifying the requirement is satisfied.	
MCP-REQ-4 -- RSU and Backhaul Communications Shakedown 1	The WYDOT CV Pilot System shall support periodic testing to verify functionality and DSRC range performance of RSUs.	I			WSHKR-2 -- RSU and Backhaul Communications Shakedown	* Perform Test Case WSHKR-2 * Confirm RSUs with performance less than 90% of baseline are checked for damage or unit failure. * Confirmation shows the WYDOT CV Pilot System supports periodic testing to verify functionality and DSRC range performance of RSUs, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
MCP-REQ-5 -- RSU and Backhaul Communicatio	The WYDOT CV Pilot System shall support periodic testing to verify functionality and DSRC range performance of	I			RSU and Backhaul Communications Shakedown	* Perform Test Case WSHKR-2 * Confirm RSUs with performance less than 90% of baseline after	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
ns Shakedown 2	RSUs after major storm events					storm events are checked for damage or unit failure. * Confirmation shows the WYDOT CV Pilot System support periodic testing to verify functionality and DSRC range performance of RSUs after storm events, thereby verifying the requirement is satisfied.	
MCP-REQ-6 -- OBU Installation Robustness	WYDOT CV Pilot OBUs shall maintain functionality and DSRC communications range performance after up to five installations and removal.	I			WINSTQ-1 -- OBU Installation Robustness	* Perform Test Case WINSTQ-1 * Confirm OBU passes the following two test cases after fifth installation * WV2VMCT-1 V2V exchange of BSMs * WV2IMCT-2 V2I & End-to-end communication of BSMs * Confirmation shows WYDOT CV Pilot OBUs maintain functionality and DSRC communications range performance after up to five installations and removal, thereby verifying	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						the requirement is satisfied.	
MCP-REQ-7 -- RSU Installation Robustness	WYDOT CV Pilot RSUs shall maintain functionality and DSRC communications range performance after up to three installations and removal.	I			WINSTQ-2 -- RSU Installation Robustness	* Perform Test Case WINSTQ-2 * Confirm RSU passes the following two test cases after third installation * WV2IMCT-2 V2I & End-to-end communication of BSMs * WI2VMCT-1 End-to-end & DSRC Delivery of I2V SA TIMs * Confirmation shows WYDOT CV Pilot RSUs maintain functionality and DSRC communications range performance after up to three installations and removal, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
ARQ-REQ-1 -- Architectural Requirements - Connected Device Dialogs	(Source: J3067, 3.4.3) – A connected device shall be able to establish a private wireless connection with another specific connected device that mutually agrees.	I	VS-REQ-49		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm (Source: J3067, 343) – A connected device is able to establish a private wireless connection with another	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						specific connected device that mutually agrees * Confirmation shows (Source: J3067, 343) – A connected device be able to establish a private wireless connection with another specific connected device that mutually agrees, thereby verifying the requirement is satisfied.	
CSC-REQ-1 -- OBU SCMS Use	All OBUs used in the Wyoming Pilot shall be certified from a US DOT authorized testing facility based on the SCMS current version CAMP Wiki: Requirements and Specifications.	I	VS-REQ-50		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm All OBUs used in the Wyoming Pilot be certified from a US DOT authorized testing facility based on the SCMS current version CAMP Wiki: Requirements and Specifications * Confirmation shows All OBUs used in the Wyoming Pilot be certified from a US DOT authorized testing facility based on the SCMS current version CAMP Wiki: Requirements and	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						Specifications, thereby verifying the requirement is satisfied.	
CSC-REQ-2 -- OBU Certification	All OBUs used in the Wyoming Pilot shall be certified from a USDOT authorized testing facility based on J2945/1.	I	VS-REQ-50		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm All OBUs used in the Wyoming Pilot be certified from a USDOT authorized testing facility based on J2945/1 At a minimum, the following applications interfaces and requirements from J2945/1 will be included in the certification testing * Confirmation shows All OBUs used in the Wyoming Pilot be certified from a USDOT authorized testing facility based on J2945/1 At a minimum, the following applications interfaces and requirements from J2945/1 will be included in the certification testing, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
BC-REQ-1 -- Traveler Information Requirements	(Source: J3067, 3.5.8). Traveler information is used to provide connected devices with travel advisories and information.	I		BC-REQ-1.1 BC-REQ-1.2 BC-REQ-1.3	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: BC-REQ-1.1 BC-REQ-1.2 BC-REQ-1.3	Requirement Verification Confirmed by:
BC-REQ-1.1 -- Broadcast Traveler Information	(Source: J3067, 3.5.8.1). A connected device shall broadcast a packet containing traveler information to connected devices. Each packet may contain one or more individual traveler information messages.	I	BC-REQ-1		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.1) a connected device broadcast a packet containing traveler information to connected devices. Each packet may contain one or more individual traveler information messages, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
BC-REQ-1.2 -- Broadcast Traveler Information - Mandatory Requirements	(Source: J3067, 3.5.8.2). The following are the minimum requirements for a connected device to broadcast traveler information to connected devices.	I	BC-REQ-1	BC-REQ-1.2.1 BC-REQ-1.2.2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases:	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						BC-REQ-1.2.1 BC-REQ-1.2.2	
BC-REQ-1.2.1 -- Broadcast Traveler Information - Packet Identifier	(Source: J3067, 3.5.8.2.1). A connected device shall include a packet identifier for the traveler information packet broadcasted to connected devices.	I	BC-REQ-1.2		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.2.1) a connected device include a packet identifier for the traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
BC-REQ-1.2.2 -- Broadcast Traveler Information - Message Identifier Requirements	(Source: J3067, 3.5.8.2.2). For each traveler information message in a traveler information packet, a connected device needs to identify each message transmitted as part of a traveler information packet broadcasted to connected devices.	I	BC-REQ-1.2		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.2.2) For each traveler information message in a traveler information packet, a connected device needs to identify each message transmitted as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
BC-REQ-1.2.2.1 -- Broadcast Traveler Advisories - Message Identifier	(Source: J3067, 3.5.8.2.2.1). For traveler advisories, a connected device shall include a message identifier for each traveler advisory message as part of a traveler information packet broadcasted to connected devices.	I	BC-REQ-1.2.2		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.2.2.1) For traveler advisories, a connected device include a message identifier for each traveler advisory message as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
BC-REQ-1.3 -- Broadcast Traveler Information	(Source: J3067, 3.5.8.3). The following are the requirements for a connected device to broadcast traveler information to connected devices.	I	BC-REQ-1	BC-REQ-1.3.1 BC-REQ-1.3.2 BC-REQ-1.3.3 BC-REQ-1.3.4 BC-REQ-1.3.5 BC-REQ-1.3.6 BC-REQ-1.3.7	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: BC-REQ-1.3.1-WOBUDOC-1 BC-REQ-1.3.2-WOBUDOC-1 BC-REQ-1.3.3-WOBUDOC-1 BC-REQ-1.3.4-WOBUDOC-1 BC-REQ-1.3.5-WOBUDOC-1	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						BC-REQ-1.3.6-WOBUDOC-1 BC-REQ-1.3.7-WOBUDOC-1	
BC-REQ-1.3.1 -- Broadcast Traveler Information - Validity Duration	(Source: J3067, 3.5.8.3.4). For each traveler information message in a traveler information packet, a connected device shall include the duration from the start time that the traveler message is valid for as part of a traveler information packet broadcasted to connected devices.	I	BC-REQ-1.3		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.4) For each traveler information message in a traveler information packet, a connected device include the duration from the start time that the traveler message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
BC-REQ-1.3.2 -- Broadcast Traveler Information – Importance	(Source: J3067, 3.5.8.3.5). For each traveler information message in a traveler information packet, a connected device shall include the importance of the message relative to other traveler information	I	BC-REQ-1.3		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.5) For each traveler information message in a traveler information packet, a connected device include	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	messages being broadcasted as part of a traveler information packet broadcasted to connected devices.					the importance of the message relative to other traveler information messages being broadcasted as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	
BC-REQ-1.3.3 -- Broadcast Traveler Information - Presentation Requirements	(Source: J3067, 3.5.8.3.6). Agencies may need to present traveler information messages only to specific travelers, such as travelers within specific geographic (spatial) regions or a direction of travel.	I	BC-REQ-1.3		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6) agencies may need to present traveler information messages only to specific travelers, such as travelers within specific geographic (spatial) regions or a direction of travel, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
BC-REQ-1.3.3.1 -- Broadcast Traveler Information -	(Source: J3067, 3.5.8.3.6.1). For each traveler information message in a traveler information packet, a connected device shall	I	BC-REQ-1.3.3		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.1) For each traveler information	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
Default Anchor Point Position	include the geographic location (latitude, longitude, elevation) of the default anchor point for which valid regions are determined as part of a traveler information packet broadcasted to connected devices.					message in a traveler information packet, a connected device include the geographic location (latitude, longitude, elevation) of the default anchor point for which valid regions are determined as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	
BC-REQ-1.3.3.2 -- Broadcast Traveler Information - Heading Slice	(Source: J3067, 3.5.8.3.6.2). For each traveler information message in a traveler information packet, a connected device shall include the direction of motion (of the connected device) that the message is valid for as part of a traveler information packet broadcasted to connected devices.	I	BC-REQ-1.3.3		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.2) For each traveler information message in a traveler information packet, a connected device include the direction of motion (of the connected device) that the message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						the requirement is satisfied.	
BC-REQ-1.3.3.3 -- Broadcast Traveler Information - Circular Valid Region Requirements	(Source: J3067, 3.5.8.3.6.3). A spatial region for which a traveler information message is valid for may be a circular region around an anchor point. The connected device should be located within the circular region for the traveler information message to be presented to the traveler.	I	BC-REQ-1.3.3		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.3) a spatial region for which a traveler information message is valid for may be a circular region around an anchor point. the connected device should be located within the circular region for the traveler information message to be presented to the traveler, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
BC-REQ-1.3.3.3.1 -- Broadcast Traveler Information - Circular Region – Radius	(Source: J3067, 3.5.8.3.6.3.1). For each traveler information message in a traveler information packet, a connected device shall include the radius for the circular region defining where the traveler information message is valid for as part of a traveler information	I	BC-REQ-1.3.3.3		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.3.1) For each traveler information message in a traveler information packet, a connected device include the radius for the circular region defining where the	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	packet broadcasted to connected devices.					traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	
BC-REQ-1.3.3.3.2 -- Broadcast Traveler Information - Circular Region - Anchor Point	(Source: J3067, 3.5.8.3.6.3.2). For each traveler information message in a traveler information packet, a connected device shall include the geographic location (latitude, longitude, elevation) of the anchor point for the circular region of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.	I	BC-REQ-1.3.3.3		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.3.2) For each traveler information message in a traveler information packet, a connected device include the geographic location (latitude, longitude, elevation) of the anchor point for the circular region of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
BC-REQ-1.3.3.4 -- Broadcast Traveler Information - Polygon Valid Region Requirements	(Source: J3067, 3.5.8.3.6.4). A spatial region for which a traveler information message is valid for may be a polygon, which may represent the jurisdictional boundaries of a specific transportation agency or a work zone. The connected device should be located within this polygon region for the traveler information message to be presented to the traveler.	I	BC-REQ-1.3.3		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.4) a spatial region for which a traveler information message is valid for may be a polygon, which may represent the jurisdictional boundaries of a specific transportation agency or a work zone. the connected device should be located within this polygon region for the traveler information message to be presented to the traveler, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
BC-REQ-1.3.3.4.1 -- Broadcast Traveler Information - Polygon Region – Offsets	(Source: J3067, 3.5.8.3.6.4.1). For each traveler information message in a traveler information packet, a connected device shall include the area of travel defining where the traveler information message is valid for as part of a traveler information packet	I	BC-REQ-1.3.3.4		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.4.1) For each traveler information message in a traveler information packet, a connected device include the area of travel defining where the traveler information message is	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	broadcasted to connected devices.					valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	
BC-REQ-1.3.3.4.2 -- Broadcast Traveler Information - Polygon Region - Anchor Point	(Source: J3067, 3.5.8.3.6.4.2). For each traveler information message in a traveler information packet, a connected device shall include the geographic location (latitude, longitude, elevation) of the anchor point for the area of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.	I	BC-REQ-1.3.3.4		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.4.2) For each traveler information message in a traveler information packet, a connected device include the geographic location (latitude, longitude, elevation) of the anchor point for the area of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
BC-REQ-1.3.3.5 -- Broadcast	(Source: J3067, 3.5.8.3.6.5). A spatial region for which a traveler information message	I	BC-REQ-1.3.3		WOBUDOC-1 -- Inspection of OBU	* Perform Test Case WOBUDOC-1 * Confirm that (Source:	Requirement Verification

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
Traveler Information - Valid Shape Point Set Region Requirements	is valid for may be a shape point set, which allows a spline-like representation of a geographic area such as a road segment. A connected device should be located within the shape point set region for the traveler information message to be presented to the traveler.				Certification and Test Documents	J3067, 3.5.8.3.6.5) a spatial region for which a traveler information message is valid for may be a shape point set, which allows a spline-like representation of a geographic area such as a road segment. a connected device should be located within the shape point set region for the traveler information message to be presented to the traveler, thereby verifying the requirement is satisfied.	Confirmed by:
BC-REQ-1.3.3.5.1 -- Broadcast Traveler Information - Shape Point Set - Default Direction	(Source: J3067, 3.5.8.3.6.5.1). For each traveler information message in a traveler information packet, a connected device shall include the default direction of travel along the shape point set as part of a traveler information packet broadcasted to connected devices.	I	BC-REQ-1.3.3.5		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.1) For each traveler information message in a traveler information packet, a connected device include the default direction of travel along the shape point set as part of a traveler information packet broadcasted to connected	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						devices, thereby verifying the requirement is satisfied.	
BC-REQ-1.3.3.5.2 -- Broadcast Traveler Information - Shape Point Set - Default Width	(Source: J3067, 3.5.8.3.6.5.2). For each traveler information message in a traveler information packet, a connected device shall include the default width of the shape point set as part of a traveler information packet broadcasted to connected devices.	I	BC-REQ-1.3.3.5		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.2) For each traveler information message in a traveler information packet, a connected device include the default width of the shape point set as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
BC-REQ-1.3.3.5.3 -- Broadcast Traveler Information - Shape Point Set – Offsets	(Source: J3067, 3.5.8.3.6.5.3). For each traveler information message in a traveler information packet, a connected device shall include the shape point set defining where the traveler information message is valid for as part of a traveler information packet	I	BC-REQ-1.3.3.5		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.3) For each traveler information message in a traveler information packet, a connected device include the shape point set defining where the traveler information message is	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	broadcasted to connected devices.					valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	
BC-REQ-1.3.3.5.4 -- Broadcast Traveler Information - Shape Point Set – Direction	(Source: J3067, 3.5.8.3.6.5.4). For each shape point set in a traveler information message, a connected device shall include the allowed direction of travel along the shape point set as part of a traveler information packet broadcasted to connected devices.	I	BC-REQ-1.3.3.5		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.4) For each shape point set in a traveler information message, a connected device include the allowed direction of travel along the shape point set as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
BC-REQ-1.3.3.5.5 -- Broadcast Traveler Information - Shape Point Set – Width	(Source: J3067, 3.5.8.3.6.5.5). For a shape point set in a traveler information message, a connected device shall include the width for the shape point set as part of a traveler information packet	I	BC-REQ-1.3.3.5		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.5) For a shape point set in a traveler information message, a connected device include the width	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	broadcasted to connected devices.					for the shape point set as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	
BC-REQ-1.3.3.5.6 -- Broadcast Traveler Information - Shape Point Set - Node Width	(Source: J3067, 3.5.8.3.6.5.6). For a shape point offset in a traveler information message, a connected device shall include the width of the geographic area at that node as part of a traveler information packet broadcasted to connected devices.	I	BC-REQ-1.3.3.5		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.6) For a shape point offset in a traveler information message, a connected device include the width of the geographic area at that node as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
BC-REQ-1.3.3.5.7 -- Broadcast Traveler Information - Shape Point	(Source: J3067, 3.5.8.3.6.5.7). For each shape point set in a traveler information message, a connected device shall include the geographic location (latitude, longitude,	I	BC-REQ-1.3.3.5		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.7) For each shape point set in a traveler information message, a connected	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
Set - Anchor Point	elevation) of the anchor point for the shape point set defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.					device include the geographic location (latitude, longitude, elevation) of the anchor point for the shape point set defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	
BC-REQ-1.3.4 -- Broadcast Traveler Advisories – Content	(Source: J3067, 3.5.8.3.7). For traveler advisory message in a traveler information packet, a connected device shall include the contents of the travel advisory information as part of a traveler information packet broadcasted to connected devices.	I	BC-REQ-1.3		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.7) For traveler advisory message in a traveler information packet, a connected device include the contents of the travel advisory information as part of a traveler information packet broadcasted to connected devices, thereby verifying	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						the requirement is satisfied.	
BC-REQ-1.3.5 -- Broadcast Road Sign – Content	(Source: J3067, 3.5.8.3.8). For each road sign message in a traveler information packet, a connected device shall include the road sign information as part of a traveler information packet broadcasted to connected devices	I	BC-REQ-1.3		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.8) For each road sign message in a traveler information packet, a connected device include the road sign information as part of a traveler information packet broadcasted to connected device, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
BC-REQ-1.3.6 -- Broadcast Traveler Information - Uniform Resource Locator	(Source: J3067, 3.5.8.3.9). For each traveler information message in a traveler information packet, an OBU shall include a uniform resource locator (URL) for the traveler information message as part of a traveler information packet broadcasted to connected devices.	I	BC-REQ-1.3		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.9) For each traveler information message in a traveler information packet, an OBU include a uniform resource locator (URL) for the traveler information message as part of a traveler information packet broadcasted to connected	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						devices, thereby verifying the requirement is satisfied.	
BC-REQ-1.3.7 -- Broadcast Traveler Information - Valid Vehicle Type	(Source: J3067, 3.5.8.3.10). For each traveler information message, a connected device shall include the vehicle types that the traveler advisory or road sign is valid for as part of a traveler information message broadcasted to connected vehicles.	I	BC-REQ-1.3		WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.10) For each traveler information message, a connected device include the vehicle types that the traveler advisory or road sign is valid for as part of a traveler information message broadcasted to connected vehicles, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
CSC-REQ-3 -- RSU SCMS Use	All RSUs used in the Wyoming Pilot shall be certified from a US DOT authorized testing facility based on the SCMS current version CAMP Wiki: Requirements and Specifications.	I	WCVS-REQ-20 RSU-REQ-6		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm that all RSUs used in the Wyoming Pilot are certified from a US DOT authorized testing facility based on the SCMS current version CaMP Wiki: Requirements and Specifications,	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						thereby verifying the requirement is satisfied.	
CSC-REQ-4 -- RSU Certification	All RSUs used in the Wyoming Pilot shall be certified from a US DOT authorized testing facility based on J2945/1.	I	WCVS-REQ-20 RSU-REQ-6		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm that all RSUs used in the Wyoming Pilot are certified from a US DOT authorized testing facility based on J2945/1. the following interfaces and requirements from J2945/1, at a minimum, will are included in the certification testing, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
CSC-REQ-5 -- RSU Specification	All RSUs used in the Wyoming Pilot shall be compliant with the following interfaces and requirements from DSRC Roadside Unit (RSU) Specifications Document v4.1. • Minimum Requirements o 3.4 Functional Requirements § USDOT_RSU-Req_513-v003 System Time:	I	WCVS-REQ-20 RSU-REQ-6		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm that all RSUs used in the Wyoming Pilot are compliant with the following interfaces and requirements from DSRC Roadside Unit (RSU) Specifications Document v4.1, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	GPS primary o 3.4.8 Security § USDOT_RSU-Req_442-v002 Data Protection: NTP Secondary Time o 3.7.1.2 IEEE 1609.2 § USDOT_RSU-Req_579-v001 Secure Storage: HSM						
BC-REQ-3 -- Traveler Information Requirements	(Source: J3067, 3.5.8). Traveler information is used to provide connected devices with travel advisories and information	I	RSU-REQ-7	BC-REQ-3.1 BC-REQ-3.2 BC-REQ-3.3	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: BC-REQ-3.1-WRSUDOC-1 BC-REQ-3.2-WRSUDOC-1 BC-REQ-3.3-WRSUDOC-1	Requirement Verification Confirmed by:
BC-REQ-3.1 -- Broadcast Traveler Information	(Source: J3067, 3.5.8.1). A connected device shall broadcast a packet containing traveler information to connected devices. Each packet may contain one or more	I	BC-REQ-3		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.1) a connected device broadcast a packet containing traveler	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	individual traveler information messages.					information to connected devices. Each packet may contain one or more individual traveler information messages, thereby verifying the requirement is satisfied.	
BC-REQ-3.2 -- Broadcast Traveler Information - Mandatory Requirements	(Source: J3067, 3.5.8.2). The following are the minimum requirements for a connected device to broadcast traveler information to connected devices.	I	BC-REQ-3	BC-REQ-3.2.1 BC-REQ-3.2.2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: BC-REQ-3.2.1-WRSUDOC-1 BC-REQ-3.2.2-WRSUDOC-1	Requirement Verification Confirmed by:
BC-REQ-3.2.1 -- Broadcast Traveler Information - Packet Identifier	(Source: J3067, 3.5.8.2.1). A connected device shall include a packet identifier for the traveler information packet broadcasted to connected devices.	I	BC-REQ-3.2		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.2.1) a connected device include a packet identifier for the traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
BC-REQ-3.2.2 -- Broadcast Traveler Information - Message Identifier Requirements	(Source: J3067, 3.5.8.2.2). For each traveler information message in a traveler information packet, a connected device needs to identify each message transmitted as part of a traveler information packet broadcasted to connected devices.	I	BC-REQ-3.2		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.2.2) For each traveler information message in a traveler information packet, a connected device needs to identify each message transmitted as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
BC-REQ-3.2.2.1 -- Broadcast Traveler Advisories - Message Identifier	(Source: J3067, 3.5.8.2.2.1). For traveler advisories, a connected device shall include a message identifier for each traveler advisory message as part of a traveler information packet broadcasted to connected devices.	I	BC-REQ-3.2.2		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.2.2.1) For traveler advisories, a connected device include a message identifier for each traveler advisory message as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
BC-REQ-3.2.2.2 -- Broadcast Road Sign - Message Identifier	(Source: J3067, 3.5.8.2.2.2). For road sign messages, the message identifier is determined by its geographic location and its viewing angle. Thus, for each road sign message, a connected device shall include the geographic location (latitude, longitude, elevation), based on the WGS-84 coordinate system, and the viewing angle of the road sign as part of a traveler information packet broadcasted to connected devices.	I	BC-REQ-3.2.2		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.2.2.2) For road sign messages, the message identifier is determined by its geographic location and its viewing angle. Thus, for each road sign message, a connected device include the geographic location (latitude, longitude, elevation), based on the WGS-84 coordinate system, and the viewing angle of the road sign as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
BC-REQ-3.3 -- Broadcast Traveler Information	(Source: J3067, 3.5.8.3). The following are the requirements for a connected device to broadcast traveler	I	BC-REQ-3	BC-REQ-3.3.1 BC-REQ-3.3.2 BC-REQ-3.3.3 BC-REQ-3.3.4	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases:	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	information to connected devices.			BC-REQ-3.3.5 BC-REQ-3.3.6		BC-REQ-3.3.1-WRSUDOC-1 BC-REQ-3.3.2-WRSUDOC-1 BC-REQ-3.3.3-WRSUDOC-1 BC-REQ-3.3.4-WRSUDOC-1 BC-REQ-3.3.5-WRSUDOC-1 BC-REQ-3.3.6-WRSUDOC-1	
BC-REQ-3.3.1 -- Broadcast Traveler Information - Validity Duration	(Source: J3067, 3.5.8.3.4). For each traveler information message in a traveler information packet, a connected device shall include the duration from the start time that the traveler message is valid for as part of a traveler information packet broadcasted to connected devices.	I	BC-REQ-3.3		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.4) For each traveler information message in a traveler information packet, a connected device include the duration from the start time that the traveler message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
BC-REQ-3.3.2 -- Broadcast Traveler Information – Importance	(Source: J3067, 3.5.8.3.5). For each traveler information message in a traveler information packet, a connected device shall include the importance of the message relative to other traveler information messages being broadcasted as part of a traveler information packet broadcasted to connected devices.	I	BC-REQ-3.3		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.5) For each traveler information message in a traveler information packet, a connected device include the importance of the message relative to other traveler information messages being broadcasted as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
BC-REQ-3.3.3 -- Broadcast Traveler Information - Presentation Requirements	(Source: J3067, 3.5.8.3.6). Agencies may need to present traveler information messages only to specific travelers, such as travelers within specific geographic (spatial) regions or a direction of travel.	I	BC-REQ-3.3		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6) agencies may need to present traveler information messages only to specific travelers, such as travelers within specific geographic (spatial) regions or a direction of travel, thereby verifying	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						the requirement is satisfied.	
BC-REQ-3.3.3.1 -- Broadcast Traveler Information - Default Anchor Point Position	(Source: J3067, 3.5.8.3.6.1). For each traveler information message in a traveler information packet, a connected device shall include the geographic location (latitude, longitude, elevation) of the default anchor point for which valid regions are determined as part of a traveler information packet broadcasted to connected devices.	I	BC-REQ-3.3.3		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.1) For each traveler information message in a traveler information packet, a connected device include the geographic location (latitude, longitude, elevation) of the default anchor point for which valid regions are determined as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
BC-REQ-3.3.3.2 -- Broadcast Traveler Information - Heading Slice	(Source: J3067, 3.5.8.3.6.2). For each traveler information message in a traveler information packet, a connected device shall include the direction of motion (of the connected device) that the message is	I	BC-REQ-3.3.3		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.2) For each traveler information message in a traveler information packet, a connected device include	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	valid for as part of a traveler information packet broadcasted to connected devices.					the direction of motion (of the connected device) that the message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	
BC-REQ-3.3.3.3 -- Broadcast Traveler Information - Circular Valid Region Requirements	(Source: J3067, 3.5.8.3.6.3). A spatial region for which a traveler information message is valid for may be a circular region around an anchor point. The connected device should be located within the circular region for the traveler information message to be presented to the traveler.	I	BC-REQ-3.3.3		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.3) a spatial region for which a traveler information message is valid for may are a circular region around an anchor point. the connected device should are located within the circular region for the traveler information message to are presented to the traveler, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
BC-REQ-3.3.3.3.1 -- Broadcast	(Source: J3067, 3.5.8.3.6.3.1). For each traveler information message	I	BC-REQ-3.3.3.3		WRSUDOC-1 -- Inspection of RSU	* Perform Test Case WRSUDOC-1 * Confirm that (Source:	Requirement Verification

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
Traveler Information - Circular Region – Radius	in a traveler information packet, a connected device shall include the radius for the circular region defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.				Certification and Test Documents	J3067, 3.5.8.3.6.3.1) For each traveler information message in a traveler information packet, a connected device include the radius for the circular region defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Confirmed by:
BC-REQ-3.3.3.3.2 -- Broadcast Traveler Information - Circular Region - Anchor Point	(Source: J3067, 3.5.8.3.6.3.2). For each traveler information message in a traveler information packet, a connected device shall include the geographic location (latitude, longitude, elevation) of the anchor point for the circular region of travel defining where the traveler information message is valid for as part of a traveler information packet	I	BC-REQ-3.3.3.3		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.3.2) For each traveler information message in a traveler information packet, a connected device include the geographic location (latitude, longitude, elevation) of the anchor point for the circular region of travel defining where the traveler information message is	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	broadcasted to connected devices.					valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	
BC-REQ-3.3.3.4 -- Broadcast Traveler Information - Polygon Valid Region Requirements	(Source: J3067, 3.5.8.3.6.4). A spatial region for which a traveler information message is valid for may be a polygon, which may represent the jurisdictional boundaries of a specific transportation agency or a work zone. The connected device should be located within this polygon region for the traveler information message to be presented to the traveler.	I	BC-REQ-3.3.3		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.4) a spatial region for which a traveler information message is valid for may are a polygon, which may represent the jurisdictional boundaries of a specific transportation agency or a work zone. the connected device should are located within this polygon region for the traveler information message to are presented to the traveler, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
BC-REQ-3.3.3.4.1 -- Broadcast Traveler	(Source: J3067, 3.5.8.3.6.4.1). For each traveler information message in a traveler information	I	BC-REQ-3.3.3.4		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.4.1) For	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
Information - Polygon Region – Offsets	packet, a connected device shall include the area of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.					each traveler information message in a traveler information packet, a connected device include the area of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	
BC-REQ-3.3.3.4.2 -- Broadcast Traveler Information - Polygon Region - Anchor Point	(Source: J3067, 3.5.8.3.6.4.2). For each traveler information message in a traveler information packet, a connected device shall include the geographic location (latitude, longitude, elevation) of the anchor point for the area of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.	I	BC-REQ-3.3.3.4		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.4.2) For each traveler information message in a traveler information packet, a connected device include the geographic location (latitude, longitude, elevation) of the anchor point for the area of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						devices, thereby verifying the requirement is satisfied.	
BC-REQ-3.3.3.5 -- Broadcast Traveler Information - Valid Shape Point Set Region Requirements	(Source: J3067, 3.5.8.3.6.5). A spatial region for which a traveler information message is valid for may be a shape point set, which allows a spline-like representation of a geographic area such as a road segment. A connected device should be located within the shape point set region for the traveler information message to be presented to the traveler.	I	BC-REQ-3.3.3		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5) a spatial region for which a traveler information message is valid for may are a shape point set, which allows a spline-like representation of a geographic area such as a road segment. a connected device should are located within the shape point set region for the traveler information message to are presented to the traveler, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
BC-REQ-3.3.3.5.1 -- Broadcast Traveler Information - Shape Point	(Source: J3067, 3.5.8.3.6.5.1). For each traveler information message in a traveler information packet, a connected device shall include the default	I	BC-REQ-3.3.3.5		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.1) For each traveler information message in a traveler	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
Set - Default Direction	direction of travel along the shape point set as part of a traveler information packet broadcasted to connected devices.					information packet, a connected device include the default direction of travel along the shape point set as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	
BC-REQ-3.3.3.5.2 -- Broadcast Traveler Information - Shape Point Set - Default Width	(Source: J3067, 3.5.8.3.6.5.2). For each traveler information message in a traveler information packet, a connected device shall include the default width of the shape point set as part of a traveler information packet broadcasted to connected devices.	I	BC-REQ-3.3.3.5		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.2) For each traveler information message in a traveler information packet, a connected device include the default width of the shape point set as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
BC-REQ-3.3.3.5.3 -- Broadcast Traveler	(Source: J3067, 3.5.8.3.6.5.3). For each traveler information message in a traveler information	I	BC-REQ-3.3.3.5		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.3) For	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
Information - Shape Point Set – Offsets	packet, a connected device shall include the shape point set defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.					each traveler information message in a traveler information packet, a connected device include the shape point set defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	
BC-REQ-3.3.3.5.4 -- Broadcast Traveler Information - Shape Point Set – Direction	(Source: J3067, 3.5.8.3.6.5.4). For each shape point set in a traveler information message, a connected device shall include the allowed direction of travel along the shape point set as part of a traveler information packet broadcasted to connected devices.	I	BC-REQ-3.3.3.5		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.4) For each shape point set in a traveler information message, a connected device include the allowed direction of travel along the shape point set as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
BC-REQ-3.3.3.5.5 -- Broadcast Traveler Information - Shape Point Set – Width	(Source: J3067, 3.5.8.3.6.5.5). For a shape point set in a traveler information message, a connected device shall include the width for the shape point set as part of a traveler information packet broadcasted to connected devices.	I	BC-REQ-3.3.3.5		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.5) For a shape point set in a traveler information message, a connected device include the width for the shape point set as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
BC-REQ-3.3.3.5.6 -- Broadcast Traveler Information - Shape Point Set - Node Width	(Source: J3067, 3.5.8.3.6.5.6). For a shape point offset in a traveler information message, a connected device shall include the width of the geographic area at that node as part of a traveler information packet broadcasted to connected devices.	I	BC-REQ-3.3.3.5		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.6) For a shape point offset in a traveler information message, a connected device include the width of the geographic area at that node as part of a traveler information packet broadcasted to connected devices, thereby verifying	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						the requirement is satisfied.	
BC-REQ-3.3.3.5.7 -- Broadcast Traveler Information - Shape Point Set - Anchor Point	(Source: J3067, 3.5.8.3.6.5.7). For each shape point set in a traveler information message, a connected device shall include the geographic location (latitude, longitude, elevation) of the anchor point for the shape point set defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.	I	BC-REQ-3.3.3.5		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.7) For each shape point set in a traveler information message, a connected device include the geographic location (latitude, longitude, elevation) of the anchor point for the shape point set defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
BC-REQ-3.3.4 -- Broadcast Traveler Advisories – Content	(Source: J3067, 3.5.8.3.7). For traveler advisory message in a traveler information packet, a connected device shall include the contents of the	I	BC-REQ-3.3		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.7) For traveler advisory message in a traveler information	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	travel advisory information as part of a traveler information packet broadcasted to connected devices.					packet, a connected device include the contents of the travel advisory information as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	
BC-REQ-3.3.5 -- Broadcast Road Sign – Content	(Source: J3067, 3.5.8.3.8). For each road sign message in a traveler information packet, a connected device shall include the road sign information as part of a traveler information packet broadcasted to connected devices	I	BC-REQ-3.3		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.8) For each road sign message in a traveler information packet, a connected device include the road sign information as part of a traveler information packet broadcasted to connected device, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
BC-REQ-3.3.6 -- Broadcast Traveler Information	(Source: J3067, 3.5.8.3.10). For each traveler information message, a connected device shall include the vehicle types that the traveler advisory or	I	BC-REQ-3.3		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.10) For each traveler information	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	road sign is valid for as part of a traveler information message broadcasted to connected vehicles.					message, a connected device include the vehicle types that the traveler advisory or road sign is valid for as part of a traveler information message broadcasted to connected vehicles, thereby verifying the requirement is satisfied.	
MNG-REQ-1 -- Performance Requirements – Message Transmission Rates	(Source: J3067, G.2). This section defines the range of allowable time intervals between consecutive transmissions of the same message between connected devices.	I	WCVS-REQ-18 RSU-REQ-10	MNG-REQ-1.6	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: MNG-REQ-1.6-WRSUDOC-1	Requirement Verification Confirmed by:
MNG-REQ-1.6 -- Transmission Rate Requirements - Broadcast Traveler Information	(Source: J3067, G.2.11). The detailed transmission rate requirements for an RSU to broadcast traveler information to connected devices are as follows.	I	MNG-REQ-1	MNG-REQ-1.6.1 MNG-REQ-1.6.2	Verified by Subrequirements or Peer Requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: MNG-REQ-1.6.1-WRSUDOC-1 MNG-REQ-1.6.2-WRSUDOC-1	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
MNG-REQ-1.6.1 -- Maximum Transmission Rate - Broadcast Traveler Information	(Source: J3067, G.2.11.1). An RSU shall broadcast a traveler information message to connected devices no more than once per second.	I	MNG-REQ-1.6		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm (Source: J3067, G2111) an RSU broadcasts a traveler information message to connected devices no more than once per second * Confirmation shows (Source: J3067, G2111) an RSU broadcasts a traveler information message to connected devices no more than once per second, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
MNG-REQ-1.6.2 -- Default Transmission Rate - Broadcast Traveler Information	(Source: J3067, G.2.11.2). If the specification does not indicate a default transmission rate, the suggested default transmission rate for an RSU to broadcast a traveler information message to connected devices once per second. If there is no need for an RSU to broadcast a message, then it	I	MNG-REQ-1.6		WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	* Perform Test Case WRSUDOC-1 * Confirm (Source: J3067, G.2.11.2). If the specification does not indicate a default transmission rate, the suggested default transmission rate for an RSU to broadcast a traveler information message to connected	Requirement Verification Confirmed by:

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
	recommended that no messages be transmitted from the RSU to minimize traffic, i.e., congestion. Otherwise, it is recommended that an RSU transmit a broadcast message frequently enough to ensure that the connected device for which the message is intended, traveling at the expected percentile speed would be within the transmission zone for at least three or four broadcasts.					devices once per second. If there is no need for an RSU to broadcast a message, then it recommended that no messages be transmitted from the RSU to minimize traffic, i.e., congestion. Otherwise, it is recommended that an RSU transmit a broadcast message frequently enough to ensure that the connected device for which the message is intended, traveling at the expected percentile speed would be within the transmission zone for at least three or four broadcasts. * Confirmation shows (Source: J3067, G2112) If the specification does not indicate a default transmission rate, the suggested default transmission rate for an RSU to broadcast a traveler information	

Requirement ID and Name	Requirement Description	Req Verif Method (I,D,T,A)	Parent Requirements	Child Requirements	Verified by Test Case ID and Name (Integrated Test Case ID)	Requirement Verification Methodology	Test Engineer Verification and Remarks
						message to connected devices once per second If there is no need for an RSU to broadcast a message, then it recommended that no messages be transmitted from the RSU to minimize traffic, i.e., congestion Otherwise, it is recommended that an RSU transmit a broadcast message frequently enough to ensure that the connected device for which the message is intended, traveling at the expected percentile speed would be within the transmission zone for at least three or four broadcasts, thereby verifying the requirement is satisfied.	

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Connected Vehicle Pilot Deployment Program Phase 2

Operational Readiness Plan – WYDOT CV Pilot

Attachment B - Operational Readiness Test Plan

Appendix B - Requirements Verification Methodology Sorted by Test Case

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Final Report — July 30, 2018

FHWA-JPO-17-472B

U.S. Department of Transportation

Produced by DTFH6116H00027

U.S. Department of Transportation

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA-JPO-17-472B		

4. Title and Subtitle	**5. Report Date**
Connected Vehicle Pilot Deployment Program Phase 2, Operational Readiness Plan – WYDOT CV Pilot Attachment B - Operational Readiness Test Plan Appendix B - Requirements Verification Methodology Sorted by Test Case	Final 3/16/2018 Updated 07/30/2018
	6. Performing Organization Code
7. Author(s) Denny Stephens (Vital Assurance), Tony English (Trihydro), Nayel Ureña Serulle (ICF), Deepak Gopalakrishna (ICF), Vince Garcia (Wyoming DOT)	**8. Performing Organization Report No.** Task 2G Operational Readiness Test and Demonstration Planning Report Number T2G.02.01
9. Performing Organization Name and Address Wyoming DOT, 5300 Bishop Boulevard, Cheyenne, WY 82009 ICF International, 1725 Eye St NW, Washington DC, 20006 Trihydro Corporation, 1252 Commerce Drive, Laramie, WY 82070 Vital Assurance, 175 S. Third St., Suite 200, Columbus, OH 43215	**10. Work Unit No. (TRAIS)**
	11. Contract or Grant No. DTFH6116H00027
12. Sponsoring Agency Name and Address U.S Department of Transportation 1200 New Jersey Ave, SE Washington, DC 20590	**13. Type of Report and Period Covered** Operational Readiness Plan, 09/01/2016 to 3/16/2018
	14. Sponsoring Agency Code

15. Supplementary Notes
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16. Abstract
The Wyoming Department of Transportation's (WYDOT) Connected Vehicle (CV) Pilot Deployment Program is intended to develop a suite of applications that utilize vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communication technology to reduce the impact of adverse weather on truck travel in the I-80 corridor. These applications support a flexible range of services from advisories, roadside alerts, parking notifications and dynamic travel guidance. Information from these applications are made available directly to the equipped fleets or through data connections to fleet management centers (who will then communicate it to their trucks using their own systems). The pilot will be conducted in three Phases. Phase 1 includes the planning for the CV pilot including the concept of operations development. Phase 2 is the design, development, and testing phase. Phase 3 includes a real-world demonstration of the applications developed as part of this pilot.

This document is Appendix B of the WYDOT CV Pilot Operational Test Plan which is Attachment B to the Operational Readiness Plan (ORP) for The WYDOT CV Pilot project for the United States Department of Transportation's (USDOT) CV program. The purpose of this document is to sort by test cases the methodology used to verify each system requirement.

17. Key Words	**18. Distribution Statement**
Connected Vehicle Technology, I-80 Corridor, Road Weather, Truck Safety, System Architecture	This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161

19. Security Classif. (of this report)	**20. Security Classif. (of this page)**	**21. No. of Pages**	**22. Price**
None	None	94	NA

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

Acknowledgements

The Operational Readiness Plan development team would like to thank USDOT and Noblis for their technical assistance throughout the development of this document.

1 Requirements Verification Methodology Sorted by Test Case

This document is one of two appendices (A and B) that characterize the Requirements Verification Methodology planned for the WYDOT CV Pilot. Table 1-1 lists the system requirements from the *Connected Vehicle Pilot Deployment Program Phase 1, System Requirements Specification (SyRS)*, with Phase 2 updates, and sorts them by Test Case, to show the reader which requirements are verified by each Test Case. As such, for each Test Case this table presents:

- Verification Test Case ID and Name in which the requirement will be verified
- Requirement ID and Name from the SyRS
- Requirement Description from the SyRS
- Requirement Verification Methodology which describes the process by which the requirement will be verified after completion of the test case
- Test Engineer Verification and Remarks to be filled in upon verification of the requirement

1. Requirements Verification Methodology Sorted by Test Cases

Table 1-1. Requirements Verification Methodology Sorted by Test Case

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WV2VMCT-1 -- V2V exchange of BSMs (Integrated with WFCWT-1)	VS-REQ-1 -- Receive BSM	The Vehicle System shall receive Basic Safety Message (as defined in SAE J2945/1) over DSRC from other connected vehicles consistent with Section 6.3.8 of SAE J2945/1 (BSM Scheduling and Congestion Control).	* Perform Test Case WFCWT-1 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped remote vehicle ahead * Confirm issuance of imminent danger alert * Issuance of imminent danger alert verifies Vehicle System receives Basic Safety Message (as defined in SAE J2945/1) over DSRC from other connected vehicles consistent with Section 6.3.8 of SAE J2945/1 (BSM Scheduling and Congestion Control), thereby verifying requirement. (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	Requirement Verification Confirmed by:
WV2VMCT-1 -- V2V exchange of BSMs (Integrated with WFCWT-1)	VS-REQ-33 -- BCVI Messages	The Vehicle System shall wirelessly broadcast over DSRC a basic safety message (BSM) to other connected devices.	* Perform Test Case WV2VMCT-1(WFCWT-1) * Inspect Host Vehicle OBU Logs and identify 1 or more instances of BSMs sent from Host Vehicle to Remote Vehicle * Inspect Remote Vehicle OBU logs and identify corresponding receipt of BSMs * Confirmation shows the Vehicle System wirelessly broadcasts over DSRC a basic safety message (BSM) to other connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2VMCT-2 -- V2V exchange of DNMs (Integrated with WDNR-1)	VS-REQ-3 -- Receive Distress Information	The Vehicle System shall wirelessly receive a packet containing distress information from other connected vehicles over DSRC. Distress information is a high priority messages based on the received distress broadcast (defined in J3067 3.5.9.2.1), but has the content of the TIM (defined in J2735 5.16 Part III advisory ITIS data elements 6.1 from J2540-2 Accidents and Incidents).	* Perform Test Case WV2VMCT-2 * Inspect Distressed Vehicle OBU Logs and 1 or more instances of DN TIMs sent to Relay Vehicle * Inspect Relay Vehicle logs and identify corresponding instances of DN TIMs received from Distressed Vehicle	Requirement Verification Confirmed by:
WV2VMCT-2 -- V2V exchange of DNMs (Integrated with WDNR-1)	DNP-REQ-2 -- Distress Notification OBU DSRC Performance 2	Remote vehicles shall receive distress notification from other remote "relay" vehicles via DSRC between at least 2 and 300 meters from the other remote vehicle.	* Perform Test Case WV2VMCT-2 * Inspect Relay Vehicle OBU Event Logs, determine time, location, speed, and heading path of Relay Vehicle when first Distress Notification Message received. * Inspect Distressed Vehicle OBU Event Logs, determine location and heading path of Distressed Vehicle at time that Relay Vehicle received first Distress Notification Message. * Compute Distance between Relay Vehicle and Distressed Vehicle at time first Distress Notification Message was received by Relay Vehicle. * Confirm Relay Vehicles receive distress notification from other remote "relay" vehicles via DSRC between at least 2 and 300 meters from the other Relay Vehicle, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WV2IMCT-1 -- V2I and End-to-end communication of DNMs (Integrated with WDNR-1)	WCVS-REQ-1.3 -- Collect Distress Messages	The Wyoming CV System shall collect distress messages using the Traveler Information Message (as defined in section 5.16 of J2735) from the Vehicle System consistent with Section 3.5.8 (Traveler Information Requirements) of J3067	* Perform Test Case WV2IMCT-1(WDNR-1) * Inspect Relay Vehicle OBU Logs and confirm receipt of DNM from Distressed Vehicle * Inspect ODE Logs and identify corresponding instance of received DNM * Receipt of DNMs confirms Wyoming CV System collects distress messages using the Traveler Information Message (as defined in section 5.16 of J2735) from the Vehicle System consistent with Section 3.5.8 (Traveler Information Requirements) of J3067, thereby verifying the requirement is satisfied. * (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	Requirement Verification Confirmed by:
WV2IMCT-1 -- V2I and End-to-end communication of DNMs (Integrated with WDNR-1)	WCVS-REQ-11.3 -- Store Distress Messages	The Wyoming CV System shall store processed distress messages using the Traveler Information Message (as defined in section 5.16 of J2735) received from the Vehicle System consistent with Section 3.5.8 (Traveler Information Requirements) of J3067. As the distress message will be previously validated, only core data will be stored (defined in sections 5.16, and 6.142 of J2735).	* Perform Test Case WV2IMCT-1(WDNR-1) * Inspect Relay Vehicle OBU Logs and confirm receipt of DNM from Distressed Vehicle * Inspect DW logs and verify receipt of identified DNM from OBU for storage. * Receipt of DNMs by DW confirms Wyoming CV System stores processed distress messages using the Traveler Information Message (as defined in section 5.16 of J2735) received from the Vehicle System consistent with Section 3.5.8 (Traveler Information Requirements) of J3067, thereby verifying the requirement is satisfied. * (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	Requirement Verification Confirmed by:
WV2IMCT-1 -- V2I and End-to-end communication of DNMs (Integrated with WDNR-1)	VS-REQ-38 -- SLD Information	The Vehicle System shall store information generated by the host vehicle on local storage. Information to be stored is detailed in Table 4-3 of the SyRS.	* Perform Test Case WV2IMCT-1(WDNR-1) * Confirm that the Vehicle System store information generated by the host vehicle on local storage. * Confirmation shows the Vehicle System store information generated by the host vehicle on local storage, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-1 -- V2I and End-to-end communication of DNMs (Integrated with WDNR-1)	VS-REQ-39 -- SLD Rolling Log	The Vehicle System shall maintain rolling logs for in vehicle generated CV data for 10 seconds. Table 4-4 of the SyRS lists one or more sources of the rolling logs that may be available in a vehicle Sub-System.	* Perform Test Case WV2IMCT-1(WDNR-1) * Confirm that the Vehicle System maintain rolling logs for in vehicle generated CV data for 10 seconds. * Confirmation shows the Vehicle System maintain rolling logs for in vehicle generated CV data for 10 seconds, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-1 -- V2I and End-to-end communication of DNMs (Integrated with WDNR-1)	VS-REQ-40 -- SLD Log Format	The event log format shall contain UTC time stamped text or binary data.	* Perform Test Case WV2IMCT-1(WDNR-1) * Confirm that the event log format contain UTC time stamped text or binary data * Confirmation shows the event log format contain UTC time stamped text or binary data, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WV2IMCT-1 -- V2I and End-to-end communication of DNMs (Integrated with WDNR-1)	VS-REQ-41 -- SLD Log Data	The Vehicle System shall create event logs for all interactions with the Wyoming CV System or Vehicle System that is retained until it is sent to the Wyoming CV System or is older than seven (7) days. An interaction is defined as a received message from the Wyoming CV System or the Vehicle System. Each log should contain the information in Table 4-5 of the SyRS.	* Perform Test Case WV2IMCT-1(WDNR-1) * Confirm that the Vehicle System create event logs for all interactions with the Wyoming CV System or Vehicle System that is retained until it is sent to the Wyoming CV System or is older than seven (7) days. * Confirmation shows the Vehicle System create event logs for all interactions with the Wyoming CV System or Vehicle System that is retained until it is sent to the Wyoming CV System or is older than seven (7) days, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-1 -- V2I and End-to-end communication of DNMs (Integrated with WDNR-1)	ODE-REQ-3.5 -- Distribute to Data Broker	The Operational Data Environment shall distribute distress information to the Data Broker, as described in Section 5.21.1 of the ICD.	* Perform Test Case WV2IMCT-1(WDNR-1) * Inspect ODE Logs and identify 1 or more instances of DNMs received * Inspect DB logs and verify receipt of corresponding 1 or more DNMs * Confirmation shows the Operational Data Environment distributes distress information to the Data Broker, as described in Section 5.21.1 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-1 -- V2I and End-to-end communication of DNMs (Integrated with WDNR-1)	DB-REQ-6 -- Receive from ODE	The DB shall receive distress information from the ODE, as defined in Section 5.21.1 of the ICD.	* Perform Test Case WV2IMCT-1(WDNR-1) * Inspect ODE Logs and identify 1 or more instances of DN TIMs received * Inspect DB logs and verify receipt of corresponding DN TIMs * Confirmation shows the DB receive distress information from the ODE, as defined in Section 5211 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-1 -- V2I and End-to-end communication of DNMs (Integrated with WDNR-1)	DNP-REQ-3 -- Distress Notification RSU DSRC Performance	ODE shall receive Distress Notification Messages (through RSU) from distressed vehicle or remote "relay" vehicles via DSRC from a distance between at least 2 and 300 meters between vehicles and RSU.	* Perform Test Case WV2IMCT-1(WDNR-1) * Inspect Remote Vehicle OBU Event Logs, determine time, location, speed, and heading path of Remote Vehicle when OBU receives an RSU WSA broadcast for the ODE server’s IPv6 address, and the OBU copies a log for the DNM to the ODE server. * Inspect ODE Logs, determine time when ODE received first Distress Notification Message. * Determine which RSU received the DNM and its location. * Compute Distance between Remote Vehicle and RSU at time first Distress Notification Message was received by Remote Vehicle 2. * Confirmation shows ODE receive Distress Notification Messages (through RSU) from distressed vehicle or remote "relay" vehicles via DSRC from a distance between at least 2 and 300 meters between vehicles and RSU, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-2 -- V2I & End-to-end Communication of	SCMS-REQ-2.1 -- SCMS Vehicle System Certificates	The Vehicle System shall download certificates from the USDOT SCMS.	* Conduct Test WV2IMCT-2(WFCWT-1) * Inspect Vehicle System SCMS logs * Confirm Vehicle System downloads certificates from the USDOT SCMS, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
BSMs (Integrated with WFCWT-1)				
WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-1)	WCVS-REQ-1.1 -- Collect BSM Data	The Wyoming CV System shall collect Basic Safety Message Parts I and II (as defined in J2945/1) from the Vehicle System consistent with Section 6.3.8 (BSM Scheduling and Congestion Control) of J2945/1	* Perform Test Case WV2IMCT-2(WFCWT-1) * Inspect OBU Logs and identify 1 or more instances of BSMs sent to RSUs * Inspect RSU logs and identify corresponding 1 or more instances of BSMs received * Inspect ODE Logs and identify corresponding 1 or more instances of BSMs received * Inspect Pikalert logs and identify corresponding 1 or more instances BSMs received Confirmation shows Wyoming CV System collects Basic Safety Message Parts I and II (as defined in J2945/1) from the Vehicle System consistent with Section 6.3.8 (BSM Scheduling and Congestion Control) of J2945/1, thereby verifying the requirement is satisfied. (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	Requirement Verification Confirmed by:
WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-1)	WCVS-REQ-11.1 -- Store BSM	The Wyoming CV System shall store processed BSM Parts I and II data received from the Vehicle System. As the BSM will be previously validated, only core data elements will be stored (defined in sections 6.8, 6.147, 6.128, and 6.133 of J2735).	* Perform Test Case WV2IMCT-2(WFCWT-1) * Inspect ODE logs and confirm receipt of BSM Part 1 and 2 from OBU. * Inspect DW logs and confirm receipt of BSM Part 1 and 2 from OBU for storage. * Receipt of BSM by DW confirms the Wyoming CV System stores processed BSM Parts I and II data received from the Vehicle System, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-1)	VS-REQ-4.1 -- Collect Vehicle Status Data	The Vehicle System shall have the capability to collect vehicle status information from the host vehicle, as stated in Section 5.4.2 of the ICD.	* Perform Test Case WV2IMCT-2(WFCWT-1) * Inspect OBU Logs and identify 1 or more instances of BSMs sent to RSUs * Inspect BSMs and identify CAN data elements, identified as "yes/CAN" in WYDOT ICD Table 7 1: BSM Message Fields * Confirmation shows the Vehicle System has the capability to collect vehicle status information from the host vehicle, as stated in Section 542 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-1)	VS-REQ-4.2.1 -- Vehicle Dimension Data	The Vehicle System shall have the capability to collect vehicle dimension from the host vehicle driver through the Human Machine Interface.	* Perform Test Case WV2IMCT-2(WFCWT-1) * Inspect OBU Logs and identify 1 or more instances of BSMs sent to RSUs * Inspect BSMs and identify vehicle dimension data elements, identified in WYDOT ICD Table 7 1: BSM Message Fields * Confirmation shows the Vehicle System has the capability to collect vehicle dimension from the host vehicle driver through the Human Machine Interface, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-2 -- V2I & End-to-end Communication of	VS-REQ-4.2.2 -- Vehicle Trailer Data	The Vehicle System shall have the capability to collect information from the host vehicle driver regarding the dimensions of attached trailers,	* Perform Test Case WV2IMCT-2(WFCWT-1) * Inspect OBU Logs and identify 1 or more instances of BSMs sent to RSUs * Inspect BSMs and identify vehicle trailer data elements, identified in WYDOT ICD Table 7 1: BSM Message Fields * Confirmation shows the Vehicle System has the capability to collect information from the host vehicle driver regarding	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
BSMs (Integrated with WFCWT-1)		including capability to indicate that no trailer is present, through the Human Machine Interface.	the dimensions of attached trailers, including capability to indicate that no trailer is present, through the Human Machine Interface, thereby verifying the requirement is satisfied.	
WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-1)	RSU-REQ-11 -- Distribute to ODE	The Roadside Units shall share all collected information with the Operational Data Environment, as described in Section 5.18.1 of the ICD.	* Perform Test Case WV2IMCT-2(WFCWT-1) * Inspect RSU logs and identify 1 or more instances of BSMs received from Vehicles * Inspect ODE logs and identify receipt of corresponding BSMs. * Confirmation shows the Roadside Units share all collected information with the Operational Data Environment, as described in Section 5.18.1 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-1)	ODE-REQ-3.4.1 -- Distribute to Data Warehouse-BSM	The Operational Data Environment shall distribute all collected and processed BSM information to the Data Warehouse, as described in Section 5.20 of the ICD.	* Perform test case WV2IMCT-2(WFCWT-1) * Inspect DW logs * Confirm receipt of BSMs * Confirmation shows the Operational Data Environment distributes all collected and processed BSM information to the Data Warehouse, as described in Section 5.20 of the ICD, thereby verifying the requirement is satisfied. * Confirmation shows the Operational Data Environment distribute all collected and processed BSM information to the Data Warehouse, as described in Section 520 of the ICD , thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-1)	ODE-REQ-3.6 -- Distribute to SDC	The Operational Data Environment shall distribute CV data to the Secure Data Commons, as defined in Section 5.37.1 of the ICD	* Perform Test Case WV2IMCT-1(WDNR-1) * Inspect ODE logs * Confirm 1 or more instances of BSMs received. * Confirm corresponding 1 or more instances of BSMs sent to Secure Data Commons * Confirmation shows the Operational Data Environment distributes CV data to the Secure Data Commons, as defined in Section 5.37.1 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-1)	ODE-REQ-3.7 -- Distribute to RDE	The Operational Data Environment shall distribute CV data to the Research Data Exchange, as defined in Section 5.40.1 of the ICD	* Perform Test Case WV2IMCT-1(WDNR-1) * Inspect ODE logs * Confirm 1 or more instances of BSMs received. * Confirm corresponding 1 or more instances of BSMs sent to RDE * Confirmation shows the Operational Data Environment distributes CV data to the Research Data Exchange, as defined in Section 5.37.1 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-1)	MV-REQ-3 -- Static Identifier	WYDOT Maintenance Vehicles' DSRC communications shall have a static identifier.	* Perform Test Case WV2IMCT-2(WFCWT-1) * Inspect OBU Logs and identify 1 or more instances of BSMs sent to RSUs * Inspect BSMs and identify static identifier * Confirmation shows the WYDOT Fleet vehicles' DSRC communications have a static identifier, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WV2IMCT-3 -- V2I & End-to-end communication of Environmental Sensor Data	WCVS-REQ-1.2 -- Collect Environmental Sensor Data	The Wyoming CV System shall collect environment sensor data using secure copy (SCP) from the Vehicle System consistent with secure shell (SSH).	-Perform Test Case WV2IMCT-3 * Inspect HMI Logs and identify 1 or more instances of environmental sensor data copied to ODE * Inspect ODE logs and identify corresponding 1 or more instances of environmental sensor data copied from OBU to ODE * Confirmation shows Wyoming CV System collects environment sensor data using secure copy (SCP) from the Vehicle System consistent with secure shell (SSH), thereby verifying the requirement is satisfied. * (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	Requirement Verification Confirmed by:
WV2IMCT-3 -- V2I & End-to-end communication of Environmental Sensor Data	WCVS-REQ-11.2 -- Store Environment Sensor Data	The Wyoming CV System shall store processed environment sensor data consistent with Section 5.19.2 of the ICD.	* Perform Test Case WV2IMCT-3. * Inspect ODE logs and verify receipt (copy) of environmental sensor data from OBU. * Inspect DW logs and verify receipt (copy) of environmental sensor data from OBU for storage. * Receipt of environmental sensor data by DW confirms the Wyoming CV System stores processed environment sensor data consistent with Section 5.19.2 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-3 -- V2I & End-to-end communication of Environmental Sensor Data	VS-REQ-5 -- External Environment Sensor Data	The Vehicle System shall collect additional environmental sensor data from host vehicles equipped with external environmental sensors. Additional data collected from external environmental sensors is shown in Table 7-4 of the Interface Control Document.	* Perform Test Case WV2IMCT-3 * Inspect HMI Logs and identify 1 or more instances of environmental sensor data copied to ODE * Inspect ODE logs and identify corresponding 1 or more instances of environmental sensor data copied from OBU to ODE * Confirmation shows the Vehicle System collects additional environmental sensor data from host vehicles equipped with external environmental sensors, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-3 -- V2I & End-to-end communication of Environmental Sensor Data	VS-REQ-5.1 -- External Environment Sensor Data Configuration	The collection of sensor data by the Vehicle System shall be configurable as specified in Section 3.2.5.1 of the SDD.	* Perform Test Case WV2IMCT-3. * Inspect ODE Logs and locate and verify 1 or more instances of receipt of Environmental Sensor Data. * Inspect SDD and confirm configuration of Environmental Sensor Data * Inspect Environmental Sensor Data and confirm collection of sensor data by the Vehicle System is configurable * Confirmation shows the collection of sensor data by the Vehicle System is configurable as specified in Section 3251 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-3 -- V2I & End-to-end communication of Environmental Sensor Data	VS-REQ-5.2 -- External Environment Sensor Data Management	The application shall support a data management mechanism, specified in Section 3.2.5.1 of the SDD.	* Perform Test Case WV2IMCT-3. * Inspect ODE Logs and locate and verify 1 or more instances of receipt of Environmental Sensor Data. * Inspect SDD and confirm data management mechanism * Inspect Environmental Sensor Data and confirm application supports a data management mechanism * Confirmation shows the application supports a data management mechanism, specified in Section 3251 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WV2IMCT-3 -- V2I & End-to-end communication of Environmental Sensor Data	VS-REQ-36.1 -- Transmit Environmental Data	The Vehicle System shall transmit over DSRC environmental data, defined in Table 7-4 of the SDD, to the Wyoming CV System when available from a vehicle Sub-System.	* Perform Test Case WV2IMCT-3 * Confirm secure copy to the Wyoming CV System of Environmental Data. * Confirmation shows the Vehicle System transmits over DSRC environmental data, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-3 -- V2I & End-to-end communication of Environmental Sensor Data	ODE-REQ-3.3 -- Distribute to Pikalert	The Operational Data Environment shall distribute Environmental Data to the Pikalert System, as described in Section 5.19 of the ICD.	* Perform Test Case WV2IMCT-3 * Inspect HMI Logs and identify 1 or more instances of environmental sensor data copied to ODE * Inspect ODE logs and identify corresponding 1 or more instances of environmental sensor data copied from OBU to ODE * Inspect Pikalert logs and identify corresponding 1 or more instances of environmental sensor data received * Confirmation shows the Operational Data Environment distributes Environmental Data to the Pikalert System, as described in Section 5.19 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-3 -- V2I & End-to-end communication of Environmental Sensor Data	ODE-REQ-3.4.3 -- Distribute to Data Warehouse-ES	The Operational Data Environment shall distribute all collected and processed Environmental Sensor information to the Data Warehouse, as described in Section 5.20 of the ICD.	* Perform Test Case WV2IMCT-3 * Inspect DW logs * Confirm receipt of Environmental Sensor Data * Confirmation shows the Operational Data Environment distributes all collected and processed Environmental Sensor information to the Data Warehouse, as described in Section 5.20 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-3 -- V2I & End-to-end communication of Environmental Sensor Data	PA-REQ-2.1 -- ODE Data	The Pikalert System shall receive CV data from the Operational Data Environment as defined in ODE-REQ-3.3	* Perform Test Case WV2IMCT-3 * Inspect HMI Logs and identify 1 or more instances of environmental sensor data copied to ODE * Inspect ODE logs and identify corresponding 1 or more instances of environmental sensor data copied from OBU to ODE * Inspect Pikalert logs and identify corresponding 1 or more instances of environmental sensor data received * Confirmation shows the Pikalert System receives CV data from the Operational Data Environment as defined in ODE-REQ-3.3, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-4 -- V2I & End-to-end communication of log files (Integrated with WFCWT-1)	VS-REQ-36.2 -- TVI Data Management-Log	The Vehicle System shall transmit log files via secure copy (SCP) to the Wyoming CV System over DSRC that contain event logs data defined in VS-REQ-41.	* Perform Test Case WV2IMCT-4(WFCWT-1) * Confirm secure copy to the Wyoming CV System of Event Logs. * Confirmation shows the Vehicle System transmits log files via secure copy (SCP) to the Wyoming CV System over DSRC that contain event logs data, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated with WI2VSAT-1-REP)	SCMS-REQ-1.1 -- SCMS Wyoming CV System Certificates	The Wyoming CV System shall download certificates from the USDOT SCMS.	* Perform Test Case WI2VMCT-1(WI2VSAT-1-REP) * Inspect Wyoming CV System SCMS logs * Confirm Wyoming CV System downloads certificates from the USDOT SCMS. * Confirmation shows the Wyoming CV System downloads certificates from the USDOT SCMS, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated with WI2VSAT-1-REP)	SDC-REQ-1 -- Data Provided to the SDC	The Wyoming CV System shall transmit information to the Secure Data Commons.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: ODE-REQ-3.6-WV2IMCT-2(WFCWT-1) DW-REQ-2.2-WI2VMCT-1(WI2VSAT-1-REP)	Requirement Verification Confirmed by:
WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated with WI2VSAT-1-REP)	SDC-REQ-1 -- Data Provided to the SDC	The Wyoming CV System shall transmit information to the Secure Data Commons.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: ODE-REQ-3.6- WV2IMCT-2(WFCWT-1) DW-REQ-2.2-WI2VMCT-1(WI2VSAT-1-REP)	Requirement Verification Confirmed by:
WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated with WI2VSAT-1-REP)	RDE-REQ-1 -- Data Provided to the RDE	The Wyoming CV System shall transmit information to the Research Data Exchange.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: ODE-REQ-3.6-WV2IMCT-1(WDNR-1) DW-REQ-2.2-WI2VMCT-1(WI2VSAT-1-REP)	Requirement Verification Confirmed by:
WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated with WI2VSAT-1-REP)	WCVS-REQ-10.1 -- Distribute TIM to VS	The Wyoming CV System shall distribute signed TIM to the Vehicle System consistent with Section 3.5.8 (Traveler Information Requirements) of J3067	* Perform Test Case WI2VMCT-1(WI2VSAT-REP) * Inspect DB logs and verify generation of TIMs. * Inspect DB Logs and verify output and distribution of TIM to Vehicle Systems via DSRC. * Confirmation shows Wyoming CV System distributes TIM to the Vehicle System consistent with Section 3.5.8 (Traveler Information Requirements) of J3067, thereby verifying the requirement is satisfied. * (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated with WI2VSAT-1-REP)	VS-REQ-2.1 -- Receive TIM through DSRC	The Vehicle System shall wirelessly receive a packet containing traveler information from the Wyoming CV System through DSRC	* Perform Test Case WI2VMCT-1(WI2VSAT-REP) * Inspect DB Logs and locate 1 or more instances of formation of TIMs. * Inspect OBU logs and locate corresponding instances of TIMs received by OBU via DSRC. * Confirmation shows the Vehicle System wirelessly receives a packet containing traveler information from the Wyoming CV System through DSRC, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated with WI2VSAT-1-REP)	ODE-REQ-7 -- Receive from Data Broker	The Operational Data Environment shall receive information from the Data Broker, as defined in Section 5.21.2 of the ICD.	* Perform Test Case WI2VMCT-1(WI2VSAT-1-REP) * Inspect DB Logs and locate 1 or more instances of formation of TIMs. * Inspect ODE logs and locate corresponding 1 or more instances of TIMs received. * Confirmation shows the Operational Data Environment receive information from the Data Broker, as defined in Section 5212 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated with WI2VSAT-1-REP)	HSM-REQ-1 -- Receive from ODE	The HSM shall receive unsigned TIMs from the ODE as defined in Section 3.1.4.1 of the SDD.	* Perform Test Case WI2VMCT-1(WI2VSAT-1-REP) * Inspect Wyoming CV System ODE logs * Confirm Wyoming CV System ODE receives signed TIMs from the HSM. * Confirmation shows the HSM receives unsigned TIMs from the ODE as defined in section 3.1.4.1 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated with WI2VSAT-1-REP)	HSM-REQ-2 -- Share with ODE	The HSM shall provide signed TIMs to the ODE as defined in Section 3.1.4.1 of the SDD.	* Perform Test Case WI2VMCT-1(WI2VSAT-1-REP) * Inspect Wyoming CV System ODE logs * Confirm Wyoming CV System ODE receives signed TIMs from the HSM. * Confirmation shows the HSM provides signed TIMs to the ODE as defined in section 3.1.4.1 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated with WI2VSAT-1-REP)	HSM-REQ-3 -- Receive from SCMS	The HSM shall receive updated certificates from the SCMS as defined in Section 3.1.3 of the SDD.	* Perform Test Case WI2VMCT-1(WI2VSAT-1-REP) * Inspect Wyoming CV System ODE logs * Confirm Wyoming CV System ODE receives signed TIMs with up to date certificates from the HSM. * Confirmation shows the HSM receives updated certificates from the SCMS as defined in Section 3.1.3 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VMCT-1 -- End-to-end & DSRC Delivery of	HSM-REQ-4 -- Share with SCMS	The HSM shall shares authentication data with the SCMS as defined in Section 3.1.3 of the SDD.	* Perform Test Case WI2VMCT-1(WI2VSAT-1-REP) * Inspect Wyoming CV System ODE logs * Confirm Wyoming CV System ODE receives signed TIMs with up to date certificates from the HSM.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
I2V SA TIMs (Integrated with WI2VSAT-1-REP)			* Confirmation shows the HSM shares authentication data with the SCMS as defined in Section 3.1.3 of the SDD, thereby verifying the requirement is satisfied.	
WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated with WI2VSAT-1-REP)	HP-REQ-2 -- Receive TIM over DSRC	Highway Patrol vehicles shall receive traveler information from the Wyoming CV System over DSRC. Traveler information may contain one or more packets of traveler information as defined in Section 5.16 of SAE J2735.	* Perform Test Case WI2VMCT-1(WI2VSAT-REP) * Inspect DB Logs and locate 1 or more instances of formation of TIMs. * Inspect OBU logs and locate corresponding instances of TIMs received by OBU via DSRC. * Confirmation shows the Vehicle System wirelessly receives a packet containing traveler information from the Wyoming CV System through DSRC, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VMCT-2 -- End-to-end & Satellite Delivery of I2V SA TIMs (Integrated with WI2VSAT-5)	VS-REQ-2.2 -- Receive TIM through Satellite	The Vehicle System shall wirelessly receive a packet containing traveler information from the Wyoming CV System (via the Situational Data Warehouse) through satellite.	* Perform Test Case WI2VMCT-2(WI2VSAT-5) * Inspect DB Logs and locate 1 or more instances of formation of TIMs. * Inspect OBU logs and locate corresponding instances of TIMs received by OBU via satellite. * Confirmation shows the Vehicle System wirelessly receives a packet containing traveler information from the Wyoming CV System (via the Situational Data Warehouse) through satellite , thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VMCT-3 -- Simultaneous DSRC Upload/Download of messages and log files.	I2VSAP-REQ-13 -- Simultaneous I2V and V2I DSRC Communications	The WYDOT CV Pilot System shall support simultaneous capture of vehicle system BSMs, capture of vehicle system log files, and broadcast of I2V SA TIMs via DSRC.	* Perform Test Case WI2VMCT-3 * Inspect OBU logs * Confirm receipt of broadcast of I2V SA TIMs. * Inspect ODE logs * Confirm receipt of vehicle system BSMs and capture of vehicle system log files * Confirmation shows the WYDOT CV Pilot System supports simultaneous capture of vehicle system BSMs, capture of vehicle system log files, and broadcast of I2V SA TIMs via DSRC, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WFCWT-1 -- FCW Stopped Vehicle Ahead	LTS-REQ-4 -- VS LTS Time	The Vehicle System shall acquire time from the LTS interface in accordance with Section 5.3.1 of the ICD.	Perform Test Case WFCWT-1 * Inspect vehicle system logs and locate 1 or more instances of formation of BSMs * Determine time BSM was formulated * Identify located BSMs and inspect time and compare * Confirm message contains correct time message was sent, verifying requirement is satisfied.	Requirement Verification Confirmed by:
WFCWT-1 -- FCW Stopped Vehicle Ahead	LTS-REQ-5 -- VS LTS Time Standard	The Vehicle System shall use Coordinated Universal Time (UTC) time for logged data (e.g., events logs and environmental data) based on the format defined in J2735 section 6.19 and epoch of January 1st 1970.	* Perform Test Case WFCWT-1 * Inspect event logs and locate 1 or more instances of events * Inspect event(s) located and determine reported time(s) * Confirm time reported is Coordinated Universal Time (UTC), verifying requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WFCWT-1 -- FCW Stopped Vehicle Ahead	LTS-REQ-6 -- VS LTS Location	The Vehicle System shall acquire location from the LTS interface in accordance with J2945/1 section 6.2.1.	* Perform Test Case WFCWT-1 * Inspect OBU logs and locate 1 or more instances of BSMs sent * Inspect BSMs and determine location * Confirm message contains correct location, verifying requirement is satisfied.	Requirement Verification Confirmed by:
WFCWT-1 -- FCW Stopped Vehicle Ahead	VS-REQ-9.1 -- Rear-End Crash in Straight Road	The Vehicle System shall identify imminent danger of a rear-end crash with a remote vehicle lead vehicle in its lane of travel in a straight roadway geometry.	* Perform Test Case WFCWT-1 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped remote vehicle ahead * Confirm issuance of imminent danger alert * Issuance of imminent danger alert verifies Vehicle System identifies imminent danger of a rear-end crash with a remote vehicle lead vehicle in its lane of travel in a straight roadway geometry, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WFCWT-1 -- FCW Stopped Vehicle Ahead	VS-REQ-26 -- IVAA FCW	The Vehicle System shall alert the vehicle operator for forward collision warning based on the warning distance calculation algorithm in section 3.1 of the Connected Commercial Vehicles—Retrofit Safety Device Kit Project Safety Applications and Development Plan (FHWA-JPO-14-106) and guidance for FCW Time-to Collision, Advisories and Alerts provided in SyRS Section 6.1.1. This could be an inform message, warning 1 or warning 2 based on the calculated deceleration rate required. During the design phase a deceleration rate will be selected for a warning 1 and for warning 2 based on vehicle type and weight.	* Perform Test Case WFCWT-1 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped remote vehicle ahead * Confirm issuance of imminent danger alert * Issuance of imminent danger alert verifies the Vehicle System alerts the vehicle operator for forward collision warning based on the warning distance calculation algorithm in section 3.1 of the Connected Commercial Vehicles—Retrofit Safety Device Kit Project Safety Applications and Development Plan (FHWA-JPO-14-106) and guidance for FCW Time-to Collision, Advisories and Alerts provided in SyRS Section 6.1.1, thereby verifying the requirement is satisfied. (Note: As a system integrator, WYDOT Team tests to verify basic functionalities are present in vendor supplied systems, but does not have the resources to verify detailed implementation of algorithms.)	Requirement Verification Confirmed by:
WFCWT-1 -- FCW Stopped Vehicle Ahead	FCWP-REQ-1 -- FCW Advisory Alert Performance	The Vehicle System shall issue an advisory FCW alert when the Time-to-Collision is below a configurable threshold for advising the driver of potential for collision with a stopped vehicle ahead in the same lane of travel. Guidance for FCW Time-to Collision, Advisories and Alerts is provided in SyRS Section 6.1.1.	* Perform Test Case WFCWT-1 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped remote vehicle ahead * Confirm issuance of advisory alert * Issuance of advisory alert verifies Vehicle System issues an advisory FCW alert when the Time-to-Collision is below a configurable threshold for advising the driver of potential for collision with a stopped vehicle ahead in the same lane of travel, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WFCWT-1 -- FCW Stopped Vehicle Ahead	FCWP-REQ-2 -- FCW Imminent Alert Performance	The Vehicle System shall issue an imminent FCW alert when the Time-to-Collision is below a configurable threshold for alerting the driver that there is an imminent threat of forward collision with a stopped vehicle ahead in the same lane of travel and immediate action is required from the driver to avoid the collision. Guidance for FCW Time-to Collision, Advisories and Alerts is provided in SyRS Section 6.1.1.	* Perform Test Case WFCWT-1 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped remote vehicle ahead * Confirm issuance of imminent FCW alert * Issuance of imminent FCW verifies Vehicle System issues an imminent FCW alert when the Time-to-Collision is below a configurable threshold for alerting the driver that there is an imminent threat of forward collision with a stopped vehicle ahead in the same lane of travel and immediate action is required from the driver to avoid the collision, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WFCWT-2 -- FCW Passing Stopped Vehicle	VS-REQ-10.2 -- Passing a Stopped Vehicle	The Vehicle System shall identify when no imminent danger of a rear-end crash is present with a remote vehicle that is stopped and not in its lane of travel in common roadway geometries.	* Perform Test Case WFCWT-2 * Inspect Host Vehicle OBU Event Logs, determine location, speed, and heading path of Host Vehicle. * Inspect Remote Vehicle OBU Event Logs, determine location, speed, and heading path of Remote Vehicle. * Verify vehicles are not in the same travel lane. * Inspect Host Vehicle OBU Event Logs and verify that alert was not issued. * Inspect Host Vehicle HMI Logs and verify that alert was not issued. * Absence of alert verifies the Vehicle System identifies when no imminent danger of a rear-end crash is present with a remote vehicle that is stopped and not in its lane of travel in common roadway geometries, thereby verifying the requirement is satisfied. (Note: As a system integrator, WYDOT Team tests to verify basic functionalities are present in vendor supplied systems, but does not have the resources to verify all conditions defined by "common roadway geometries".)	Requirement Verification Confirmed by:
WFCWT-2 -- FCW Passing Stopped Vehicle	FCWP-REQ-3 -- Passing a Stopped Vehicle Performance	The Vehicle System shall not issue an FCW advisory or alert when passing a stopped vehicle in an adjacent lane.	* Perform Test Case WFCWT-2 * Inspect Host Vehicle OBU Event Logs, determine location, speed, and heading path of Host Vehicle. * Inspect Remote Vehicle OBU Event Logs, determine location, speed, and heading path of Remote Vehicle. * Verify vehicles are not in the same travel lane. * Inspect Host Vehicle OBU Event Logs and verify that alert was not issued. * Inspect Host Vehicle HMI Logs and verify that alert was not issued. * Absence of alert verifies the Vehicle System does not issue an FCW advisory or alert when passing a stopped vehicle in an adjacent lane, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WFCWT-3 -- FCW Steady State	VS-REQ-10.1 -- Safely Following a Vehicle	The Vehicle System shall identify when no imminent danger of a rear-end crash is present with a remote vehicle in its lane of travel in common roadway geometries.	* Perform Test Case WFCWT-3 * Inspect Host Vehicle OBU Event Logs, determine location, speed, and heading path of Host Vehicle. * Determine travel lane of Host Vehicle * Inspect Remote Vehicle OBU Event Logs, determine location, speed, and heading path of Remote Vehicle. * Determine travel lane of Remote Vehicle. * Inspect Host and Remote Vehicle Event Logs and identify time period when Host follows Remote at 35 mph at a	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			distance of 5 to 8 meters for 60 seconds or more. * Inspect Host Vehicle OBU Event Logs and verify that alert was not issued during this time. * Inspect Host Vehicle HMI Logs and verify that alert was not issued during this time. * Absence of alert verifies the Vehicle System identifies when no imminent danger of a rear-end crash is present with a remote vehicle in its lane of travel in common roadway geometries, thereby verifying the requirement is satisfied. (Note: As a system integrator, WYDOT Team tests to verify basic functionalities are present in vendor supplied systems, but does not have the resources to verify all conditions defined by "common roadway geometries".)	
WFCWT-3 -- FCW Steady State	FCWP-REQ-4 -- Following a Vehicle Performance	The Vehicle System shall not issue an imminent FCW alert when following a remote vehicle traveling at a constant speed above 30 mph.	* Perform Test Case WFCWT-3 * Inspect Host Vehicle OBU Event Logs, determine location, speed, and heading path of Host Vehicle. * Determine travel lane of Host Vehicle * Inspect Remote Vehicle OBU Event Logs, determine location, speed, and heading path of Remote Vehicle. * Determine travel lane of Host Vehicle. * Inspect Host and Remote Vehicle Event Logs and identify time period when Host follows Remote at 35 mph at a distance of 5 to 8 meters for 60 seconds or more. * Inspect Host Vehicle OBU Event Logs and verify that alert was not issued during this time. * Inspect Host Vehicle HMI Logs and verify that alert was not issued during this time. * Absence of alert verifies the Vehicle System does not issue an imminent FCW alert when following a remote vehicle traveling at a constant speed above 30 mph, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WFCWT-4 -- FCW Braking Vehicle Ahead	FCWP-REQ-5 -- Decelerating Vehicle Performance	The Vehicle System shall issue an imminent FCW alert when the Time-to-Collision is below a configurable threshold for alerting the driver that there is an imminent threat of forward collision with a decelerating vehicle ahead in the same lane of travel and immediate action is required from the driver to avoid the collision. Guidance for FCW Time-to Collision, Advisories and Alerts is provided in SyRS Section 6.1.1.	* Perform Test Case WFCWT-4 * Inspect Host Vehicle OBU Logs * Confirm detection of decelerating remote vehicle ahead * Confirm issuance of imminent FCW alert * Issuance of imminent FCW alert verifies Vehicle System issues an imminent FCW alert when the Time-to-Collision is below a configurable threshold for alerting the driver that there is an imminent threat of forward collision with a decelerating vehicle ahead in the same lane of travel and immediate action is required from the driver to avoid the collision, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WFCWT-5 -- FCW Stopped Vehicle in a Curve	VS-REQ-9.2 -- Rear-End Crash in Curved Road	The Vehicle System shall identify imminent danger of a rear-end crash with a remote vehicle lead vehicle in its lane of travel in a curved roadway geometry.	* Perform Test Case WFCWT-5 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped remote vehicle ahead * Confirm issuance of imminent danger alert * Issuance of imminent danger alert verifies Vehicle System identifies imminent danger of a rear-end crash with a remote vehicle lead vehicle in its lane of travel in a curved roadway geometry, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WFCWT-5 -- FCW Stopped Vehicle in a Curve	FCWP-REQ-6 -- FCW Advisory Alert in a Curve Performance	The Vehicle System shall issue an advisory FCW alert when the Time-to-Collision is below a configurable threshold for advising the driver of potential for collision with a stopped vehicle ahead in the same lane of travel in a curve. Guidance for FCW Time-to Collision, Advisories and Alerts is provided in SyRS Section 6.1.1.	* Perform Test Case WFCWT-5 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped remote vehicle ahead * Confirm issuance of advisory FCW alert * Issuance of advisory FCW alert verifies Vehicle System issues an advisory FCW alert when the Time-to-Collision is below a configurable threshold for advising the driver of potential for collision with a stopped vehicle ahead in the same lane of travel in a curve, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WFCWT-5 -- FCW Stopped Vehicle in a Curve	FCWP-REQ-7 -- FCW Imminent Alert in a Curve Performance	The Vehicle System shall issue an imminent FCW alert when the Time-to-Collision is below a configurable threshold for alerting the driver that there is an imminent threat of forward collision with a stopped vehicle ahead in the same lane of travel in a curve and immediate action is required from the driver to avoid the collision. Guidance for FCW Time-to Collision, Advisories and Alerts is provided in SyRS Section 6.1.1.	* Perform Test Case WFCWT-5 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped remote vehicle ahead * Confirm issuance of FCW Imminent danger alert * Issuance of FCW Imminent danger alert verifies Vehicle System issues an imminent FCW alert when the Time-to-Collision is below a configurable threshold for alerting the driver that there is an imminent threat of forward collision with a stopped vehicle ahead in the same lane of travel in a curve and immediate action is required from the driver to avoid the collision, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WFCWT-6 -- FCW Passing Stopped Vehicle in a Curve	FCWP-REQ-8 -- Passing a Stopped Vehicle in a Curve Performance	The Vehicle System shall not issue an FCW advisory or alert when passing a stopped vehicle in an adjacent lane in a curve.	* Perform Test Case WFCWT-6 * Inspect Host Vehicle OBU Event Logs, determine location, speed, and heading path of Host Vehicle. * Inspect Remote Vehicle OBU Event Logs, determine location, speed, and heading path of Remote Vehicle. * Verify vehicles are not in the same travel lane. * Inspect Host Vehicle OBU Event Logs and verify that alert was not issued. * Inspect Host Vehicle HMI Logs and verify that alert was not issued. * Absence of alert verifies the Vehicle System does not issue an FCW advisory or alert when passing a stopped vehicle in an adjacent lane in a curve.	Requirement Verification Confirmed by:
WFCWT-7 -- FCW Stopped and Obstructed Remote Vehicle Ahead	VS-REQ-8 -- FCW Stopped and Obstructed Vehicles	The Vehicle System shall ingest BSM Parts I and II data received from remote vehicles to identify stopped and obstructed remote vehicles directly ahead in the same lane and direction of travel (defined in J2945/1 section 4.2.4.2 (d)). Data ingest is defined as obtaining and importing data for use or storage	* Perform Test Case WFCWT-7 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped and obstructed remote vehicle ahead * Confirm issuance of advisory alert * Issuance of advisory alert confirms Vehicle System ingests BSM data received from remote vehicles to identify stopped and obstructed remote vehicles directly ahead in the same lane and direction of travel, thereby verifying requirement. (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WFCWT-8 -- FCW Slow Moving Vehicle	FCWP-REQ-9 -- Slow Moving Vehicle Advisory Alert in a Curve Performance	The Vehicle System shall issue an advisory FCW alert when the Time-to-Collision is below a configurable threshold for advising the driver of potential for collision with a moving vehicle ahead in the same lane of travel in a curve. Guidance for FCW Time-to Collision, Advisories and Alerts is provided in SyRS Section 6.1.1.	* Perform Test Case WFCWT-8 * Inspect Host Vehicle OBU Logs * Confirm detection of slow moving remote vehicle ahead * Confirm issuance of advisory FCW alert * Issuance of advisory FCW alert verifies Vehicle System issues an advisory FCW alert when the Time-to-Collision is below a configurable threshold for advising the driver of potential for collision with a moving vehicle ahead in the same lane of travel in a curve, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WFCWT-8 -- FCW Slow Moving Vehicle	FCWP-REQ-10 -- Slow Moving Vehicle Imminent Alert in a Curve Performance	The Vehicle System shall issue an imminent FCW alert when the Time-to-Collision is below a configurable threshold for alerting the driver that there is an imminent threat of forward collision with a moving vehicle ahead in the same lane of travel in a curve and immediate action is required from the driver to avoid the collision. Guidance for FCW Time-to Collision, Advisories and Alerts is provided in SyRS Section 6.1.1.	* Perform Test Case WFCWT-8 * Inspect Host Vehicle OBU Logs * Confirm detection of slow moving remote vehicle ahead * Confirm issuance of FCW Imminent danger alert * Issuance of FCW Imminent danger alert verifies Vehicle System issues an imminent FCW alert when the Time-to-Collision is below a configurable threshold for alerting the driver that there is an imminent threat of forward collision with a moving vehicle ahead in the same lane of travel in a curve and immediate action is required from the driver to avoid the collision, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WFCWT-9 -- Simultaneous Message Prioritization	VS-REQ-23 -- IVAA Rank	The Vehicle System shall provide prioritized in-vehicle alerts based on the rank order presented in Table 4-1 of the SyRS, with the highest rank on top.	* Perform Test Case WFCWT-9 * Verify I2V SA Message displays within 8 meters of beginning of specified geofence. * Verify DN TIM message displays at specified distance from distressed vehicle, prioritized over I2V SA message. * Verify that, as host vehicle approaches remote vehicle, FCW imminent danger warning is issued, prioritized over I2V SA and DN TIM, in time for driver to avoid collision. * Prioritized delivery of I2V SA Message, DN TIM, and FCW imminent danger alert verifies the Vehicle System provides prioritized in-vehicle alerts based on the rank order presented in Table 4-1 of the SyRS, with the highest rank on top, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WFCWT-9 -- Simultaneous Message Prioritization	VS-REQ-24 -- IVAA Level	The Vehicle System shall have three levels of alert, as described in Table 4-2 of the SyRS.	* Perform Test Case WFCWT-9 * Verify I2V SA Message displays within 8 meters of beginning of specified geofence. * Verify DN TIM message displays at specified distance from distressed vehicle, prioritized over I2V SA message. * Verify that, as host vehicle approaches remote vehicle, FCW imminent danger warning is issued, prioritized over I2V SA and DN TIM, in time for driver to avoid collision. * Prioritized delivery of I2V SA Message, DN TIM, and FCW imminent danger alert verifies the Vehicle System has three levels of alert, as described in Table 4-2 of the SyRS, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WFCWT-9 -- Simultaneous Message Prioritization	VS-REQ-25 -- IVAA Priority Alert	The Vehicle System shall provide only the highest priority alert to the vehicle operator when more than one alert is currently active	* Perform Test Case WFCWT-9 * Verify I2V SA Message displays within 8 meters of beginning of specified geofence. * Verify DN TIM message displays at specified distance from distressed vehicle, prioritized over I2V SA message. * Verify that, as host vehicle approaches remote vehicle, FCW imminent danger warning is issued, prioritized over I2V SA and DN TIM, in time for driver to avoid collision. * Prioritized delivery of I2V SA Message, DN TIM, and FCW imminent danger alert verifies the Vehicle System provides only the highest priority alert to the vehicle operator when more than one alert is currently active, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-REP -- Message Display in Travel Lanes	LTS-REQ-1.1 -- WCVS LTS Time	The Wyoming CV System shall acquire time from the LTS interface in accordance with Section 5.10.1 of the ICD.	* Perform Test Case WI2VSAT-1-REP * Inspect DB Logs and locate 1 or more instances of formation of TIMs * Determine time TIM was formulated * Identify located TIMs and inspect time and compare to independent time source * Confirm message contains correct time message was sent, verifying requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-REP -- Message Display in Travel Lanes	LTS-REQ-1.2 -- WCVS Time Synchronization	The Wyoming CV System shall receive time synchronization information from a Stratum 2 NTP source, as described in Section 5.12.1 of the ICD.	* Perform Test Case WI2VSAT-1-REP * Inspect DB Logs and locate 1 or more instances of formation of TIMs * Determine time TIM was formulated * Identify located TIMs and inspect time and compare to independent time source * Confirm message contains correct time message was sent, verifying requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-REP -- Message Display in Travel Lanes	LTS-REQ-2 -- WCVS LTS Time Standard	The Wyoming CV System shall use Coordinated Universal Time (UTC) time for logged data (e.g., events logs and environmental data) based on the format defined in J2735 section 6.19 and epoch of January 1st 1970.	Perform Test Case WI2VSAT-1-REP * Inspect event logs and locate 1 or more instances of events * Inspect event(s) located and determine reported time(s) * Confirm time reported is Coordinated Universal Time (UTC), verifying requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-REP -- Message Display in Travel Lanes	LTS-REQ-3 -- WCVS LTS Location	The Wyoming CV System shall acquire location from the LTS interface in accordance with J2945/1 section 6.2.1.	* Perform Test Case WI2VSAT-1-REP * Inspect RSU Logs and locate 1 or more instances of TIMs sent * Inspect TIMs and compare location to independent location source * Confirm message contains correct location, verifying requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-REP -- Message Display in Travel Lanes	TRAC-REQ-1.2.1 -- Transmission Time	The Wyoming CV System shall transmit alerts to TRAC within five minutes of its generation in the system.	* Perform Test Case WI2VSAT-1-REP * Inspect DB logs. * Verify receipt of information from System * Verify generation of TIMs for alerts and time TIM was generated * Inspect TRAC logs and verify receipt of the corresponding alerts within five minutes of its generation in the system.	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			* TRAC log of TIM within 5 minutes verifies the Wyoming CV System transmits alerts to TRAC within five minutes of its generation in the system, thereby verifying requirement.	
WI2VSAT-1-REP -- Message Display in Travel Lanes	WCVS-REQ-9 -- Create TIM	The Wyoming CV System shall create a Traveler Information Message (TIM) formatted as defined in J2735 – 5.16 Message: MSG_TravelerInformation Message (TIM).	* Perform test Case WI2VSAT-1-REP * Inspect DB Logs and confirm generation of TIMs * Inspect DB Logs and confirm output and distribution of TIM * Confirmation shows Wyoming CV System creates a Traveler Information Message (TIM) formatted as defined in J2735 – 5.16 Message: MSG_TravelerInformation Message (TIM), thereby verifying the requirement is satisfied. * (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	Requirement Verification Confirmed by:
WI2VSAT-1-REP -- Message Display in Travel Lanes	WCVS-REQ-17 -- Archive Data	The Wyoming CV System shall provide the TMC administrator the ability to archive data used by the CV pilot by writing CV data to the WYDOT Data Warehouse, data written to the Data Warehouse is automatically archived per existing TMC best practices.	* Perform Test Case WI2VSAT-1-REP. * Inspect TIM in DW and confirm storage of alert by DW. * Inspect DW Logs and confirm archive of TIM * Inspect TMC archives and confirm archive of BSM, TIM, and DNM messages * Confirmation shows Wyoming CV System provides the TMC administrator the ability to archive data used by the CV pilot by writing CV data to the WYDOT Data Warehouse, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-REP -- Message Display in Travel Lanes	VS-REQ-14 -- SA TIM-Region	The Vehicle System shall ingest received TIMs to identify the applicable regions of use geographical path (Part II defined in J2735 section 6.142). Data ingest is defined as obtaining and importing data for use or storage	* Perform Test Case WI2VSAT-1-REP * Confirm issuance of advisories and alerts at the location specified in the TIM. * Confirmation shows the Vehicle System ingests received TIMs to identify the applicable regions of use geographical path (Part II defined in J2735 section 6142), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-REP -- Message Display in Travel Lanes	VS-REQ-28 -- IVAA SA-Advisory	The Vehicle System shall alert the vehicle operator for a situational awareness advisory using an inform message when the host vehicle is traveling towards the segment where the situational awareness applies.	* Perform Test Case WI2VSAT-1-REP * Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm issuance of advisories and alerts at the location specified in the TIM. * Confirmation shows the Vehicle System alerts the vehicle operator for a situational awareness advisory using an inform message when the following conditions are met: i) Host vehicle is traveling towards the segment where the situational awareness applies; ii) Host vehicle meets the criteria for the advisory, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-REP -- Message Display in Travel Lanes	DB-REQ-5 -- Distribute to ODE	The DB shall share TIM information with the ODE, as defined in Section 5.21.2 of the ICD.	* Perform Test Case WI2VSAT-1-REP * Inspect DB logs. * Confirm 1 or more instances of DB generation of representative TIMs * Inspect ODE Logs * Confirm ODE receipt of 1 or more instances of representative DB TIMs	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			* Confirmation shows the DB shares TIM information with the ODE, as defined in Section 5.21.2 of the ICD, thereby verifying the requirement is satisfied.	
WI2VSAT-1-REP -- Message Display in Travel Lanes	DB-REQ-7 -- Distribute to Data Warehouse	The DB shall transmit information to the Data Warehouse as defined in Table 5-2 of the SyRS.	* Perform Test Case WI2VSAT-1-REP * Inspect DB logs. * Confirm 1 or more instances of DB generation of representative TIMs * Inspect DW Logs * Confirm DW receipt of 1 or more instances of representative DB TIMs * Confirmation shows the DB shares TIM information with the ODE, as defined in Section 5.21.2 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-REP -- Message Display in Travel Lanes	DB-REQ-9 -- Distribute to SDC	The DB shall manually upload data to the SDC as defined in ICD Section 5.39.1.	* Perform Test Case WI2VSAT-1-REP * Inspect DB logs. * Confirm 1 or more instances of DB generation of representative TIMs * Confirm 1 or more instances of manual upload of data to the SDC * Confirmation shows DB manual upload of data to the SDC as defined in ICD Section 5.39.1, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-REP -- Message Display in Travel Lanes	DW-REQ-1.3 -- Store TIM	The Data Warehouse shall store all TIMs distributed to the Vehicle System and the Situational Data Warehouse, as defined in WCVS-REQ-13.	* Perform Test Case WI2VSAT-1-REP * Inspect DB logs and verify generation of TIMs for alerts. * Inspect DB Logs and verify output of alert. * Inspect TIM in DW and verify storage of alert by DW. * Confirmation shows Data Warehouse stores all TIMs distributed to the Vehicle System and the Situational Data Warehouse, as defined in WCVS-REQ-13, thereby verifying the requirement is satisfied. (Note: Data written to the Data Warehouse is automatically archived per existing TMC best practices.)	Requirement Verification Confirmed by:
WI2VSAT-1-REP -- Message Display in Travel Lanes	DW-REQ-2.2 -- Share Data with SDC	The Data Warehouse shall transmit information to the Secure Data Commons, as defined in Section 5.38.1 of the ICD.	* Perform Test Case WI2VMCT-1(WI2VSAT-1-REP) * Inspect DB Logs and locate 1 or more instances of formation of TIMs. * Inspect Data Warehouse logs and located corresponding 1 or more instances of TIMs received. * Inspect Data Warehouse logs and locate corresponding 1 or more instances of TIM information sent to Secure Data Commons * Confirmation shows the Data Warehouse transmit information to the Secure Data Commons, as defined in Section 5.37.1 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-REP -- Message Display in Travel Lanes	DW-REQ-2.3 -- Share Data with RDE	The Data Warehouse shall transmit information to the RDE, as defined in Section 5.41.1 of the ICD.	* Perform Test Case WI2VMCT-1(WI2VSAT-1-REP) * Inspect DB Logs and locate 1 or more instances of formation of TIMs. * Inspect Data Warehouse logs and located corresponding 1 or more instances of TIMs received. * Inspect Data Warehouse logs and locate corresponding 1 or more instances of TIM information sent to RDE	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			* Confirmation shows the Data Warehouse transmit information to the RDE, as defined in Section 5411 of the ICD, thereby verifying the requirement is satisfied.	
WI2VSAT-1-REP -- Message Display in Travel Lanes	I2VSAP-REQ-1 -- Message Display in Travel Lanes	Situational Awareness Message(s) shall display in vehicles traveling in all travel lanes of the roadway in the direction specified in the I2V SA TIM.	* Perform Test Case WI2VSAT-1-REP * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine Roadway and lane of travel of vehicle. * Confirm Situational Awareness Message displays in vehicles traveling in all lanes of the roadway specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) display in vehicles traveling in all travel lanes of the roadway in the direction specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-REP -- Message Display in Travel Lanes	I2VSAP-REQ-4 -- Message Display Geofence Beginning	Situational Awareness Message(s) shall display within 8 meters, at a speed of 35 miles per hour, of beginning of geofence specified in the I2V SA TIM.	* Perform Test Case WI2VSAT-1-REP * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine Roadway and lane of travel of vehicle. * Confirm Situational Awareness Message displays within 8 meters of beginning of geofence specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) display within 8 meters, at a speed of 35 miles per hour, of beginning of geofence specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-REP -- Message Display in Travel Lanes	I2VSAP-REQ-5 -- Message Display Geofence Ending	Situational Awareness Message(s) shall cease display within 8 meters, at a speed of 35 miles per hour, of end of geofence specified in the I2V SA TIM.	* Perform Test Case WI2VSAT-1-REP * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine Roadway and lane of travel of vehicle. * Confirm Situational Awareness Message displays within 8 meters of end of geofence specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) cease display within 8 meters, at a speed of 35 miles per hour, of end of geofence specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	TRAC-REQ-1.2.2 -- Segment Alerts-Pikalert	The Wyoming CV System shall transmit Pikalert segment-level alerts, defined in WCVS-REQ-4, to TRAC	* Perform Test Case WI2VSAT-1-Pikalert * Inspect DB logs. * Verify generation of TIMs for alerts for Spot Weather Impact Warning * Inspect TRAC logs and verify receipt of each of the corresponding alerts, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WTI-REQ-1.1.1 -- Transmission Time	They Wyoming CV System shall transmit alerts within five minutes of its generation in the system to the WTI.	* Perform Test Case WI2VSAT-1-Pikalert * Inspect DB logs. * Verify receipt of information from System * Verify generation of TIMs for alerts and time TIM was generated * Inspect WTI logs and verify receipt of the corresponding alerts within five minutes of its generation in the system. * WTI log of TIM within 5 minutes verifies the Wyoming CV System transmits alerts within five minutes of its generation in the system to the WTI, thereby verifying requirement.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WTI-REQ-1.2.1 -- Forecast Time	The Wyoming CV System shall transmit forecast reports to WTI for pre-specified forecast windows determined by WYDOT (6, 12, 24, 48, 72 hours).	* Perform Test Case WI2VSAT-1-Pikalert. * Inspect Pikalert Logs and verify output of customizable forecast windows, such as 12, 24, 48, and 72 hours. * Inspect WTI logs and verify receipt of customizable forecast windows, such as 12, 24, 48, and 72 hours. * Receipt confirms the Wyoming CV System transmits forecast reports to WTI for pre-specified forecast windows determined by WYDOT (6, 12, 24, 48, 72 hours). thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WTI-REQ-1.2.2 -- Forecast Update	The Wyoming CV System shall update its forecast reports in WTI at WYDOT-determined intervals (every 12 hours for example).	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs and verify output of forecast updates at WYDOT-determined intervals. * Inspect WTI logs and verify output of forecast updates at WYDOT-determined intervals. * Output confirms that the Wyoming CV System updates its forecast reports in WTI at WYDOT-determined intervals (every 12 hours for example), thereby verifying requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	CVOP-REQ-1.1.1 -- Transmission Time	They Wyoming CV System shall transmit alerts within five minutes of its generation in the system to the CVOP.	* Perform Test Case WI2VSAT-1-Pikalert * Inspect DB logs. * Verify receipt of information from System * Verify generation of TIMs for alerts and time TIM was generated * Inspect CVOP logs and verify receipt of the corresponding alerts within five minutes of its generation in the system. * CVOP log of TIM within 5 minutes verifies the Wyoming CV System transmits alerts within five minutes of its generation in the system to the CVOP, thereby verifying requirement.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display	CVOP-REQ-1.2.1 -- Forecast Time	The Wyoming CV System shall transmit forecast reports to the CVOP for pre-specified forecast windows determined by WYDOT (6, 12, 24, 48, 72 hours).	Verified by WI2VSAT-1-Pikalert, inspection of Logs. * Perform Test Case WI2VSAT-1-Pikalert. * Inspect Pikalert Logs and verify output of customizable forecast windows, such as 12, 24, 48, and 72 hours. * Inspect CVOP logs and verify receipt of customizable forecast windows, such as 12, 24, 48, and 72 hours.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
in Travel Lanes - Pikalert			* Receipt confirms the Wyoming CV System transmits forecast reports to CVOP for pre-specified forecast windows determined by WYDOT (6, 12, 24, 48, 72 hours). thereby verifying the requirement is satisfied.	
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	CVOP-REQ-1.2.2 -- Forecast Update	The Wyoming CV System shall update its forecast reports in CVOP at WYDOT-determined intervals (every 12 hours for example).	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs and verify output of forecast updates at WYDOT-determined intervals. * Inspect CVOP logs and verify output of forecast updates at WYDOT-determined intervals. * Output confirms that the Wyoming CV System updates its forecast reports in CVOP at WYDOT-determined intervals (every 12 hours for example), thereby verifying requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WI-REQ-1 -- External Data Acquisition	The Wyoming CV System shall collect weather information from external sources, as defined in the Section 4.1 - Data Ingest Module Requirements of the Motorist Alert and Warning Application (NCAR, 2014)	* Perform Test Case WI2VSAT-1-Pikalert with Spot Weather Impact Warning alert from Pikalert. * Inspect Pikalert Logs * Confirm receipt of weather information from external sources, as defined in SyRS Section 4.1 * Receipt confirms the Wyoming CV System collects weather information from external sources, as defined in the Section 4.1 * Data Ingest Module Requirements of the Motorist Alert and Warning Application (NCAR, 2014), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WI-REQ-2 -- Fixed Data Acquisition	The Wyoming CV System shall receive road weather information system (RWIS) data from the WYDOT RWIS Server as defined in Section 4.1 – Data Ingest Module Requirements of the Motorist Alert and Warning Application (NCAR 2014).	* Perform Test Case WI2VSAT-1-Pikalert with Spot Weather Impact Warning alert from Pikalert. * Inspect Pikalert Logs * Confirm receipt of road weather information system (RWIS) data from the WYDOT RWIS Server * Receipt confirms the Wyoming CV System receives road weather information system (RWIS) data from the WYDOT RWIS Server as defined in Section 4.1 – Data Ingest Module Requirements of the Motorist Alert and Warning Application (NCAR 2014), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WCVS-REQ-4.1 -- Precipitation Hazard	The Wyoming CV System shall generate a precipitation type and intensity report every 5 minutes, as specified in Section 3.1.4.2 of the SDD.	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs and verify output of precipitation type and intensity every 5 minutes * Inspect DB logs and verify generation of TIMs for alerts from Pikalert (Spot Weather Impact Warning) * Inspect TIM and verify output of precipitation type and intensity * Confirmation shows Wyoming CV System generates a precipitation type and intensity report every 5 minutes, as specified in Section 3.1.4.2 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WCVS-REQ-4.2 -- Road Condition Hazard	The Wyoming CV System shall generate a pavement state and slickness flag report every 5 minutes, depending on input data, as specified in Section 3.1.4.2 of the SDD.	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs and verify output of a pavement state and slickness flag report every 5 minutes * Inspect DB logs and verify generation of TIMs for alerts from Pikalert (Spot Weather Impact Warning) * Inspect TIM and verify output of a pavement state and slickness flag * Confirmation shows Wyoming CV System generates a pavement state and slickness flag report every 5 minutes, as specified in Section 3.1.4.2 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WCVS-REQ-4.3 -- Visibility Hazard	The Wyoming CV System shall generate a visibility report, along with the condition causing it, every 5 minutes, as specified in Section 3.1.4.2 of the SDD.	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs and verify output of a visibility report, along with the condition causing it, every 5 minutes * Inspect DB logs and verify generation of TIMs for alerts from Pikalert (Spot Weather Impact Warning) * Inspect TIM and verify output of a visibility report, along with the condition causing it * Confirmation shows Wyoming CV System generates a visibility report, along with the condition causing it, report every 5 minutes, as specified in Section 3.1.4.2 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WCVS-REQ-5.1 -- Atmospheric Forecasts	The Wyoming CV System shall produce atmospheric weather forecasts, at a minimum, for (a) atmospheric temperature, (b) probability of precipitation, (c) wind speed, and (d) wind direction	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs and confirm output of atmospheric weather forecasts. * Inspect DB logs and confirm generation of TIMs for alerts from Pikalert (Spot Weather Impact Warning) * Inspect TIM and confirm output of atmospheric weather forecasts for (a) atmospheric temperature, (b) probability of precipitation, (c) wind speed, and (d) wind direction * Confirmation shows Wyoming CV System produces atmospheric weather forecasts, at a minimum, for (a) atmospheric temperature, (b) probability of precipitation, (c) wind speed, and (d) wind direction, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WCVS-REQ-5.2 -- Road Weather Forecasts	The Wyoming CV System shall produce road weather forecasts, at a minimum, for (a) pavement temperature, and (b) subsurface temperature	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs and confirm output of atmospheric weather forecasts. * Inspect DB logs and confirm generation of TIMs for alerts from Pikalert (Spot Weather Impact Warning) * Inspect TIM and confirm output of road weather forecasts for (a) pavement temperature, and (b) subsurface temperature * Confirmation shows Wyoming CV System produces road weather forecasts, at a minimum, for (a) pavement temperature, and (b) subsurface temperature, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WCVS-REQ-5.3 -- Forecast Time	The Wyoming CV System shall generate forecast reports for customizable forecast windows. The windows of interest will be determined by WYDOT (6, 12, 24, 48 hours for example).	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs and confirm output of atmospheric weather forecasts. * Inspect DB logs and confirm generation of TIMs for alerts from Pikalert (Spot Weather Impact Warning) * Inspect TIM and confirm output of generates forecast reports for customizable forecast windows * Confirmation shows Wyoming CV System generates forecast reports for customizable forecast windows, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WCVS-REQ-5.4 -- Forecast Update	The Wyoming CV System shall generate forecast updates for customizable intervals. The update frequency will be determined by WYDOT and may vary based on time of year (every 3 hours for example in winter to 12 hours during summer).	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs and confirm output of atmospheric weather forecasts. * Inspect DB logs and confirm generation of TIMs for alerts from Pikalert (Spot Weather Impact Warning) * Inspect TIM and confirm output of forecast updates for customizable intervals * Confirmation shows Wyoming CV System generates forecast updates for customizable intervals, thereby verifying the requirement is satisfied	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WCVS-REQ-6 -- Associate Alerts and Forecast to Segments	The Wyoming CV System shall associate each alert and forecast to one or more road segments on I-80. Roadway segments are defined by WYDOT as sections of roadway between variable mileposts.	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs and verify each alert and forecast is associated with one or more road segments on I-80. * Inspect DB logs and verify generation of TIMs for alerts from Pikalert (Spot Weather Impact Warning) * Inspect TIMs and verify each alert and forecast is associated with one or more road segments on I-80. * Confirmation shows Wyoming CV System associate each alert and forecast to one or more road segments on I-80, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	VS-REQ-21 -- SWIW TIM	The Vehicle System shall ingest received TIMs to identify advisories for wind and weather conditions (Part III content choice advisories defined in J2735 section 6.142 for ITIS - data elements 6.54 Weather Conditions and 6.55 Winds defined in J2540_2). Data ingest is defined as obtaining and importing data for use or storage.	* Perform test Case WI2VSAT-1-Pikalert with Spot Weather Impact Warning alert from Pikalert. * Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm receipt of TIMs identifying Spot Weather Impact Warning alert from Pikalert * Confirmation shows the Vehicle System ingests received TIMs to identify advisories for wind and weather conditions (Part III content choice advisories defined in J2735 section 6.142 for ITIS * data elements 6.54 Weather Conditions and 6.55 Winds defined in J2540_2), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	VS-REQ-22 -- SWIW TIM-Region	The Vehicle System shall ingest received TIMs to identify the applicable regions of use geographical path (Part II defined in J2735 section 6.142). Data ingest is defined as obtaining and importing data for use or storage.	* Perform test Case WI2VSAT-1-Pikalert with Spot Weather Impact Warning alert from Pikalert. * Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm receipt of TIMs identifying Spot Weather Impact Warning alert from Pikalert * Confirm message begins and ends display at correct geofence milepost * Confirmation shows the Vehicle System ingests received TIMs to identify advisories for wind and weather conditions (Part III content choice advisories defined in J2735 section 6.142 for ITIS * data elements 6.54 Weather Conditions and 6.55 Winds defined in J2540_2), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	VS-REQ-30 -- IVAA SWIW	The Vehicle System shall alert the vehicle operator of a spot weather incident when the host vehicle is traveling toward and within five miles of the incident's location using an inform message as defined in Section 2.6.5 of the SyRS.	* Perform test Case WI2VSAT-1-Pikalert * Inspect OBU logs. * Confirm receipt of TIMs by OBU. -Confirm receipt of TIMs identifying Spot Weather Impact Warning alert from Pikalert * Confirm issuance of advisories and alerts at the location specified in the TIM. * Confirmation shows the Vehicle System alerts the vehicle operator of a spot weather incident when the host vehicle is traveling toward and within five miles of the incident's location using an inform message as defined in Section 2.6.5 of the SyRS, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display	PA-REQ-4.1 -- Distribute to DB	The Pikalert System shall transmit generated information to the Data Broker, as described in Section 5.27 of the ICD.	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert logs * Identify 1 or more instances of alerts or advisories generated * Inspect DB logs	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
in Travel Lanes - Pikalert			* Confirm receipt 1 or more instances of alerts or advisories generated by DW * Confirmation shows the Pikalert System transmits generated information to the Data Broker, as described in Section 5.27 of the ICD, thereby verifying the requirement is satisfied.	
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	DB-REQ-4.1 -- Receive Alerts and Advisories	The DB shall receive all generated segment-level alerts and advisories from Pikalert, as described in Section 5.27.1 of the ICD	* Perform Test Case WI2VSAT-1-Pikalert * Inspect DB logs. * Confirm DB receipt of generated segment-level alerts and advisories from Pikalert, as described in Section 5.26.2 of the ICD * Confirmation shows the DB receives all generated segment-level alerts and advisories from Pikalert, as described in Section 5.27.1 of the ICD, thereby verifying the requirement is satisfied. * (Note: For system integration testing, WYDOT Team assumes demonstration of functionality in a single instance verifies functionality for "all" instances.)	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	DB-REQ-4.2 -- Receive Forecast	The DB shall receive all generated segment-level forecast information from Pikalert, as described in Section 5.27.2 of the ICD	* Perform Test Case WI2VSAT-1-Pikalert * Inspect DB logs. * Confirm DB receipt of generated segment-level forecast information from Pikalert, as described in Section 5.26.3 of the ICD * Confirmation shows the DB receives all generated segment-level forecast information from Pikalert, as described in Section 5.26.3 of the ICD, thereby verifying the requirement is satisfied. * (Note: For system integration testing, WYDOT Team assumes demonstration of functionality in a single instance verifies functionality for "all" instances.)	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	DW-REQ-1.1.1 -- Store Alerts/Advisories-Precipitation Hazard	The Data Warehouse shall store all generated precipitation hazard alerts, advisories and forecasts, as defined in WCVS-REQ-12.	* Perform Test Case WI2VSAT-1-Pikalert * Inspect DW and verify storage of TIM containing precipitation type and intensity * Confirmation shows Wyoming CV System generates a precipitation type and intensity report every 5 minutes, as specified in Section 3.1.4.2 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	DW-REQ-1.1.2 -- Store Alerts/Advisories-Road Condition Hazard	The Data Warehouse shall store all generated road condition hazard alerts, advisories and forecasts, as defined in WCVS-REQ-12.	* Perform Test Case WI2VSAT-1-Pikalert * Inspect DW and verify storage of TIM containing a pavement state and slickness flag * Confirmation shows Wyoming CV System generates a pavement state and slickness flag report every 5 minutes, as specified in Section 3.1.4.2 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display	DW-REQ-1.1.3 -- Store Alerts/Advisories-Visibility Hazard	The Data Warehouse shall store all generated visibility hazard alerts, advisories and forecasts, as defined in WCVS-REQ-12.	* Perform Test Case WI2VSAT-1-Pikalert * Inspect DW and verify storage of TIM containing a visibility report, along with the condition causing it * Confirmation shows Wyoming CV System generates a visibility report, along with the condition causing it, report every 5 minutes, as specified in Section 3.1.4.2 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
in Travel Lanes - Pikalert				
WI2VSAT-1-511 -- Message Display in Travel Lanes - 511	WCVS-REQ-4.6 -- Parking	The Wyoming CV System shall generate a parking report within 5 minutes of receiving parking availability notification, as specified in Section 3.1.4.3 of the SDD.	* Perform Test Case WI2VSAT-1-511 * Inspect DB logs and verify generation of TIMs for a parking report within 5 minutes of receiving parking availability notification * Inspect TIM and verify output of a parking report * Confirmation shows Wyoming CV System generates a parking report within 5 minutes of receiving parking availability notification, as specified in Section 3.1.4.3 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-511 -- Message Display in Travel Lanes - 511	VS-REQ-13 -- SA TIM-Exit Services	The Vehicle System shall ingest received TIMs to identify Exit Services (Part III content choice exitService defined in J2735 section 6.142). This is used to provide parking information if necessary. Data ingest is defined as obtaining and importing data for use or storage	* Perform test Case WI2VSAT-1-511 * Inspect OBU Logs * Confirm receipt of 1 or more TIMs by OBU. * Confirm receipt of TIMs identifying truck parking availability from 511 (Truck Parking) * Confirm message display in travel lanes. * Confirmation shows the Vehicle System ingests received TIMs to identify Exit Services (Part III content choice exitService defined in J2735 section 6.142), thereby verifying the requirement is satisfied. (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	Requirement Verification Confirmed by:
WI2VSAT-1-511 -- Message Display in Travel Lanes - 511	DW-REQ-1.1.6 -- Store Alerts/Advisories-Parking	The Data Warehouse shall store all generated parking alerts and advisories, as defined in WCVS-REQ-12.	* Perform Test Case WI2VSAT-1-511 * Inspect DW and verify storage of TIM containing a parking report * Confirmation shows Wyoming CV System generates a parking report within 5 minutes of receiving parking availability notification, as specified in Section 3.1.4.3 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-RCRS -- Message Display in Travel Lanes - RCRS	RCRS-REQ-1.1 -- Road Condition	The Wyoming CV System shall receive road condition information from the RCRS following the 8 Code System.	* Perform Test Case WI2VSAT-1-RCRS * Inspect DB Logs and locate 1 or more instances of receipt of road condition information from the RCRS * Confirm information follows the 8 Code System. * Receipt of RCRS information following the 8 codes system confirms the Wyoming CV System receives road condition information from the RCRS following the 8 Code System, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-RCRS -- Message Display in Travel Lanes - RCRS	RCRS-REQ-1.2 -- Weather	The Wyoming CV System shall receive atmospheric information from the RCRS following the 9 Code System.	* Perform Test Case WI2VSAT-1-RCRS * Inspect DB Logs and locate 1 or more instances of receipt of atmospheric information from the RCRS * Confirm information follows the 9 Code System. * Receipt of RCRS information following the 9 codes system confirms the Wyoming CV System receive atmospheric information from the RCRS following the 9 Code System, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-RCRS -- Message Display in Travel Lanes - RCRS	RCRS-REQ-1.3 -- Other Road Condition	The Wyoming CV System shall receive other road information from RCRS following the 10 Code System.	* Perform Test Case WI2VSAT-1-RCRS * Inspect DB Logs and locate 1 or more instances of receipt of other road information from the RCRS * Confirm information follows the 10 Code System. * Receipt of RCRS information following the 10 codes system confirms The Wyoming CV System receives other road information from RCRS following the 10 Code System, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-RCRS -- Message Display in Travel Lanes - RCRS	RCRS-REQ-1.4 -- Report Time	The Wyoming CV System shall receive reports from RCRS containing a timestamp of when the operator entered the information into the app.	* Perform Test Case WI2VSAT-1-RCRS * Inspect DB Logs and locate 1 or more instances of receipt of road condition information from the RCRS * Verify reports from RCRS contain a timestamp of when the operator entered the information into the app * Timestamp of when the operator entered the information into the app confirms the Wyoming CV System receives reports from RCRS containing a timestamp of when the operator entered the information into the app, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-RCRS -- Message Display in Travel Lanes - RCRS	RCRS-REQ-1.5 -- Location	The Wyoming CV System shall receive reports from RCRS containing a location reference of when the operator entered the information into the app	* Perform Test Case WI2VSAT-1-RCRS * Inspect DB Logs and locate 1 or more instances of receipt of road condition information from the RCRS * Confirm reports from RCRS contain a location reference of when the operator entered the information into the app. * Location reference confirms The Wyoming CV System receives reports from RCRS containing a location reference of when the operator entered the information into the app, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-RCRS -- Message Display in Travel Lanes - RCRS	RCRS-REQ-1.6 -- Transmit Time	The Wyoming CV System shall receive reports from RCRS containing a timestamp of when the report was transmitted to the TMC. The transmitting timestamp may be different from the reporting time	* Perform Test Case WI2VSAT-1-RCRS * Inspect DB Logs and locate 1 or more instances of receipt of road condition information from the RCRS * Verify reports from RCRS contain a timestamp of when the report was transmitted to the TMC * Timestamp of when the report was transmitted to the TMC confirms the Wyoming CV System receives reports from RCRS containing a timestamp of when the report was transmitted to the TMC, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-IC -- Message Display in Travel Lanes - IC	TPI-REQ-1 -- TPI Data	The Wyoming CV System shall transmit traffic condition information to the WYDOT TPI, as described in Section 5.36.1 of the ICD.	* Conduct Test Case WI2VSAT-1-IC. * Inspect DW logs. * Confirm DW sends incident information to TPI. * DW distribution of incident information to TPI confirms the Wyoming CV System transmits traffic condition information to the WYDOT TPI, as described in Section 5.36.1 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-IC -- Message Display in Travel Lanes - IC	IC-REQ-1 -- IC Data Sharing	The Wyoming CV System shall receive timestamped incident information from the IC.	* Perform Test Case WI2VSAT-1-IC * Inspect DB Logs * Confirm receipt of work zone information from the IC * Confirm incident information is timestamped. * Receipt confirms the Wyoming CV System receives timestamped incident information from the IC, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-IC -- Message Display in Travel Lanes - IC	IC-REQ-2 -- Protocol	The Wyoming CV System shall receive incident information, based on HTTP protocol, from the IC. The HTTP protocol used will be based on the six part specifications RFC 7230-RFC 7235.	* Perform Test Case WI2VSAT-1-IC * Inspect DB Logs * Confirm receipt of work zone information from the IC * Verify transmittal is based upon HTTP Protocol * Receipt confirms the Wyoming CV System receives incident information, based on HTTP protocol, from the IC, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-IC -- Message Display in Travel Lanes - IC	IC-REQ-3 -- Schema	The Wyoming CV System shall receive incident information from WYDOT IC, as described in Section 5.31.1 of the ICD.	* Perform Test Case WI2VSAT-1-IC * Inspect DB Logs * Confirm receipt of work zone information from the IC * Receipt confirms the Wyoming CV System receives incident information from WYDOT IC, as described in Section 5.32.1 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-IC -- Message Display in Travel Lanes - IC	IC-REQ-4 -- Transmission	The Wyoming CV System shall receive Road Incident data from WYDOT Incident Console within five minutes of generation	* Perform Test Case WI2VSAT-1-IC * Inspect CA Logs and verify transmission of work zone information from the IC * Determine time work zone information was available. * Inspect DB Logs and verify receipt of work zone information from the IC * Determine time work zone information was received by DB * Compute latency of delivery. * Receipt within 5 minutes confirms the Wyoming CV System receives incident information from WYDOT IC within five minutes of generation, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-IC -- Message Display in Travel Lanes - IC	WCVS-REQ-4.5 -- Incident Hazard	The Wyoming CV System shall generate an incident report within 5 minutes of receiving incident notifications from the Incident Console (defined in IC-REQ-1), as specified in Section 3.1.4.3 of the SDD.	* Perform Test Case WI2VSAT-1-IC * Inspect DB logs and verify generation of TIMs for an incident report within 5 minutes of receiving incident notifications from the Incident Console * Inspect TIM and verify output of an incident report * Confirmation shows Wyoming CV System generates an incident report within 5 minutes of receiving incident notifications from the Incident Console (defined in IC-REQ-1), as specified in Section 3.1.4.3 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-IC -- Message Display in Travel Lanes - IC	DW-REQ-1.1.5 -- Store Alerts/Advisories-Incident Hazard	The Data Warehouse shall store all generated incident hazard alerts and advisories, as defined in WCVS-REQ-12.	* Perform Test Case WI2VSAT-1-IC * Inspect DW and verify storage of TIM containing an incident report * Confirmation shows Wyoming CV System generates an incident report within 5 minutes of receiving incident notifications from the Incident Console (defined in IC-REQ-1), as specified in Section 3.1.4.3 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-IC -- Message Display in Travel Lanes - IC	DW-REQ-2.1 -- Share Data with TPI	The Data Warehouse shall transmit information to the TPI, as defined in Section 5.36.1 of the ICD.	* Perform Test Case WI2VSAT-1-IC. * Inspect DB Logs and locate 1 or more instances of formation of TIMs. * Inspect Data Warehouse logs and located corresponding 1 or more instances of TIMs received. * Inspect Data Warehouse logs and locate corresponding 1 or more instances of TIM information sent to TPI * Confirmation shows the Data Warehouse transmit information to the TPI, as defined in Section 5361 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-CA -- Message Display in Travel Lanes - CA	CA-REQ-1 -- CA Data Sharing	The Wyoming CV System shall receive timestamped work zone information from the CA.	* Perform Test Case WI2VSAT-1-CA * Inspect DB Logs * Confirm receipt of work zone information from the CA * Confirm work zone information is timestamped. * Receipt confirms the Wyoming CV System receives timestamped work zone information from the CA, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-CA -- Message Display in Travel Lanes - CA	CA-REQ-2 -- Protocol	The Wyoming CV System shall receive work zone information, based on HTTP protocol, from the CA.	* Perform Test Case WI2VSAT-1-CA * Inspect DB Logs * Confirm receipt of work zone information from the CA * Verify transmittal is based upon HTTP Protocol * Receipt confirms the Wyoming CV System receives work zone information, based on HTTP protocol, from the CA, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-CA -- Message Display in Travel Lanes - CA	CA-REQ-3 -- Schema	The Wyoming CV System shall receive work zone information from WYDOT CA, as described in Section 5.32.1 of the ICD.	* Perform Test Case WI2VSAT-1-CA * Inspect DB Logs and * Confirm receipt of work zone information from the CA * Receipt confirms the Wyoming CV System receives work zone information from WYDOT CA, as described in Section 5.32.1 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-CA -- Message Display in Travel Lanes - CA	CA-REQ-4 -- Transmission	The Wyoming CV System shall receive work zone data from WYDOT Construction Administrator within thirty minutes of generation.	* Perform Test Case WI2VSAT-1-CA * Inspect CA Logs and verify transmission of work zone information from the CA * Determine time work zone information was available. * Inspect DB Logs and verify receipt of work zone information from the CA. * Determine time work zone information was received by DB. * Compute latency of delivery. * Receipt within 30 minutes confirms the Wyoming CV System receives work zone data from WYDOT Construction Administrator within thirty minutes of generation, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-CA -- Message Display in Travel Lanes - CA	WCVS-REQ-4.4 -- Work Zone Hazard	The Wyoming CV System shall generate a work zone report within 5 minutes of receiving work zone information from the Construction Administration (defined in CA-REQ-1), as specified in Section 3.1.5.4 of the SDD.	* Perform Test Case WI2VSAT-1-CA * Inspect DB logs and verify generation of TIMs for work zone report within 5 minutes of receiving work zone information * Inspect TIM and verify output of a work zone report * Confirmation shows Wyoming CV System generates a work zone report within 5 minutes of receiving work zone information from the Construction Administration (defined in CA-REQ-1), as specified in Section 3.1.5.4 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-CA -- Message Display in Travel Lanes - CA	VS-REQ-19 -- WZW TIM	The Vehicle System shall ingest received TIMs to identify work zone warnings (Part III content choice workZone defined in J2735 section 6.142). Data ingest is defined as obtaining and importing data for use or storage.	* Perform Test Case WI2VSAT-1-CA * Inspect OBU logs. * Confirm receipt of TIMs by OBU * Confirm receipt of TIMs identifying alerts from CA (Work Zone Warning) * Confirmation shows the Vehicle System ingests received TIMs to identify work zone warnings (Part III content choice workZone defined in J2735 section 6.142), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-CA -- Message Display in Travel Lanes - CA	VS-REQ-20 -- WZW TIM-Region	The Vehicle System shall ingest received TIMs to identify the applicable regions of use geographical path (Part II defined in J2735 section 6.142). Data ingest is defined as obtaining and importing data for use or storage.	* Perform Test Case WI2VSAT-1-CA * Inspect OBU logs. * Confirm receipt of TIMs by OBU * Confirm receipt of TIMs identifying alerts from CA (Work Zone Warning) * Confirm message begins and ends display at correct geofence milepost * Confirmation shows the Vehicle System ingests received TIMs to identify the applicable regions of use geographical path (Part II defined in J2735 section 6.142), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-CA -- Message Display in Travel Lanes - CA	VS-REQ-31 -- IVAA WZW	The Vehicle System shall alert the vehicle operator of a work zone, based on the information defined in requirement CA-REQ-3, when host vehicle is traveling towards and within two miles of the location of a work zone using an inform message as defined in Section 2.6.4 of the SyRS.	* Perform Test Case WI2VSAT-1-CA * Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm receipt of TIMs identifying alerts from CA (Work Zone Warning) * Confirm issuance of advisories and alerts at the location specified in the TIM. * Confirmation shows the Vehicle System alerts the vehicle operator of a work zone, based on the information defined in requirement CA-REQ-3, when host vehicle is traveling towards and within two miles of the location of a work zone using an inform message as defined in Section 2.6.4 of the SyRS, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-CA -- Message Display in Travel Lanes - CA	DW-REQ-1.1.4 -- Store Alerts/Advisories-Work Zone Hazard	The Data Warehouse shall store all generated work zone hazard alerts and advisories, as defined in WCVS-REQ-12.	* Perform Test Case WI2VSAT-1-CA * Inspect DW and verify storage of TIM containing a work zone report * Confirmation shows Wyoming CV System generates a work zone report within 5 minutes of receiving work zone information from the Construction Administration (defined in CA-REQ-1), as specified in Section 3.1.5.4 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-WTI-Speed -- Message Display in Travel Lanes - WTI Speed	WTI-REQ-2.1 -- Posted Speed	The Wyoming CV System shall receive notification that current posted speed for a segment is changed	* Perform Test Case WI2VSAT-1-WTI-Speed. * Inspect WTI Logs and verify output of current information for corridor roadway segments. * Verify receipt of notification that current posted speed for the segment has changed * Receipt confirms that the Wyoming CV System receives notification that current posted speed for the segment is changed, thereby verifying the requirement	Requirement Verification Confirmed by:
WI2VSAT-1-WTI-Speed -- Message Display in Travel Lanes - WTI Speed	VS-REQ-11 -- SA TIM-Advisories	The Vehicle System shall ingest received TIMs to identify advisories (Part III content choice ITIS.ITIScodesAndText defined in J2735 section 6.142). Data ingest is defined as obtaining and importing data for use or storage	* Perform test Case WI2VSAT-1-WTI-Speed * Inspect OBU Logs * Confirm receipt of 1 or more TIMs by OBU. * Confirm message display in travel lanes * Confirmation shows the Vehicle System ingests received TIMs to identify advisories (Part III content choice ITIS.ITIScodesAndText defined in J2735 section 6.142), thereby verifying the requirement is satisfied. (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	Requirement Verification Confirmed by:
WI2VSAT-1-WTI-Speed -- Message Display in Travel Lanes - WTI Speed	VS-REQ-12 -- SA TIM-Speed Limit	The Vehicle System shall ingest received TIMs to identify speed limits (Part III content choice speedLimit defined in J2735 section 6.142). Data ingest is defined as obtaining and importing data for use or storage	* Perform test Case WI2VSAT-1-WTI-Speed * Inspect OBU Logs * Confirm receipt of 1 or more TIMs by OBU. * Confirm receipt of TIMs identifying speed limits from WTI (Variable Speed Limit) * Confirm message display in travel lanes. * Confirmation shows the Vehicle System ingests received TIMs to identify speed limits (Part III content choice speedLimit defined in J2735 section 6.142), thereby verifying the requirement is satisfied. (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	Requirement Verification Confirmed by:
WI2VSAT-1-WTI-Speed -- Message Display in Travel Lanes - WTI Speed	VS-REQ-29 -- IVAA SA-VSL	The Vehicle System shall inform the vehicle operator of the current speed limit of the variable speed limit zone the vehicle is within using an inform message. Additionally, when the host vehicle is traveling towards and within one mile of a variable speed limit zone, the Vehicle System shall inform the vehicle operator of the speed limit using an inform message.	* Perform Test Case WI2VSAT-1-WTI-Speed * Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm receipt of TIMs identifying speed limits from WTI (Variable Speed Limit) * Confirm issuance of advisories and alerts at the location specified in the TIM. * Confirmation shows the Vehicle System informs the vehicle operator of the current speed limit of the variable speed limit zone the vehicle is within using an inform message. Additionally, when the host vehicle is traveling towards and within one mile of a variable speed limit zone, the Vehicle System informs the vehicle operator of the speed limit using an inform message, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-WTI-Speed -- Message Display in Travel Lanes - WTI Speed	DB-REQ-8 -- Receive Data from DW	The DB shall receive current TIM information from the DW. Current TIM information is defined in DB-REQ-7.	* Perform Test Case WI2VSAT-1-WTI-Speed * Note: When a new TIM is issued to RSUs and Satellite the TIM data is also stored in the Data Warehouse. When an existing TIM needs to be updated, the existing TIM is retrieved from the Data Warehouse, revised, and resent to the RSUs and Satellite, rather than generating a new TIM. * Initiate variable speed limit for corridor roadway segment and specify new speed limit. * Inspect WTI Logs and verify output of specified speed for corridor roadway segments. * Inspect DW Logs * Confirm DW receipt of 1 or more instances of TIMs with specified Speed for corridor roadway segments. * Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm receipt of TIMs specifying new speed limit from WTI (Variable Speed Limit) * Change specified speed for corridor roadway segment in WTI. * Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm receipt of TIMs specifying changed speed limit from WTI (Variable Speed Limit) * Receipt of TIM with changed speed limit comfirms DB receives current TIM information from the DW, thereby verifying the requirement.	Requirement Verification Confirmed by:
WI2VSAT-1-WTI-Speed -- Message Display in Travel Lanes - WTI Speed	DW-REQ-2.4 -- Share Data with DB	The DW shall share current TIM information, including starting and stopping milepost, TIM ID, active RSU ID, and RSU TIM index, with the DB. The DW receives TIM information from the DB, as defined in DB-REQ-7	* Perform Test Case WI2VSAT-1-WTI-Speed * Note: When a new TIM is issued to RSUs and Satellite the TIM data is also stored in the Data Warehouse. When an existing TIM needs to be updated, the existing TIM is retrieved from the Data Warehouse, revised, and resent to the RSUs and Satellite, rather than generating a new TIM. * Initiate variable speed limit for corridor roadway segment and specify new speed limit. * Inspect WTI Logs and verify output of specified speed for corridor roadway segments. * Inspect DW Logs * Confirm DW receipt of 1 or more instances of TIMs with specified Speed for corridor roadway segments. * Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm receipt of TIMs specifying new speed limit from WTI (Variable Speed Limit) * Change specified speed for corridor roadway segment in WTI. * Inspect DB logs. * Verify receipt of current TIM information, including starting and stopping milepost, TIM ID, active RSU ID, and RSU TIM index. * Receipt of current TIM information, including starting and stopping milepost, TIM ID, active RSU ID, and RSU TIM index confirms receipt of current information from the DW, thereby verifying the requirement.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			* Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm receipt of TIMs specifying changed speed limit from WTI (Variable Speed Limit) * Receipt of TIM with changed speed limit comfirms DB receives current TIM information from the DW, thereby verifying the requirement.	
WI2VSAT-1-WTI-Restriction -- Message Display in Travel Lanes - WTI Restriction	WTI-REQ-2.2.1 -- Restriction Information	The Wyoming CV System shall receive details on the restriction in effect for affected segments. Restrictions can consist of one or more of the following: • Width restriction, • Height restriction, • Weight restrictions, • High-Profile restrictions, • Chain Law Level 1, • Chain Law Level 2	* Perform Test Case WI2VSAT-1-WTI-Restriction. * Inspect WTI Logs and verify output of current information for corridor roadway segments. * Confirm receipt of notification of details on the restriction in effect for affected segments * Receipt confirms the Wyoming CV System receives details on the restriction in effect for affected segments, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-WTI-Restriction -- Message Display in Travel Lanes - WTI Restriction	WTI-REQ-2.2.2 -- Restriction Start Time	Wyoming CV System shall receive the start time of restrictions in effect for segments.	* Perform Test Case WI2VSAT-1-WTI-Restriction. * Inspect WTI Logs and verify output of current information for corridor roadway segments. * Confirm receipt of the start time of restrictions in effect for segments * Receipt confirms the Wyoming CV System receives the start time of restrictions in effect for segments, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-WTI-DMS -- Message Display in Travel Lanes - DMS	WTI-REQ-2.3 -- Posted Messages	The Wyoming CV System shall receive the notification of DMS messages that have been set in the corridor	* Perform Test Case WI2VSAT-1-WTI-DMS * Inspect WTI Logs and verify output of current information for corridor roadway segments * Confirm receipt of the notification of DMS messages that have been set in the corridor * Receipt confirms the Wyoming CV System receives the notification of DMS messages that have been set in the corridor, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-WTI-DMS -- Message Display in Travel Lanes - DMS	WTI-REQ-2.3.1 -- Message Information	Wyoming CV System shall receive the content of the posted DMS message	* Perform Test Case WI2VSAT-1-WTI-DMS. * Inspect WTI Logs and verify output of current information for corridor roadway segments. * Verify receipt of receive the content of the posted DMS message * Receipt confirms Wyoming CV System receives the content of the posted DMS message, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-WTI-Closure -- Message Display in Travel Lanes - Closures	WTI-REQ-2.4.1 -- Closure Beginning	The Wyoming CV System shall receive notification of the beginning point of the closure.	* Perform Test Case WI2VSAT-1-WTI-Closure. * Inspect WTI Logs and verify output of current information for corridor roadway segments. * Verify receipt of notification of the beginning point of the closure. * Receipt confirms the Wyoming CV System receives notification of the beginning point of the closure, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-WTI-Closure -- Message Display in Travel Lanes - Closures	WTI-REQ-2.4.2 -- Closure End	The Wyoming CV System shall receive notification of the ending point of the closure.	* Perform Test Case WI2VSAT-1-WTI-Closure. * Inspect WTI Logs and verify output of current information for corridor roadway segments. * Verify receipt of notification of the ending point of the closure. * Receipt confirms the Wyoming CV System receives notification of the ending point of the closure, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-WTI-Closure -- Message Display in Travel Lanes - Closures	WTI-REQ-2.4.3 -- Closure Start Time	The Wyoming CV System shall receive notification of the starting time of the closure.	* Perform Test Case WI2VSAT-1-WTI-Closure. * Inspect WTI Logs and verify output of current information for corridor roadway segments. * Verify receipt of notification of the starting time of the closure. * Receipt confirms the Wyoming CV System receives notification of the starting time of the closure, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-2 -- Message Display in Shoulder Lanes	I2VSAP-REQ-2 -- Message Display in Shoulder Lanes	Situational Awareness Message(s) shall display in vehicles traveling on shoulders of the roadway in the direction specified in the I2V SA TIM.	* Perform Test Case WI2VSAT-2 * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine Roadway and lane of travel of vehicle. * Confirm Situational Awareness Message displays in vehicles traveling on shoulders of the roadway specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) display in vehicles traveling on shoulders of the roadway in the direction specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-2 -- Message Display in Shoulder Lanes	I2VSAP-REQ-3 -- Message Display in Acceleration Lane	Situational Awareness Message(s) shall display in vehicles in entrance acceleration lane of the roadway in the direction specified in the I2V SA TIM.	* Perform Test Case WI2VSAT-2 * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine Roadway and lane of travel of vehicle. * Confirm Situational Awareness Message displays in vehicles traveling on entrance acceleration lane (and shoulder) of the roadway specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) display in vehicles in entrance acceleration lane of the roadway in the direction specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-3 -- Message Display	I2VSAP-REQ-7 -- Message Display on	Situational Awareness Message(s) shall not display in vehicles on roadways adjacent to that specified in the I2V SA TIM.	* Perform Test Case WI2VSAT-3 * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
on Adjacent Service Road	Adjacent Service Road		* Inspect Host Vehicle BSM logs. * Determine roadway and lane of travel of vehicle. * Confirm Situational Awareness Message does not display in vehicles on roadways adjacent to that specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) not display in vehicles on roadways adjacent to that specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	
WI2VSAT-4 -- I2V SA * Message Display Perpendicular to Travel Lanes	I2VSAP-REQ-8 -- Message Display in Perpendicular to Travel Lanes	Situational Awareness Message(s) shall not display in vehicles on roadways intersecting that specified in the I2V SA TIM.	* Perform Test Case WI2VSAT-4 * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine roadway and lane of travel of vehicle. * Confirm Situational Awareness Message does not display in vehicles traveling on roadways perpendicular to that specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) not display in vehicles on roadways intersecting that specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-5 -- *Message Display in Travel Lanes sent via Satellite	SDW-REQ-1 -- Data Provided to the SDW	The Wyoming CV System shall transmit traveler information messages (TIMs) generated by the system to the SDW within five minutes of generation. TIMs are formatted as defined in J2735 – 5.16 Message: MSG_TravelerInformation Message (TIM).	* Perform Test Case WI2VSAT-5 * Inspect DB Logs and locate 1 or more instances of formation of TIMs Record * Time each located TIM was generated by DB * Time each located TIM was sent to SDW Compute * Time difference between generation and distribution Confirm and Verify * Time difference less than 5 minutes, confirms the Wyoming CV System transmits traveler information messages (TIMs) generated by the system to the SDW within five minutes of generation, thereby verifying the requirement is satisfied. (Note: WYDOT Team does not have access to SDW logs to verify TIM was received and what time TIM it was received by SDW.)	Requirement Verification Confirmed by:
WI2VSAT-6 -- Message Display in Opposing Travel Lanes	I2VSAP-REQ-6 -- Message Display in Opposing Travel Lanes	Situational Awareness Message(s) shall not display in vehicles traveling in a direction other than that specified in the I2V SA TIM.	* Perform Test Case WI2VSAT-6 * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			* Determine roadway and lane of travel of vehicle. * Confirm Situational Awareness Message does not display in vehicles traveling in a direction other than that specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) not display in vehicles traveling in a direction other than that specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	
WI2VSAT-7 -- Simultaneous DSRC and Satellite I2V SA TIMs communications	I2VSAP-REQ-14 -- Simultaneous DSRC and Satellite TIM Processing	Vehicle Systems shall support processing of identical I2V SA TIMs received via DSRC and satellite without conflict or error.	* Perform Test Case WI2VSAT-7 * Inspect OBU logs * Confirm receipt of broadcast of I2V SA TIMs by both DSRC and Satellite. * Inspect HMI logs * Confirm accurate display of TIM driver alerts. * Confirmation shows Vehicle Systems support processing of identical I2V SA TIMs received via DSRC and satellite without conflict or error, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-8 -- Message Display Start Time	I2VSAP-REQ-9 -- Message Display Start Time	Situational Awareness Message(s) shall begin display within 1 second of the time specified in the I2V SA TIM.	* Perform Test Case WI2VSAT-8 * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine Roadway and lane of travel of vehicle. * Confirm Situational Awareness Message displays within 1 second of the beginning time specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) begin display within 1 second of the time specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-9 -- Message Display Stop Time	I2VSAP-REQ-10 -- Message Display Stop Time	Situational Awareness Message(s) shall cease display within 1 second of the time specified in the I2V SA TIM.	* Perform Test Case WI2VSAT-9 * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine Roadway and lane of travel of vehicle. * Confirm Situational Awareness Message ceases display within 1 second of the end display time specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) cease display within 1 second of the time specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WDNR-1 -- Same direction Distress Notification relay to RSU	TRAC-REQ-1.1 -- Distress Notification	The Wyoming CV System shall transmit received distress notifications to TRAC. Distress notifications are defined in WCVS-REQ-1.3.	* Perform Test Case WDNR-1 * Inspect Relay Vehicle OBU Logs and confirm receipt of DNM from Distressed Vehicle * Inspect DB logs and locate and confirm receipt of DNM from Relay Vehicle * Inspect TRAC logs and confirm 1 confirm receipt of DNM from DB * TRAC Display of Distress Notifications verifies Wyoming CV System transmits received distress notifications to TRAC, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDNR-1 -- Same direction Distress Notification relay to RSU	TRAC-REQ-1.1.1 -- Transmission Time	They Wyoming CV System shall transmit distress notifications to TRAC within five minutes of its generation in the system.	* Perform Test Case WDNR-1 * Inspect Relay Vehicle OBU Logs and confirm receipt of DNM from Distressed Vehicle * Inspect DB Logs and locate and confirm receipt of DNM from Relay Vehicle and the time received by the DB * Inspect TRAC logs and confirm receipt of DNM from DB and the time received by the TRAC * Compute time between receipt by the DB and receipt by the TRAC * TRAC log of Distress Notifications within 5 minutes verifies Wyoming CV System transmits distress notifications to TRAC within five minutes of its generation in the system, thereby verifying the requirement is satisfied. (Note: the DNM is generated by the vehicle system, rather than the Wyoming CV system. "Generation in the system" is interpreted as "received by the DB".)	Requirement Verification Confirmed by:
WDNR-1 -- Same direction Distress Notification relay to RSU	VS-REQ-15.1 -- Log	The Vehicle System shall log received distress notifications to include the DNM.	* Perform Test Case WDNR-1 * Inspect Relay Vehicle OBU Logs and identify instance of DNM received from Distressed Vehicle * Identification of receipt of DNMs in Relay Vehicle OBU confirms Vehicle System logs received distress notifications to include the DNM, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDNR-1 -- Same direction Distress Notification relay to RSU	VS-REQ-16.2 -- Driver-Generated Distress Notification	The Vehicle System shall have the ability to generate a distress notification when the vehicle operator selects the distress notification activation alternative in the HMI.	* Perform Test Case WDNR-1 * Inspect Distressed Vehicle OBU logs and confirm Distress Notification is activated 1 or more times. * Inspect Distressed Vehicle OBU Logs and identify instance of DNMs broadcast * Inspect Relay Vehicle OBU Logs and identify instance of DNM received from Distressed Vehicle * Receipt of DNMs by Relay Vehicle confirms Vehicle System has the ability to generate a distress notification when the vehicle operator selects the distress notification activation alternative in the HMI, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDNR-1 -- Same direction Distress Notification relay to RSU	VS-REQ-18 -- DN PSID	The Vehicle System shall use a unique high priority Provider Service Identifier (PSID) for the distress notification application as per IEEE 1609.12.	* Perform Test Case WDNR-1 * Inspect Relay Vehicle OBU logs and confirm receipt of Distress Notification. * Confirm use of unique high priority PSID * Use of unique high priority PSID verifies the Vehicle System uses a unique high priority Provider Service Identifier (PSID) for the distress notification application as per IEEE 1609.12. * (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WDNR-1 -- Same direction Distress Notification relay to RSU	VS-REQ-34.2 -- Generated Distress	The Vehicle System, in distress (described in Section 2.6 of the SyRS), shall broadcast distress notifications over DSRC, until the vehicle event code that triggered the distress notification is reset or power is lost (whichever comes first).	* Perform Test Case WDNR-1 * Inspect Distress Vehicle OBU logs and confirm Distress Notification is activated 1 or more times. * Inspect Distress Vehicle OBU Logs and identify 1 or more instances of DNMs broadcast. * Shut Off OBU and Restart. * Confirm OBU ceases broadcast of DNM. * Termination of broadcast confirms the Vehicle System, in distress (as defined in Section 2.6.3), broadcasts distress notifications (over DSRC), until the vehicle event code that triggered the distress notification is reset or power is lost (whichever comes first), thereby verifying the requirement is satisfied. (Note: The trigger event code is reset by cycling power on the OBU.)	Requirement Verification Confirmed by:
WDNR-1 -- Same direction Distress Notification relay to RSU	ODE-REQ-3.4.2 -- Distribute to Data Warehouse-DNM	The Operational Data Environment shall distribute all collected and processed DNM information to the Data Warehouse, as described in Section 5.20 of the ICD.	* Perform test case WDNR-1 * Inspect DW logs * Confirm receipt of DNMs * Confirmation shows the Operational Data Environment distributes all collected and processed DNM information to the Data Warehouse, as described in Section 5.20 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDNR-1 -- Same direction Distress Notification relay to RSU	DNP-REQ-1 -- Distress Notification OBU DSRC Performance 1	Remote vehicles shall receive distress notification via DSRC between at least 2 and 300 meters from the distressed vehicle.	* Perform Test Case WDNR-1 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Relay Vehicle OBU Event Logs, determine location, speed, and heading path of Relay Vehicle when first Distress Notification Message received. * Compute Distance between Distressed and Relay Vehicle at time first Distress Notification Message was received by Relay Vehicle. * Confirm Relay Vehicles receive distress notification via DSRC between at least 2 and 300 meters from the distressed vehicle, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDNR-1 -- Same direction Distress Notification relay to RSU	DNP-REQ-11 -- Remote Vehicle Distress Notification Upload to ODE	When a remote Relay Vehicle receives an RSU WSA broadcast for the ODE server's IPv6 address, the OBU shall copy a log for the DNM to the ODE server.	* Perform Test Case WDNR-1 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Same Direction Relay Vehicle OBU Event Logs and confirm receipt of an RSU WSA broadcast for the ODE server's IPv6 address. * Inspect Same Direction Relay Vehicle OBU Event Logs and confirm copy of a log for the DNM to the ODE Server. * Inspect ODE logs and confirm copy of a log for the DNM to the ODE Server. * Confirm that when a remote Relay Vehicle receives an RSU WSA broadcast for the ODE server's IPv6 address, the OBU copies a log for the DNM to the ODE server, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WDNR-1 -- Same direction Distress Notification relay to RSU	DNP-REQ-12 -- Remote Vehicle Distress Notification Upload Termination	When a remote Relay Vehicle OBU completes copying copies a log for the DNM to the ODE server, the Relay Vehicle shall stop further broadcasting the DNM and will stop copying it to RSUs to the ODE.	* Perform Test Case WDNR-1 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Same Direction Relay Vehicle OBU Event Logs, determine time, location, speed, and heading path of Same Direction Relay Vehicle when RSU WSA broadcast for the ODE server's IPv6 address was received and OBU copies a log for the DNM to the ODE server. * Inspect logs to confirm no further broadcast of Distress Notification Messages or OBU copies a log for the DNM log to the ODE. * Confirm that when a remote Relay Vehicle OBU completes copying copies a log for the DNM to the ODE server, the Relay Vehicle ceases further broadcasting the DNM and ceases copying it to RSUs to the ODE, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDNR-2 -- Opposite direction Distress Notification relay to RSU and Following Vehicle	VS-REQ-17 -- DNM-Region	The Vehicle System shall ingest received DNMs to identify the applicable regions of use geographical path (Part II defined in J2735 section 6.142). Data ingest is defined as obtaining and importing data for use or storage.	* Perform Test Case WDNR-2 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Same Direction Following Vehicle OBU Event Logs, determine time, location, speed, and heading path of when first Distress Notification Message received. * Determine if Same Direction Following Vehicle is traveling in the same direction as the Distressed Vehicle. * Inspect Same Direction Following Vehicle HMI Logs and determine if the Distress Notification Cautions indicate if the distressed vehicle is in the same direction of travel as the receiving vehicle was displayed to the driver. * Confirm Distress Notification Cautions indicate if the distressed vehicle is in the same direction of travel verifies that the Vehicle System ingests received DNMs to identify the applicable regions of use geographical path (Part II defined in J2735 section 6.142), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDNR-2 -- Opposite direction Distress Notification relay to RSU and Following Vehicle	VS-REQ-34.1 -- Received Distress	The Vehicle System shall broadcast distress notifications (over DSRC), received from remote vehicles, for five miles from the location where the distressed vehicle is located.	* Perform Test Case WDNR-2 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Opposing Direction Relay Vehicle OBU Event Logs, determine time, location, speed, and heading path of Opposing Direction Relay Vehicle when first Distress Notification Message was broadcast. * Inspect Opposing Direction Relay Vehicle OBU Event Logs, determine time, location, speed, and heading path of Opposing Direction Relay Vehicle when Distress Notification ceased to be broadcast. * Compute Distance between first and last Distress Notification broadcast. * Confirm the Vehicle System broadcasts distress notifications (over DSRC), received from Relay Vehicles, for approximately five miles from the location where the distressed vehicle is located, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDNR-2 -- Opposite direction Distress Notification relay	DNP-REQ-4 -- Distress Notification	Distress Notification Caution shall be issued to the driver of the receiving vehicle at least at a configurable distance from the distressed vehicle. Note: the configurable distance is to be	* Perform Test Case WDNR-2 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Same Direction Following Vehicle OBU Event Logs, determine time, location, speed, and heading path of when first Distress Notification Message received.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
to RSU and Following Vehicle	Driver Display Performance	determined empirically by system engineers during development and testing.	* Inspect Same Direction Following Vehicle HMI Logs, and determine time when Distress Notification caution was first issued to driver. * Verify Distress Notification Caution was issued to the driver of the Same Direction Following Vehicle at least at a configurable distance from the distressed vehicle, thereby verifying the requirement is satisfied. (Note: the configurable distance is to be determined empirically by system engineers during development and testing.)	
WDNR-2 -- Opposite direction Distress Notification relay to RSU and Following Vehicle	DNP-REQ-5 -- Distressed Vehicle Distance	Distress Notification Cautions shall indicate the approximate distance to the distressed vehicle.	* Perform Test Case WDNR-2 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Same Direction Following Vehicle OBU Event Logs, determine time, location, speed, and heading path of when first Distress Notification Message received. * Inspect Same Direction Following Vehicle HMI Logs, and determine time when Distress Notification caution was first issued to driver. * Compute Distance between Distressed and Same Direction Following Vehicle at time when Distress Notification caution was first issued to driver. * Inspect Same Direction Following Vehicle HMI Logs and verify approximate distance to Distressed Vehicle was displayed to the driver. * Confirm Distress Notification Cautions indicate the approximate distance to the distressed vehicle, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDNR-2 -- Opposite direction Distress Notification relay to RSU and Following Vehicle	DNP-REQ-6 -- Distressed Vehicle Direction of Travel	Distress Notification Cautions shall indicate if the distressed vehicle is in the same direction of travel as the receiving vehicle.	* Perform Test Case WDNR-2 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Same Direction Following Vehicle OBU Event Logs, determine time, location, speed, and heading path of when first Distress Notification Message received. * Determine if Same Direction Following Vehicle is traveling in the same direction as the Distressed Vehicle. * Inspect Same Direction Following Vehicle HMI Logs and determine if the Distress Notification Cautions indicate if the distressed vehicle is in the same direction of travel as the receiving vehicle was displayed to the driver. * Confirm Distress Notification Cautions indicate if the distressed vehicle is in the same direction of travel as the receiving vehicle, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDNR-2 -- Opposite direction Distress Notification relay to RSU and Following Vehicle	DNP-REQ-7 -- Distressed Vehicle Roadway	Distress Notification Cautions shall be issued to drivers approaching the distressed vehicle on the same roadway.	* Perform Test Case WDNR-2 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Same Direction Following Vehicle OBU Event Logs, determine time, location, speed, and heading path of when first Distress Notification Message received. * determine if Same Direction Following Vehicle is traveling in the same direction as the Distressed Vehicle. * Inspect Same Direction Following Vehicle HMI Logs and determine if the Distress Notification Cautions indicate if the distressed vehicle is in the same direction of travel as the receiving vehicle was displayed to the driver.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			* Confirm Distress Notification Cautions issued to drivers approaching the distressed vehicle on the same roadway, thereby verifying the requirement is satisfied.	
WDNR-2 -- Opposite direction Distress Notification relay to RSU and Following Vehicle	DNP-REQ-8 -- Distress Vehicle Passing	Distress Notification Cautions shall not be issued to drivers after passing the distressed vehicle.	* Perform Test Case WDNR-2 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Opposing Direction Relay Vehicle OBU Event Logs, determine time, location, speed, and heading path of Relay Vehicle when Relay Vehicle passed Distressed Vehicle. * Inspect Opposing Direction Relay Vehicle HMI Logs and verify time when Distress Notification ceased display. * Inspect Same Direction Following Vehicle OBU Event Logs, determine time, location, speed, and heading path of Relay Vehicle when Relay Vehicle passed Distressed Vehicle. * Inspect Same Direction Following Vehicle HMI Logs and verify time when Distress Notification ceased display. * Confirm Distress Notification Cautions were not issued to drivers after passing the distressed vehicle, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDNR-2 -- Opposite direction Distress Notification relay to RSU and Following Vehicle	DNP-REQ-9 -- Remote Vehicle Distress Notification Distance 1	Remote Vehicles receiving the broadcast DNM shall continue to broadcast it for a configurable distance and configurable time. Note: Initially this distance would be set to 5 miles.	* Perform Test Case WDNR-2 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Opposing Direction Relay Vehicle OBU Event Logs, determine time, location, speed, and heading path of Opposing Direction Relay Vehicle when first Distress Notification Message was broadcast. * Inspect Opposing Direction Relay Vehicle OBU Event Logs, determine time, location, speed, and heading path of Opposing Direction Relay Vehicle when Distress Notification ceased to be broadcast. * Compute Distance between first and last Distress Notification broadcast. * Confirm Relay Vehicles receiving the broadcast DNM cease to broadcast it for a configurable distance and configurable time, thereby verifying the requirement is satisfied. (Note: Configurable Distance is initially set to 5 miles.)	Requirement Verification Confirmed by:
WDNR-2 -- Opposite direction Distress Notification relay to RSU and Following Vehicle	DNP-REQ-10 -- Remote Vehicle Distress Notification Distance 2	After broadcasting for the configurable distance or configurable time, a remote Relay Vehicle shall stop broadcasting the DNM and go silent until it receives an RSU WSA broadcast for the ODE server's IPv6 address.	* Perform Test Case WDNR-2 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Opposing Direction Relay Vehicle OBU Event Logs, determine time, location, speed, and heading path of Opposing Direction Relay Vehicle when Distress Notification ceased to be broadcast. * Inspect Opposing Direction Relay Vehicle OBU Event Logs, determine time, location, speed, and heading path of Opposing Direction Relay Vehicle when RSU WSA broadcast for the ODE server's IPv6 address was received. * Compute Distance between last Distress Notification broadcast and receipt of RSU WSA broadcast for the ODE server's IPv6. * Confirm that after broadcasting for the configurable distance or configurable time, a remote Relay Vehicle ceases broadcasting the DNM and goes silent until it receives an RSU WSA broadcast for the ODE server's IPv6 address, thereby verifying the requirement is satisfied. (Note: Configurable Distance is initially set to 5 miles.)	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WSHKR-1 -- OBU Shakedown	MCP-REQ-3 -- OBU Shakedown	The WYDOT CV Pilot System shall support periodic testing to verify functionality and DSRC range performance of WYDOT controlled Pilot vehicles.	* Perform Test Case WSHKR-1 * Confirm OBUs with performance less than 90% of baseline are checked for damage or unit failure. * Confirmation shows the WYDOT CV Pilot System support periodic testing to verify functionality and DSRC range performance of WYDOT controlled Pilot vehicles, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WSHKR-2 -- RSU and Backhaul Communications Shakedown	MCP-REQ-4 -- RSU and Backhaul Communications Shakedown 1	The WYDOT CV Pilot System shall support periodic testing to verify functionality and DSRC range performance of RSUs.	* Perform Test Case WSHKR-2 * Confirm RSUs with performance less than 90% of baseline are checked for damage or unit failure. * Confirmation shows the WYDOT CV Pilot System supports periodic testing to verify functionality and DSRC range performance of RSUs, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WSHKR-2 -- RSU and Backhaul Communications Shakedown	MCP-REQ-5 -- RSU and Backhaul Communications Shakedown 2	The WYDOT CV Pilot System shall support periodic testing to verify functionality and DSRC range performance of RSUs after major storm events	* Perform Test Case WSHKR-2 * Confirm RSUs with performance less than 90% of baseline after storm events are checked for damage or unit failure. * Confirmation shows the WYDOT CV Pilot System support periodic testing to verify functionality and DSRC range performance of RSUs after storm events, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WSHKR-3 -- I-80 Satellite TIM coverage	I2VSAP-REQ-12 -- Satellite TIM Coverage	Vehicle Systems shall be capable of receiving I2V SA TIMs via satellite in vehicles traveling on I-80 across Wyoming.	* Perform Test Case WSHKR-3 * Inspect OBU logs * Confirm receipt of TIMs via Satellite. * Confirmation shows Vehicle Systems are capable of receiving I2V SA TIMs via satellite in vehicles traveling on I-80 across Wyoming, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WSHKR-4 -- Verify I80 geofence map	I2VSAP-REQ-11 -- Verify I-80 Map and Geofences	Vehicle Systems shall be capable of displaying Situational Awareness Message(s) in vehicles traveling in all travel lanes anywhere on I-80 across Wyoming.	* Perform Test Case WSHKR-4 * Confirm Message(s) display within 8 meters of beginning of specified geofence and cease display within 8 meters of end of specified geofence. * Confirmation shows Vehicle Systems are capable of displaying Situational Awareness Message(s) in vehicles traveling in all travel lanes anywhere on I-80 across Wyoming, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WINSTQ-1 -- OBU Installation Robustness	MCP-REQ-6 -- OBU Installation Robustness	WYDOT CV Pilot OBUs shall maintain functionality and DSRC communications range performance after up to five installations and removal.	* Perform Test Case WINSTQ-1 * Confirm OBU passes the following two test cases after fifth installation * WV2VMCT-1 V2V exchange of BSMs * WV2IMCT-2 V2I & End-to-end communication of BSMs * Confirmation shows WYDOT CV Pilot OBUs maintain functionality and DSRC communications range performance after up to five installations and removal, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WINSTQ-2 -- RSU Installation Robustness	MCP-REQ-7 -- RSU Installation Robustness	WYDOT CV Pilot RSUs shall maintain functionality and DSRC communications range performance after up to three installations and removal.	* Perform Test Case WINSTQ-2 * Confirm RSU passes the following two test cases after third installation * WV2IMCT-2 V2I & End-to-end communication of BSMs * WI2VMCT-1 End-to-end & DSRC Delivery of I2V SA TIMs * Confirmation shows WYDOT CV Pilot RSUs maintain functionality and DSRC communications range performance after up to three installations and removal, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WINSTQ-3 -- OBU Installation Quality Control	MCP-REQ-1 -- V2V Exchange of BSMs	Host vehicles shall receive BSM from remote vehicles via DSRC from between at least 2 and 300 meters distance.	* Perform Test Case WINSTQ-3 * Inspect Host Vehicle OBU Logs * Inspect Remote Vehicle OBU logs * Confirm a configurable threshold percentage of BSMs sent are received and logged by host and remote vehicle OBUs, when vehicles are at least 300 meters apart. * Confirm a configurable threshold percentage of BSMs continue to be received and logged until host vehicle stops. * Confirmation that a configurable threshold percentage of BSMs sent are received by host vehicle verifies Host vehicles receive BSM from remote vehicles via DSRC from between at least 2 and 300 meters distance.	Requirement Verification Confirmed by:
WINSTQ-4 -- RSU Installation Quality Control	MCP-REQ-2 -- V2I & End-to-end Communication of BSMs	RSUs shall receive BSM from Remote Vehicles via DSRC from between at least 2 and 300 meters distance.	* Perform Test Case WINSTQ-4 * Confirm BSMs are received and processed by RSU and ODE when vehicle is between at least 2 and 300 meters distance. * Confirmation shows RSUs receive BSM from Remote Vehicles via DSRC from between at least 2 and 300 meters distance, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WSYSAA-1 -- WYDOT CV Pilot System Monitoring and Availability	WCVS-REQ-16.1 -- Sub-System Availability	The Wyoming CV System shall monitor the Sub-systems for availability of ping services running. The WYDOT maintenance team will be sent a notification after a device, web service or running service is non-responsive for five minutes.	* Perform test Case WSYSAA-1 * Inspect Logs to determine time subsystems were disabled for testing * Inspect Logs to determine time ITS Maintenance Team was notified * Confirm that *Wyoming CV System monitors the Sub-systems for availability of ping services running. *WYDOT maintenance team is sent a notification after a device, web service or running service is non-responsive for five minutes. Thereby verifying the requirement is satisfied	Requirement Verification Confirmed by:
WSYSAA-1 -- WYDOT CV Pilot System Monitoring and Availability	WCVS-REQ-16.2 -- Sus-System Performance	The Wyoming CV System shall monitor the system’s ability to transmit information in a timely manner. This will be done by monitoring message input queues age of oldest entry not processed. If the messages are not processed	* Perform test Case WSYSAA-1 * Inspect Logs to determine system’s ability to transmit information in a timely manner * Inspect Logs to determine time ITS Maintenance Team was notified * Confirm that *Wyoming CV System monitors the system’s ability to transmit information in a timely manner. This will be done by monitoring message input queues age of oldest entry not processed.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		within five minutes the WYDOT maintenance team will be notified.	*If the messages are not processed within five minutes the WYDOT maintenance team is notified. Thereby verifying the requirement is satisfied	
WSYSAA-1 -- WYDOT CV Pilot System Monitoring and Availability	WCVS-REQ-16.3 -- Availability for Interfaces	The Wyoming CV System shall monitor the external interfaces for availability of ping services running. The WYDOT maintenance team will be sent a notification after a device, web service or running service is non-responsive for five minutes.	* Perform test Case WSYSAA-1 * Inspect Logs to confirm the system monitors the external interfaces for availability of ping services running * Inspect Logs to determine time ITS Maintenance Team was notified * Confirm that *Wyoming CV System monitors the external interfaces for availability of ping services running. *WYDOT maintenance team is sent a notification after a device, web service or running service is non-responsive for five minutes. Thereby verifying the requirement is satisfied	Requirement Verification Confirmed by:
WSYSAA-1 -- WYDOT CV Pilot System Monitoring and Availability	WCVS-REQ-16.4 -- Availability for Data Storage	The Wyoming CV System shall monitor available data storage of ping services running. The WYDOT maintenance team will be sent a notification after a device, web service or running service is non-responsive for five minutes. Notification will also be sent for disk space under 10% availability.	* Perform test Case WSYSAA-1 * Inspect Logs to confirm the monitors available data storage of ping services running * Inspect Logs to determine time ITS Maintenance Team was notified * Confirm that *Wyoming CV System monitors available data storage of ping services running. *WYDOT maintenance team is sent a notification after a device, web service or running service is non-responsive for five minutes. *Notification will also be sent for disk space under 10% availability. Thereby verifying the requirement is satisfied	Requirement Verification Confirmed by:
WSYSAA-1 -- WYDOT CV Pilot System Monitoring and Availability	DW-REQ-1.4 -- Store System Monitoring Data	The Data Warehouse shall store all system monitoring data, as defined in WCVS-REQ-14.	* Perform Test Case WSYSAA-1. * Inspect DW and confirm storage of monitoring data defined in WCVS-REQ-14 by DW. * Confirmation shows Data Warehouse stores all system monitoring data, as defined in WCVS-REQ-14, thereby verifying the requirement is satisfied. (Note: Data written to the Data Warehouse is automatically archived per existing TMC best practices.)	Requirement Verification Confirmed by:
WSYSAA-2 -- System Administration Demonstration Test Case	WCVS-REQ-21 -- Manage CV Equipment	The Wyoming CV System shall provide the TMC administrator the ability to add/edit/delete equipment from the internal inventory list	* Perform Test Case WSYSAA-2 * Inspect the System Logs and confirm * Adding equipment to internal inventory list * Editing equipment in internal inventory list * Deleting equipment in internal inventory list. * Confirmation shows the Wyoming CV System provides the TMC administrator the ability to add/edit/delete equipment from the internal inventory list, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WSYSAA-2 -- System Administration Demonstration Test Case	WCVS-REQ-22 -- Test WCVS Equipment	The Wyoming CV System shall provide the TMC administrator the ability to test the RSUs by allowing a series of Python testing scripts to be run on an RSU and results of the test returned to the user.	* Perform Test Case WSYSAA-2 * Inspect the System Logs and confirm * Testing the RSUs by allowing a series of Python testing scripts to be run on an RSU. * Confirmation shows the Wyoming CV System provides the TMC administrator the ability to test the RSUs by allowing a series of Python testing scripts to be run on an RSU and results of the test returned to the user, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WSYSAA-2 -- System Administration Demonstration Test Case	WCVS-REQ-23 -- Track WCVS Equipment	The Wyoming CV System shall provide the TMC administrator the geolocation of RSUs.	* Perform Test Case WSYSAA-2 * Inspect the System Logs and confirm * The geolocation of all RSUs. * Confirmation shows the Wyoming CV System provide the TMC administrator the geolocation of RSUs, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WSYSAA-2 -- System Administration Demonstration Test Case	WCVS-REQ-24 -- Update WCVS Equipment	The Wyoming CV System shall provide the TMC administrator the ability to push out updates to the RSU firmware.	* Perform Test Case WSYSAA-2 * Inspect the System Logs and confirm * The ability to push out updates to the RSU firmware. * Confirmation shows the Wyoming CV System provide the TMC administrator the ability to push out updates to the RSU firmware, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WEXTSS-511 -- Truck Parking Information Entry and Delivery	511-REQ-1.1 -- Availability	The Wyoming CV System shall categorize parking availability for the facility of interest as follows: i) Full – No parking availability, ii) Spaces available, or iii) Only a few spaces available.	* Perform Test Case WEXTSS-511 * Inspect DB Logs * Locate 1 or more instances of receipt of Parking Status Updates from the WYDOT 511 App (via WYDOT 511 System) * Confirm parking status updates show Full or Available * Confirmation shows the Wyoming CV System categorizes parking availability for the facility of interest as follows: i) Full – No parking availability or ii) Available – Parking is available at this location, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WEXTSS-511 -- Truck Parking Information Entry and Delivery	511-REQ-1.2 -- Default	The Wyoming CV System shall set parking availability default to available if not provided.	* Perform Test Case WEXTSS-511 * Inspect DB Logs * Locate 1 or more instances of receipt of Parking Status Updates from the WYDOT 511 App (via WYDOT 511 System) * For case where driver does not enter parking availability, confirm parking status updates show "Available". * Confirmation shows The Wyoming CV System sets parking availability default to available if not provided, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WEXTSS-511 -- Truck Parking Information Entry and Delivery	511-REQ-1.3 -- Time	The Wyoming CV System shall timestamp parking availability reports.	* Perform Test Case WEXTSS-511 * Inspect DB Logs * Locate 1 or more instances of receipt of Parking Status Updates from the WYDOT 511 App (via WYDOT 511 System) * Confirm each instance is timestamped.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			* Confirmation shows the Wyoming CV System timestamps parking availability reports, thereby verifying the requirement is satisfied.	
WEXTSS-511 -- Truck Parking Information Entry and Delivery	511-REQ-1.4 -- Location	The Wyoming CV System shall associate parking availability with a parking facility on I-80.	* Perform Test Case WEXTSS-511 * Inspect DB Logs * Locate 1 or more instances of receipt of Parking Status Updates from the WYDOT 511 App (via WYDOT 511 System) * Confirm each instance is associated with a parking facility on I-80. * Confirmation shows the Wyoming CV System associates parking availability with a parking facility on I-80, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WEXTSS-511 -- Truck Parking Information Entry and Delivery	511-REQ-1.5 -- Protocol	The Wyoming CV System shall receive information, based on HTTP protocol, from the 511App.	* Perform Test Case WEXTSS-511 * Inspect DB Logs * Locate 1 or more instances of receipt of Parking Status Updates from the WYDOT 511 App (via WYDOT 511 System) * Inspect 511 logs and verify HTTP Protocol * Confirmation shows the Wyoming CV System receives information, based on HTTP protocol, from the 511App, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WEXTSS-511 -- Truck Parking Information Entry and Delivery	511-REQ-1.6 -- Schema	The Wyoming CV System shall receive information based on the parking schema defined by WYDOT (WYDOT Truck Parking Map – as of 07/2016).	* Perform Test Case WEXTSS-511 * Inspect DB Logs * Locate 1 or more instances of receipt of Parking Status Updates from the WYDOT 511 App (via WYDOT 511 System) * Inspect WYDOT Truck Parking Map and confirm information received is based upon parking schema defined by WYDOT Truck Parking Map. * Confirmation shows the Wyoming CV System receives information based on the parking schema defined by WYDOT (WYDOT Truck Parking Map – as of 07/2016), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WEXTSS-511 -- Truck Parking Information Entry and Delivery	511-REQ-2 -- Timeframe	The Wyoming CV System shall receive Parking availability data from the WYDOT 511 application within thirty minutes of generation.	* Perform Test Case WEXTSS-511 * Inspect DB Logs * Locate 1 or more instances of receipt of Parking Status Updates from the WYDOT 511 App (via WYDOT 511 System) * Verify each instance is timestamped when sent. * Verify each instance is timestamped when received by DB. * Confirm parking availability data is received within 30 minutes of generation. * Confirmation shows the Wyoming CV System receives Parking availability data from the WYDOT 511 application within thirty minutes of generation, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WEXTSS-CAM -- Pikalert Camera Imagery	PA-REQ-2.2 -- TMC Data	The Pikalert System shall receive camera imagery from the TMC File Transfer Protocol (FTP) server as described in Section 5.26.1 of the ICD.	* Perform Test Case WEXTSS-CAM. * Inspect Pikalert logs * Confirm retrieval of camera images from TMC and DB via FTP.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			* Confirmation shows the Pikalert System receives camera imagery from the TMC File Transfer Protocol (FTP) server as described in Section 5.26.1 of the ICD, thereby verifying the requirement is satisfied.	
WEXTSS-SCMSCRL -- WYDOT CV System and Vehicle System Misbehavior and CRL support	SCMS-REQ-1.2 -- SCMS Wyoming CV System Misbehavior Reporting	The Wyoming CV System shall send misbehavior reports after they are published to the USDOT SCMS within 24 hours.	* Perform Test Case WEXTSS-SCMSCRL * Inspect Wyoming CV System SCMS Logs * Confirm Wyoming CV System detects misbehavior by Remote Vehicle * Confirm Wyoming CV System sends misbehavior reports to the USDOT SCMS within 24 hours after detection, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WEXTSS-SCMSCRL -- WYDOT CV System and Vehicle System Misbehavior and CRL support	SCMS-REQ-1.3 -- SCMS Wyoming CV System Certificates Revocation List (CRL)	The Wyoming CV System shall download the CRL from the USDOT SCMS.	* Perform Test Case WEXTSS-SCMSCRL * Inspect Wyoming CV System SCMS Logs * Confirm Wyoming CV System downloads the CRL from the USDOT SCMS, thereby verifying the requirement is satisfied	Requirement Verification Confirmed by:
WEXTSS-SCMSCRL -- WYDOT CV System and Vehicle System Misbehavior and CRL support	SCMS-REQ-1.4 -- SCMS Wyoming CV System Rejection	The Wyoming CV System shall reject messages received from any vehicles on the current CRL.	* Perform Test Case WEXTSS-SCMSCRL * Inspect Wyoming CV System SCMS Logs * Confirm Wyoming CV System rejects messages received from Remote Vehicle on the current CRL, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WEXTSS-SCMSCRL -- WYDOT CV System and Vehicle System Misbehavior and CRL support	SCMS-REQ-2.2 -- SCMS Vehicle System Misbehavior Reporting	The Vehicle System shall send misbehavior reports after they are defined to the USDOT SCMS	* Perform Test Case WEXTSS-SCMSCRL * Inspect Vehicle System SCMS Logs * Confirm Vehicle System detects misbehavior by Remote Vehicle * Confirm Vehicle System sends misbehavior reports to the USDOT SCMS, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WEXTSS-SCMSCRL -- WYDOT CV	SCMS-REQ-2.3 -- SCMS Vehicle System	The Vehicle System shall download and utilize the CRL from the USDOT SCMS.	* Perform Test Case WEXTSS-SCMSCRL * Inspect Vehicle System SCMS Logs * Confirm Vehicle System downloads the CRL from the USDOT SCMS, thereby verifying the requirement is satisfied	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
System and Vehicle System Misbehavior and CRL support	Certificates Revocation List (CRL)			
WEXTSS-SCMSCRL -- WYDOT CV System and Vehicle System Misbehavior and CRL support	SCMS-REQ-2.4 -- SCMS Vehicle System Rejection	The Vehicle System shall reject messages received from any vehicles on the current CRL	* Perform Test Case WEXTSS-SCMSCRL * Inspect Vehicle System SCMS Logs * Confirm Vehicle System rejects messages received from Remote Vehicle on the current CRL, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WEXTSS-OTA -- OBU over the air updates	VS-REQ-48 -- VSM Updates	The Vehicle System shall support Over-the-Air (OTA) software updates from the Wyoming CV System based on WAVE Service Announcements (WSA).	* Perform Test Case WEXTSS-OTA * Inspect OBU logs and verify that system received and successfully performed update. * Confirmation shows the Vehicle System supports Over-the-Air (OTA) software updates from the Wyoming CV System based on WAVE Service Announcements (WSA), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WEXTSS-OTA -- OBU over the air updates	ODE-REQ-6 -- OBU Update	The Operational Data Environment shall send OTA firmware updates to the OBU.	* Perform Test Case WEXTSS-OTA * Inspect OBU logs and verify that system received and successfully performed update. * Confirmation shows the Operational Data Environment sends OTA firmware updates to the OBU, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WEXTSS-RSUFIRM -- RSU Firmware update	RSU-REQ-12 -- Receive Update	The Roadside Units shall receive firmware updates from the TMC administrator.	* Perform Test Case WEXTSS-RSUFIRM * Inspect RSU logs and verify that RSU received and successfully performed update. * Confirmation shows the Roadside Units receive firmware updates from the TMC administrator, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-32.1 -- HMI-Location	The location where the devices will be mounted/installed shall be selected so that they do not obstruct the line of sight of the driver nor distract the driver from the primary task of driving.	* Perform Test Case WOBUDOC-1 * Confirm the location where the devices will be mounted/installed is selected so that they do not obstruct the line of sight of the driver nor distract the driver from the primary task of driving. * Confirmation shows the location where the devices will be mounted/installed be selected so that they do not obstruct the line of sight of the driver nor distract the driver from the primary task of driving, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU	VS-REQ-32.2 -- HMI-Distraction	The HMI shall minimize the ‘eyes off the road’ time when presenting information for an application	* Perform Test Case WOBUDOC-1 * Confirm the HMI minimizes the ‘eyes off the road’ time when presenting information for an application	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
Certification and Test Documents			* Confirmation shows the HMI minimize the ‘eyes off the road’ time when presenting information for an application, thereby verifying the requirement is satisfied.	
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-32.3 -- HMI-Readability	The HMI shall provide messages that can be read from the driver’s normal seating position	* Perform Test Case WOBUDOC-1 * Confirm the HMI provide messages that can be read from the driver’s normal seating position. * Confirmation shows the HMI provide messages that can be read from the driver’s normal seating position, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-32.4.1 -- Visual Consistency	The HMI shall maintain a consistent structure across applications with respect to presenting information to drivers and inputs to the system.	* Perform Test Case WOBUDOC-1 * Confirm the HMI maintain a consistent structure across applications with respect to presenting information to drivers and inputs to the system. * Confirmation shows the HMI maintain a consistent structure across applications with respect to presenting information to drivers and inputs to the system, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-32.4.2 -- Audio Signals	Auditory signals shall be loud enough to overcome masking sounds from road noise, the cab environment, and other equipment.	* Perform Test Case WOBUDOC-1 * Confirm the auditory signals be loud enough to overcome masking sounds from road noise, the cab environment, and other equipment. * Confirmation shows auditory signals be loud enough to overcome masking sounds from road noise, the cab environment, and other equipment, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-32.5 -- Customizations	HMI characteristics shall be customizable to reflect driver preferences. Preferences that shall be customizable are: • Volume • Brightness • Contrast text size • Display contrast • Mounting eye position	* Perform Test Case WOBUDOC-1 * Confirm HMI characteristics are customizable to reflect driver preferences. * Confirmation shows HMI characteristics be customizable to reflect driver preferences, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-32.6.1 -- Power Status	The HMI shall notify the driver of the power status of device with the screen graphics (e.g., off, powering up and online).	* Perform Test Case WOBUDOC-1 * Confirm the HMI notifies the driver of the power status of device with the screen graphics (e.g., off, powering up and online). * Confirmation shows the HMI notifies the driver of the power status of device with the screen graphics (e.g., off, powering up and online), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU	VS-REQ-32.6.2 -- System Settings	The HMI shall allow the driver to see the system settings of the device with screen graphics. (e.g., version, brightness, volume font size).	* Perform Test Case WOBUDOC-1 * Confirm The HMI allows the driver to see the system settings of the device with screen graphics. (e.g., version, brightness, volume font size).	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
Certification and Test Documents			* Confirmation shows the HMI allow the driver to see the system settings of the device with screen graphics (e.g., version, brightness, volume font size), thereby verifying the requirement is satisfied.	
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-32.6.3 -- Application Availability	The HMI shall allow the driver to see application availability with screen graphics (e.g., failed, operating, disabled).	* Perform Test Case WOBUDOC-1 * Confirm the HMI allows the driver to see application availability with screen graphics (e.g., failed, operating, disabled).* Perform Test Case WOBUDOC-1 * Confirmation shows the HMI allows the driver to see application availability with screen graphics (e.g., failed, operating, disabled), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-32.6.4 -- Pending Update Status	The HMI shall allow the driver see pending updates for the device with screen graphics (e.g., applications, firmware, operating system).	* Perform Test Case WOBUDOC-1 * Confirm the HMI allows the driver see pending updates for the device with screen graphics (e.g., applications, firmware, operating system).* Perform Test Case WOBUDOC-1 * Confirmation shows the HMI allows the driver see pending updates for the device with screen graphics (e.g., applications, firmware, operating system), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-32.7 -- Distress Notification	The HMI shall include a distress button to allow a driver to notify the Vehicle System that the driver has initiated a distress condition. This button enables the distress notification application as defined in section 2.6.3 of the SyRS.	* Perform Test Case WOBUDOC-1 * Confirm the HMI includes a distress button to allow a driver to notify the Vehicle System that the driver has initiated a distress condition. * Confirmation shows the HMI includes a distress button to allow a driver to notify the Vehicle System that the driver has initiated a distress condition	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-35 -- BCVI General Broadcast Requirements	The Vehicle System shall use the general broadcast requirements defined in Appendix A.4 Broadcast Traveler Information of the SyRS.	* Perform Test Case WOBUDOC-1 * Confirm the Vehicle System uses the general broadcast requirements defined in Appendix A4 Broadcast Traveler Information of the SyRS. * Confirmation shows the Vehicle System use the general broadcast requirements defined in Appendix A4 Broadcast Traveler Information of the SyRS, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-42 -- VSM SCMS	The Vehicle System shall use the USDOT SCMS Certificates in accordance with the security and privacy requirements in Section 6.5 of J2945/1	* Perform Test Case WOBUDOC-1 * Confirm Vehicle System use the USDOT SCMS Certificates in accordance with the security and privacy requirements in Section 6.5 of J2945/1. * Confirmation shows the Vehicle System use the USDOT SCMS Certificates in accordance with the security and privacy requirements in Section 65 of J2945/1, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-43 -- VSM SCMS Encryption	The Vehicle System shall use the USDOT SCMS Certificates to sign and encrypt messages transmitted. The approved encryption algorithms are defined in IEEE	* Perform Test Case WOBUDOC-1 * Confirm Vehicle System uses the USDOT SCMS Certificates to sign and encrypt messages transmitted. * Confirmation shows the Vehicle System use the USDOT SCMS Certificates to sign and encrypt messages transmitted, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		1609.2 and explained in USDOT SCMS CAMP Wiki Cryptography.		
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-44 -- VSM SCMS Sign	The Vehicle System shall use the USDOT SCMS Certificates to sign, but not encrypt, all broadcasted messages.	* Perform Test Case WOBUDOC-1 * Confirm Vehicle System uses the USDOT SCMS Certificates to sign, but not encrypt, all broadcasted messages. * Confirmation shows the Vehicle System use the USDOT SCMS Certificates to sign, but not encrypt, all broadcasted messages, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-45 -- VSM SCMS Encryption-Log	The Vehicle System shall use the USDOT SCMS Certificates to encrypt log files stored locally using the Public Key Encryption defined in USDOT SCMS CAMP Wiki Cryptography. Password protection is also allowable protection for log files.	* Perform Test Case WOBUDOC-1 * Confirm Vehicle System uses the USDOT SCMS Certificates to encrypt log files stored locally using the Public Key Encryption defined in USDOT SCMS CAMP Wiki Cryptography or confirm password protection is used to protect log files. * Confirmation shows the Vehicle System use the USDOT SCMS Certificates to encrypt log files stored locally using the Public Key Encryption defined in USDOT SCMS CAMP Wiki Cryptography or that password protection is used to protect log files, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-46 -- VSM SCMS Sign-Log	The Vehicle System shall use the USDOT SCMS Certificates to sign log files stored locally. Password protection is also allowable for in place of signing log files.	* Perform Test Case WOBUDOC-1 * Confirm Vehicle System uses the USDOT SCMS Certificates to sign log files stored locally or confirm password protection is used to protect log files. * Confirmation shows the Vehicle System use the USDOT SCMS Certificates to sign log files stored locally or password protection is used to protect log files, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-47 -- VSM App Availability Log	The Vehicle System shall log local application availability to the local event logs by vehicle type.	* Perform Test Case WOBUDOC-1 * Confirm the Vehicle System logs local application availability to the local event logs by vehicle type. * Confirmation shows the Vehicle System log local application availability to the local event logs by vehicle type, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-51 -- VS Equipment	All Vehicle System equipment shall conform to the characteristics described in Appendix A of the CAP.	* Perform Test Case WOBUDOC-1 * Confirm OBU conforms to the characteristics described in Appendix A of the CAP. * Confirmation shows all Vehicle System equipment conforms to the characteristics described in Appendix A of the CAP, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	MV-REQ-9 -- General	All vehicle system requirements identified in Section 4.2 of the SyRS shall apply to this Sub-system.	* Perform Test Case WOBUDOC-1 * Confirm all vehicle system requirements identified in Section 42 of the SyRS are confirmed for this Sub-system * Confirmation shows all vehicle system requirements identified in Section 42 of the SyRS apply to this Sub-system, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	HP-REQ-1 -- General	All vehicle system requirements identified in Section 4.2 of the SyRS shall apply to this Sub-system except: • VS-REQ-4.2 Collect Dimension Data • VS-REQ-5 External Environment Sensor Data • VS-REQ-5.1 External Environment Sensor Data Configuration • VS-REQ-5.2 External Environment Sensor Data Management • VS-REQ-36.1 Transmit Environmental Data	* Perform Test Case WOBUDOC-1 * Confirm all vehicle system requirements identified in Section 42 of the SyRS apply to this Sub-system except: • VS-REQ-4.2 Collect Dimension Data • VS-REQ-5 External Environment Sensor Data • VS-REQ-5.1 External Environment Sensor Data Configuration • VS-REQ-5.2 External Environment Sensor Data Management • VS-REQ-36.1 Transmit Environmental Data * Confirmation shows all vehicle system requirements identified in Section 42 of the SyRS apply to this Sub-system except: • VS-REQ-4.2 Collect Dimension Data • VS-REQ-5 External Environment Sensor Data • VS-REQ-5.1 External Environment Sensor Data Configuration • VS-REQ-5.2 External Environment Sensor Data Management • VS-REQ-36.1 Transmit Environmental Data, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	IT-REQ-6 -- General	All vehicle system requirements identified in Section 4.2 of the SyRS shall apply to this Sub-system except: • VS-REQ-5 External Environment Sensor Data • VS-REQ-5.1 External Environment Sensor Data Configuration • VS-REQ-5.2 External Environment Sensor Data Management • VS-REQ-36.1 Transmit Environmental Data	* Perform Test Case WOBUDOC-1 * Confirm all vehicle system requirements identified in Section 42 of the SyRS apply to this Sub-system except: • VS-REQ-5 External Environment Sensor Data • VS-REQ-5.1 External Environment Sensor Data Configuration • VS-REQ-5.2 External Environment Sensor Data Management • VS-REQ-36.1 Transmit Environmental Data * Confirmation shows all vehicle system requirements identified in Section 42 of the SyRS apply to this Sub-system except: • VS-REQ-5 External Environment Sensor Data • VS-REQ-5.1 External Environment Sensor Data Configuration • VS-REQ-5.2 External Environment Sensor Data Management • VS-REQ-36.1 Transmit Environmental Data, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	RFV-REQ-5 -- General	All vehicle system requirements identified in Section 4.2 of the SyRS shall apply to this Sub-system except the following requirements pertaining to distress notifications and updates: • VS-REQ-3 Receive Distress Information • VS-REQ-4.1 Collect Vehicle Status Data	* Perform Test Case WOBUDOC-1 * Confirm all vehicle system requirements identified in Section 42 of the SyRS apply to this Sub-system except the following requirements pertaining to distress notifications and updates: • VS-REQ-3 Receive Distress Information • VS-REQ-4.1 Collect Vehicle Status Data • VS-REQ-5 External Environment Sensor Data	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		• VS-REQ-5 External Environment Sensor Data • VS-REQ-5.1 External Environment Sensor Data Configuration • VS-REQ-5.2 External Environment Sensor Data Management • VS-REQ-15 Distress Notification ID • VS-REQ-15.1 Log • VS-REQ-16 Create Distress Notification • VS-REQ-16.1 System-Generated Distress Notification • VS-REQ-16.2 Driver-Generated Distress Notification • VS-REQ-17 DNM-Region • VS-REQ-18 DN PSID • VS-REQ-27 IVAA DN • VS-REQ-32.5 Customizations • VS-REQ-32.7 Distress Notification • VS-REQ-34 BCVI Distress • VS-REQ-34.1 Received Distress • VS-REQ-34.2 Generated Distress • VS-REQ-35 BCVI General Broadcast Requirements • VS-REQ-36.1 Transmit Environmental Data	• VS-REQ-5.1 External Environment Sensor Data Configuration • VS-REQ-5.2 External Environment Sensor Data Management • VS-REQ-15 Distress Notification ID • VS-REQ-15.1 Log • VS-REQ-16 Create Distress Notification • VS-REQ-16.1 System-Generated Distress Notification • VS-REQ-16.2 Driver-Generated Distress Notification • VS-REQ-17 DNM-Region • VS-REQ-18 DN PSID • VS-REQ-27 IVAA DN • VS-REQ-32.5 Customizations • VS-REQ-32.7 Distress Notification • VS-REQ-34 BCVI Distress • VS-REQ-34.1 Received Distress • VS-REQ-34.2 Generated Distress • VS-REQ-35 BCVI General Broadcast Requirements • VS-REQ-36.1 Transmit Environmental Data * Confirmation shows all vehicle system requirements identified in Section 42 of the SyRS apply to this Sub-system except the following requirements pertaining to distress notifications and updates: • VS-REQ-3 Receive Distress Information • VS-REQ-4.1 Collect Vehicle Status Data • VS-REQ-5 External Environment Sensor Data • VS-REQ-5.1 External Environment Sensor Data Configuration • VS-REQ-5.2 External Environment Sensor Data Management • VS-REQ-15 Distress Notification ID • VS-REQ-15.1 Log • VS-REQ-16 Create Distress Notification • VS-REQ-16.1 System-Generated Distress Notification • VS-REQ-16.2 Driver-Generated Distress Notification • VS-REQ-17 DNM-Region • VS-REQ-18 DN PSID • VS-REQ-27 IVAA DN • VS-REQ-32.5 Customizations • VS-REQ-32.7 Distress Notification • VS-REQ-34 BCVI Distress	

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			• VS-REQ-34.1 Received Distress • VS-REQ-34.2 Generated Distress • VS-REQ-35 BCVI General Broadcast Requirements • VS-REQ-36.1 Transmit Environmental Data, thereby verifying the requirement is satisfied.	
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	ARQ-REQ-1 -- Architectural Requirements - Connected Device Dialogs	(Source: J3067, 3.4.3) – A connected device shall be able to establish a private wireless connection with another specific connected device that mutually agrees.	* Perform Test Case WOBUDOC-1 * Confirm (Source: J3067, 343) – A connected device is able to establish a private wireless connection with another specific connected device that mutually agrees * Confirmation shows (Source: J3067, 343) – A connected device be able to establish a private wireless connection with another specific connected device that mutually agrees, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	CSC-REQ-1 -- OBU SCMS Use	All OBUs used in the Wyoming Pilot shall be certified from a US DOT authorized testing facility based on the SCMS current version CAMP Wiki: Requirements and Specifications.	* Perform Test Case WOBUDOC-1 * Confirm All OBUs used in the Wyoming Pilot be certified from a US DOT authorized testing facility based on the SCMS current version CAMP Wiki: Requirements and Specifications * Confirmation shows All OBUs used in the Wyoming Pilot be certified from a US DOT authorized testing facility based on the SCMS current version CAMP Wiki: Requirements and Specifications, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	CSC-REQ-2 -- OBU Certification	All OBUs used in the Wyoming Pilot shall be certified from a USDOT authorized testing facility based on J2945/1.	* Perform Test Case WOBUDOC-1 * Confirm All OBUs used in the Wyoming Pilot be certified from a USDOT authorized testing facility based on J2945/1 At a minimum, the following applications interfaces and requirements from J2945/1 will be included in the certification testing * Confirmation shows All OBUs used in the Wyoming Pilot be certified from a USDOT authorized testing facility based on J2945/1 At a minimum, the following applications interfaces and requirements from J2945/1 will be included in the certification testing, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.1 -- Broadcast Traveler Information	(Source: J3067, 3.5.8.1). A connected device shall broadcast a packet containing traveler information to connected devices. Each packet may contain one or more individual traveler information messages.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.1) a connected device broadcast a packet containing traveler information to connected devices. Each packet may contain one or more individual traveler information messages, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.2.1 -- Broadcast Traveler Information - Packet Identifier	(Source: J3067, 3.5.8.2.1). A connected device shall include a packet identifier for the traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.2.1) a connected device include a packet identifier for the traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.2.2 -- Broadcast Traveler Information - Message Identifier Requirements	(Source: J3067, 3.5.8.2.2). For each traveler information message in a traveler information packet, a connected device needs to identify each message transmitted as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.2.2) For each traveler information message in a traveler information packet, a connected device needs to identify each message transmitted as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.2.2.1 -- Broadcast Traveler Advisories - Message Identifier	(Source: J3067, 3.5.8.2.2.1). For traveler advisories, a connected device shall include a message identifier for each traveler advisory message as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.2.2.1) For traveler advisories, a connected device include a message identifier for each traveler advisory message as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.1 -- Broadcast Traveler Information - Validity Duration	(Source: J3067, 3.5.8.3.4). For each traveler information message in a traveler information packet, a connected device shall include the duration from the start time that the traveler message is valid for as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.4) For each traveler information message in a traveler information packet, a connected device include the duration from the start time that the traveler message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.2 -- Broadcast Traveler Information – Importance	(Source: J3067, 3.5.8.3.5). For each traveler information message in a traveler information packet, a connected device shall include the importance of the message relative to other traveler information messages being broadcasted as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.5) For each traveler information message in a traveler information packet, a connected device include the importance of the message relative to other traveler information messages being broadcasted as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3 -- Broadcast Traveler Information - Presentation Requirements	(Source: J3067, 3.5.8.3.6). Agencies may need to present traveler information messages only to specific travelers, such as travelers within specific geographic (spatial) regions or a direction of travel.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6) agencies may need to present traveler information messages only to specific travelers, such as travelers within specific geographic (spatial) regions or a direction of travel, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.1 -- Broadcast Traveler Information - Default Anchor Point Position	(Source: J3067, 3.5.8.3.6.1). For each traveler information message in a traveler information packet, a connected device shall include the geographic location (latitude, longitude, elevation) of the default anchor point for which valid regions are determined as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.1) For each traveler information message in a traveler information packet, a connected device include the geographic location (latitude, longitude, elevation) of the default anchor point for which valid regions are determined as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.2 -- Broadcast Traveler Information - Heading Slice	(Source: J3067, 3.5.8.3.6.2). For each traveler information message in a traveler information packet, a connected device shall include the direction of motion (of the connected device) that the message is valid for as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.2) For each traveler information message in a traveler information packet, a connected device include the direction of motion (of the connected device) that the message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.3 -- Broadcast Traveler Information - Circular Valid Region Requirements	(Source: J3067, 3.5.8.3.6.3). A spatial region for which a traveler information message is valid for may be a circular region around an anchor point. The connected device should be located within the circular region for the traveler information message to be presented to the traveler.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.3) a spatial region for which a traveler information message is valid for may be a circular region around an anchor point. the connected device should be located within the circular region for the traveler information message to be presented to the traveler, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.3.1 -- Broadcast Traveler Information - Circular Region – Radius	(Source: J3067, 3.5.8.3.6.3.1). For each traveler information message in a traveler information packet, a connected device shall include the radius for the circular region defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.3.1) For each traveler information message in a traveler information packet, a connected device include the radius for the circular region defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.3.2 -- Broadcast Traveler Information -	(Source: J3067, 3.5.8.3.6.3.2). For each traveler information message in a traveler information packet, a connected device shall include the geographic location (latitude, longitude, elevation) of the anchor point for the	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.3.2) For each traveler information message in a traveler information packet, a connected device include the geographic location (latitude, longitude, elevation) of the anchor point for the circular	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
	Circular Region - Anchor Point	circular region of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.	region of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.4 -- Broadcast Traveler Information - Polygon Valid Region Requirements	(Source: J3067, 3.5.8.3.6.4). A spatial region for which a traveler information message is valid for may be a polygon, which may represent the jurisdictional boundaries of a specific transportation agency or a work zone. The connected device should be located within this polygon region for the traveler information message to be presented to the traveler.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.4) a spatial region for which a traveler information message is valid for may be a polygon, which may represent the jurisdictional boundaries of a specific transportation agency or a work zone. the connected device should be located within this polygon region for the traveler information message to be presented to the traveler, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.4.1 -- Broadcast Traveler Information - Polygon Region – Offsets	(Source: J3067, 3.5.8.3.6.4.1). For each traveler information message in a traveler information packet, a connected device shall include the area of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.4.1) For each traveler information message in a traveler information packet, a connected device include the area of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.4.2 -- Broadcast Traveler Information - Polygon Region - Anchor Point	(Source: J3067, 3.5.8.3.6.4.2). For each traveler information message in a traveler information packet, a connected device shall include the geographic location (latitude, longitude, elevation) of the anchor point for the area of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.4.2) For each traveler information message in a traveler information packet, a connected device include the geographic location (latitude, longitude, elevation) of the anchor point for the area of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.5 -- Broadcast Traveler Information - Valid Shape	(Source: J3067, 3.5.8.3.6.5). A spatial region for which a traveler information message is valid for may be a shape point set, which allows a spline-like representation of a geographic area such as a road segment. A connected device should be located within the shape point set	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5) a spatial region for which a traveler information message is valid for may be a shape point set, which allows a spline-like representation of a geographic area such as a road segment. a connected device should be located within the shape point set region for the traveler information message to be presented to the traveler, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
	Point Set Region Requirements	region for the traveler information message to be presented to the traveler.		
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.5.1 -- Broadcast Traveler Information - Shape Point Set - Default Direction	(Source: J3067, 3.5.8.3.6.5.1). For each traveler information message in a traveler information packet, a connected device shall include the default direction of travel along the shape point set as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.1) For each traveler information message in a traveler information packet, a connected device include the default direction of travel along the shape point set as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.5.2 -- Broadcast Traveler Information - Shape Point Set - Default Width	(Source: J3067, 3.5.8.3.6.5.2). For each traveler information message in a traveler information packet, a connected device shall include the default width of the shape point set as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.2) For each traveler information message in a traveler information packet, a connected device include the default width of the shape point set as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.5.3 -- Broadcast Traveler Information - Shape Point Set – Offsets	(Source: J3067, 3.5.8.3.6.5.3). For each traveler information message in a traveler information packet, a connected device shall include the shape point set defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.3) For each traveler information message in a traveler information packet, a connected device include the shape point set defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.5.4 -- Broadcast Traveler Information - Shape Point Set – Direction	(Source: J3067, 3.5.8.3.6.5.4). For each shape point set in a traveler information message, a connected device shall include the allowed direction of travel along the shape point set as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.4) For each shape point set in a traveler information message, a connected device include the allowed direction of travel along the shape point set as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.5.5 -- Broadcast Traveler Information - Shape Point Set – Width	(Source: J3067, 3.5.8.3.6.5.5). For a shape point set in a traveler information message, a connected device shall include the width for the shape point set as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.5) For a shape point set in a traveler information message, a connected device include the width for the shape point set as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.5.6 -- Broadcast Traveler Information - Shape Point Set - Node Width	(Source: J3067, 3.5.8.3.6.5.6). For a shape point offset in a traveler information message, a connected device shall include the width of the geographic area at that node as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.6) For a shape point offset in a traveler information message, a connected device include the width of the geographic area at that node as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.5.7 -- Broadcast Traveler Information - Shape Point Set - Anchor Point	(Source: J3067, 3.5.8.3.6.5.7). For each shape point set in a traveler information message, a connected device shall include the geographic location (latitude, longitude, elevation) of the anchor point for the shape point set defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.7) For each shape point set in a traveler information message, a connected device include the geographic location (latitude, longitude, elevation) of the anchor point for the shape point set defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.4 -- Broadcast Traveler Advisories – Content	(Source: J3067, 3.5.8.3.7). For traveler advisory message in a traveler information packet, a connected device shall include the contents of the travel advisory information as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.7) For traveler advisory message in a traveler information packet, a connected device include the contents of the travel advisory information as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.5 -- Broadcast Road Sign – Content	(Source: J3067, 3.5.8.3.8). For each road sign message in a traveler information packet, a connected device shall include the road sign information as part of a traveler information packet broadcasted to connected devices	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.8) For each road sign message in a traveler information packet, a connected device include the road sign information as part of a traveler information packet broadcasted to connected device, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.6 -- Broadcast Traveler Information - Uniform Resource Locator	(Source: J3067, 3.5.8.3.9). For each traveler information message in a traveler information packet, an OBU shall include a uniform resource locator (URL) for the traveler information message as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.9) For each traveler information message in a traveler information packet, an OBU include a uniform resource locator (URL) for the traveler information message as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.7 -- Broadcast Traveler Information - Valid Vehicle Type	(Source: J3067, 3.5.8.3.10). For each traveler information message, a connected device shall include the vehicle types that the traveler advisory or road sign is valid for as part of a traveler information message broadcasted to connected vehicles.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.10) For each traveler information message, a connected device include the vehicle types that the traveler advisory or road sign is valid for as part of a traveler information message broadcasted to connected vehicles, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-2 -- Inspection of Environmental Sensor Certification and Test Documents	MV-REQ-1.1 -- Environmental Sensor Equipment	Environmental Sensor equipment shall conform to the characteristics described in Appendix A of the CAP	* Perform Test Case WOBUDOC-2 * Confirm Environmental Sensor equipment conforms to the characteristics described in Appendix A of the CAP. * Confirmation shows Environmental Sensor equipment conforms to the characteristics described in Appendix A of the CAP, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	RSU-REQ-3 -- SCMS	The Roadside Units shall interface with the USDOT SCMS, as defined in SCMS-REQ-1.	* Perform Test Case WRSUDOC-1 * Confirm RSU interfaces with the USDOT SCMS, as defined in SCMS-REQ-1 (Section 3.1.1). * Confirmation shows the Roadside Units interface with the USDOT SCMS, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	RSU-REQ-4 -- LTS	The Roadside Units shall interface with the USDOT LTS, as defined in LTS-REQ-1.	* Perform Test Case WRSUDOC-1 * Confirm RSU interfaces with the USDOT LTS, as defined in LTS-REQ-1 (Section 3.2). * Confirmation shows the Roadside Units interface with the USDOT LTS, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	RSU-REQ-13 -- RSU Equipment	Roadside Unit equipment shall conform to the characteristics described in Appendix A of the CAP.	* Perform Test Case WRSUDOC-1 * Confirm RSU conforms to the characteristics described in Appendix A of the CAP. * Confirmation shows Roadside Unit equipment conforms to the characteristics described in Appendix A of the CAP, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	CSC-REQ-3 -- RSU SCMS Use	All RSUs used in the Wyoming Pilot shall be certified from a US DOT authorized testing facility based on the SCMS current version CAMP Wiki: Requirements and Specifications.	* Perform Test Case WRSUDOC-1 * Confirm that all RSUs used in the Wyoming Pilot are certified from a US DOT authorized testing facility based on the SCMS current version CaMP Wiki: Requirements and Specifications, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	CSC-REQ-4 -- RSU Certification	All RSUs used in the Wyoming Pilot shall be certified from a US DOT authorized testing facility based on J2945/1.	* Perform Test Case WRSUDOC-1 * Confirm that all RSUs used in the Wyoming Pilot are certified from a US DOT authorized testing facility based on J2945/1. the following interfaces and requirements from J2945/1, at a minimum, will are included in the certification testing, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	CSC-REQ-5 -- RSU Specification	All RSUs used in the Wyoming Pilot shall be compliant with the following interfaces and requirements from DSRC Roadside Unit (RSU) Specifications Document v4.1. • Minimum Requirements o 3.4 Functional Requirements § USDOT_RSU-Req_513-v003 System Time: GPS primary o 3.4.8 Security § USDOT_RSU-Req_442-v002 Data Protection: NTP Secondary Time o 3.7.1.2 IEEE 1609.2 § USDOT_RSU-Req_579-v001 Secure Storage: HSM	* Perform Test Case WRSUDOC-1 * Confirm that all RSUs used in the Wyoming Pilot are compliant with the following interfaces and requirements from DSRC Roadside Unit (RSU) Specifications Document v4.1, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.1 -- Broadcast Traveler Information	(Source: J3067, 3.5.8.1). A connected device shall broadcast a packet containing traveler information to connected devices. Each packet may contain one or more individual traveler information messages.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.1) a connected device broadcast a packet containing traveler information to connected devices. Each packet may contain one or more individual traveler information messages, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.2.1 -- Broadcast Traveler Information - Packet Identifier	(Source: J3067, 3.5.8.2.1). A connected device shall include a packet identifier for the traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.2.1) a connected device include a packet identifier for the traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.2.2 -- Broadcast Traveler Information - Message Identifier Requirements	(Source: J3067, 3.5.8.2.2). For each traveler information message in a traveler information packet, a connected device needs to identify each message transmitted as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.2.2) For each traveler information message in a traveler information packet, a connected device needs to identify each message transmitted as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.2.2.1 -- Broadcast Traveler Advisories - Message Identifier	(Source: J3067, 3.5.8.2.2.1). For traveler advisories, a connected device shall include a message identifier for each traveler advisory message as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.2.2.1) For traveler advisories, a connected device include a message identifier for each traveler advisory message as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.2.2.2 -- Broadcast Road Sign - Message Identifier	(Source: J3067, 3.5.8.2.2.2). For road sign messages, the message identifier is determined by its geographic location and its viewing angle. Thus, for each road sign message, a connected device shall include the geographic location (latitude, longitude, elevation), based on the WGS-84 coordinate system, and the viewing angle of the road sign as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.2.2.2) For road sign messages, the message identifier is determined by its geographic location and its viewing angle. Thus, for each road sign message, a connected device include the geographic location (latitude, longitude, elevation), based on the WGS-84 coordinate system, and the viewing angle of the road sign as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.1 -- Broadcast Traveler Information - Validity Duration	(Source: J3067, 3.5.8.3.4). For each traveler information message in a traveler information packet, a connected device shall include the duration from the start time that the traveler message is valid for as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.4) For each traveler information message in a traveler information packet, a connected device include the duration from the start time that the traveler message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU	BC-REQ-3.3.2 -- Broadcast Traveler	(Source: J3067, 3.5.8.3.5). For each traveler information message in a traveler information packet, a connected device shall include the importance of the message relative to other	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.5) For each traveler information message in a traveler information packet, a connected device include the importance of the message relative to other traveler information messages being	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
Certification and Test Documents	Information – Importance	traveler information messages being broadcasted as part of a traveler information packet broadcasted to connected devices.	broadcasted as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3 -- Broadcast Traveler Information - Presentation Requirements	(Source: J3067, 3.5.8.3.6). Agencies may need to present traveler information messages only to specific travelers, such as travelers within specific geographic (spatial) regions or a direction of travel.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6) agencies may need to present traveler information messages only to specific travelers, such as travelers within specific geographic (spatial) regions or a direction of travel, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.1 -- Broadcast Traveler Information - Default Anchor Point Position	(Source: J3067, 3.5.8.3.6.1). For each traveler information message in a traveler information packet, a connected device shall include the geographic location (latitude, longitude, elevation) of the default anchor point for which valid regions are determined as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.1) For each traveler information message in a traveler information packet, a connected device include the geographic location (latitude, longitude, elevation) of the default anchor point for which valid regions are determined as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.2 -- Broadcast Traveler Information - Heading Slice	(Source: J3067, 3.5.8.3.6.2). For each traveler information message in a traveler information packet, a connected device shall include the direction of motion (of the connected device) that the message is valid for as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.2) For each traveler information message in a traveler information packet, a connected device include the direction of motion (of the connected device) that the message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.3 -- Broadcast Traveler Information - Circular Valid Region Requirements	(Source: J3067, 3.5.8.3.6.3). A spatial region for which a traveler information message is valid for may be a circular region around an anchor point. The connected device should be located within the circular region for the traveler information message to be presented to the traveler.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.3) a spatial region for which a traveler information message is valid for may are a circular region around an anchor point. the connected device should are located within the circular region for the traveler information message to are presented to the traveler, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.3.1 -- Broadcast Traveler Information - Circular Region – Radius	(Source: J3067, 3.5.8.3.6.3.1). For each traveler information message in a traveler information packet, a connected device shall include the radius for the circular region defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.3.1) For each traveler information message in a traveler information packet, a connected device include the radius for the circular region defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.3.2 -- Broadcast Traveler Information - Circular Region - Anchor Point	(Source: J3067, 3.5.8.3.6.3.2). For each traveler information message in a traveler information packet, a connected device shall include the geographic location (latitude, longitude, elevation) of the anchor point for the circular region of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.3.2) For each traveler information message in a traveler information packet, a connected device include the geographic location (latitude, longitude, elevation) of the anchor point for the circular region of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.4 -- Broadcast Traveler Information - Polygon Valid Region Requirements	(Source: J3067, 3.5.8.3.6.4). A spatial region for which a traveler information message is valid for may be a polygon, which may represent the jurisdictional boundaries of a specific transportation agency or a work zone. The connected device should be located within this polygon region for the traveler information message to be presented to the traveler.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.4) a spatial region for which a traveler information message is valid for may are a polygon, which may represent the jurisdictional boundaries of a specific transportation agency or a work zone. the connected device should are located within this polygon region for the traveler information message to are presented to the traveler, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.4.1 -- Broadcast Traveler Information - Polygon Region – Offsets	(Source: J3067, 3.5.8.3.6.4.1). For each traveler information message in a traveler information packet, a connected device shall include the area of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.4.1) For each traveler information message in a traveler information packet, a connected device include the area of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.4.2 -- Broadcast Traveler Information - Polygon Region - Anchor Point	(Source: J3067, 3.5.8.3.6.4.2). For each traveler information message in a traveler information packet, a connected device shall include the geographic location (latitude, longitude, elevation) of the anchor point for the area of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.4.2) For each traveler information message in a traveler information packet, a connected device include the geographic location (latitude, longitude, elevation) of the anchor point for the area of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.5 -- Broadcast Traveler Information - Valid Shape Point Set Region Requirements	(Source: J3067, 3.5.8.3.6.5). A spatial region for which a traveler information message is valid for may be a shape point set, which allows a spline-like representation of a geographic area such as a road segment. A connected device should be located within the shape point set region for the traveler information message to be presented to the traveler.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5) a spatial region for which a traveler information message is valid for may are a shape point set, which allows a spline-like representation of a geographic area such as a road segment. a connected device should are located within the shape point set region for the traveler information message to are presented to the traveler, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.5.1 -- Broadcast Traveler Information - Shape Point Set - Default Direction	(Source: J3067, 3.5.8.3.6.5.1). For each traveler information message in a traveler information packet, a connected device shall include the default direction of travel along the shape point set as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.1) For each traveler information message in a traveler information packet, a connected device include the default direction of travel along the shape point set as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.5.2 -- Broadcast Traveler Information - Shape Point Set - Default Width	(Source: J3067, 3.5.8.3.6.5.2). For each traveler information message in a traveler information packet, a connected device shall include the default width of the shape point set as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.2) For each traveler information message in a traveler information packet, a connected device include the default width of the shape point set as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.5.3 -- Broadcast Traveler Information - Shape Point Set – Offsets	(Source: J3067, 3.5.8.3.6.5.3). For each traveler information message in a traveler information packet, a connected device shall include the shape point set defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.3) For each traveler information message in a traveler information packet, a connected device include the shape point set defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.5.4 -- Broadcast Traveler Information - Shape Point Set – Direction	(Source: J3067, 3.5.8.3.6.5.4). For each shape point set in a traveler information message, a connected device shall include the allowed direction of travel along the shape point set as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.4) For each shape point set in a traveler information message, a connected device include the allowed direction of travel along the shape point set as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.5.5 -- Broadcast Traveler Information - Shape Point Set – Width	(Source: J3067, 3.5.8.3.6.5.5). For a shape point set in a traveler information message, a connected device shall include the width for the shape point set as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.5) For a shape point set in a traveler information message, a connected device include the width for the shape point set as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.5.6 -- Broadcast Traveler Information - Shape Point Set - Node Width	(Source: J3067, 3.5.8.3.6.5.6). For a shape point offset in a traveler information message, a connected device shall include the width of the geographic area at that node as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.6) For a shape point offset in a traveler information message, a connected device include the width of the geographic area at that node as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.5.7 -- Broadcast Traveler Information -	(Source: J3067, 3.5.8.3.6.5.7). For each shape point set in a traveler information message, a connected device shall include the geographic location (latitude, longitude, elevation) of the anchor point for the shape point set defining where the traveler information message is valid	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.7) For each shape point set in a traveler information message, a connected device include the geographic location (latitude, longitude, elevation) of the anchor point for the shape point set defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
	Shape Point Set - Anchor Point	for as part of a traveler information packet broadcasted to connected devices.		
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.4 -- Broadcast Traveler Advisories – Content	(Source: J3067, 3.5.8.3.7). For traveler advisory message in a traveler information packet, a connected device shall include the contents of the travel advisory information as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.7) For traveler advisory message in a traveler information packet, a connected device include the contents of the travel advisory information as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.5 -- Broadcast Road Sign – Content	(Source: J3067, 3.5.8.3.8). For each road sign message in a traveler information packet, a connected device shall include the road sign information as part of a traveler information packet broadcasted to connected devices	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.8) For each road sign message in a traveler information packet, a connected device include the road sign information as part of a traveler information packet broadcasted to connected device, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.6 -- Broadcast Traveler Information	(Source: J3067, 3.5.8.3.10). For each traveler information message, a connected device shall include the vehicle types that the traveler advisory or road sign is valid for as part of a traveler information message broadcasted to connected vehicles.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.10) For each traveler information message, a connected device include the vehicle types that the traveler advisory or road sign is valid for as part of a traveler information message broadcasted to connected vehicles, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	MNG-REQ-1.6.1 -- Maximum Transmission Rate - Broadcast Traveler Information	(Source: J3067, G.2.11.1). An RSU shall broadcast a traveler information message to connected devices no more than once per second.	* Perform Test Case WRSUDOC-1 * Confirm (Source: J3067, G2111) an RSU broadcasts a traveler information message to connected devices no more than once per second * Confirmation shows (Source: J3067, G2111) an RSU broadcasts a traveler information message to connected devices no more than once per second, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	MNG-REQ-1.6.2 -- Default Transmission Rate - Broadcast Traveler Information	(Source: J3067, G.2.11.2). If the specification does not indicate a default transmission rate, the suggested default transmission rate for an RSU to broadcast a traveler information message to connected devices once per second. If there is no need for an RSU to broadcast a message, then it recommended that no messages be transmitted from the RSU	* Perform Test Case WRSUDOC-1 * Confirm (Source: J3067, G.2.11.2). If the specification does not indicate a default transmission rate, the suggested default transmission rate for an RSU to broadcast a traveler information message to connected devices once per second. If there is no need for an RSU to broadcast a message, then it recommended that no messages be transmitted from the RSU to minimize traffic, i.e., congestion. Otherwise, it is recommended that an RSU transmit a broadcast message frequently enough to ensure that the connected device for which the message is intended, traveling at the expected percentile speed would be within the transmission zone for at least three or four broadcasts. * Confirmation shows (Source: J3067, G2112) If the specification does not indicate a default transmission rate, the	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		to minimize traffic, i.e., congestion. Otherwise, it is recommended that an RSU transmit a broadcast message frequently enough to ensure that the connected device for which the message is intended, traveling at the expected percentile speed would be within the transmission zone for at least three or four broadcasts.	suggested default transmission rate for an RSU to broadcast a traveler information message to connected devices once per second If there is no need for an RSU to broadcast a message, then it recommended that no messages be transmitted from the RSU to minimize traffic, i.e., congestion Otherwise, it is recommended that an RSU transmit a broadcast message frequently enough to ensure that the connected device for which the message is intended, traveling at the expected percentile speed would be within the transmission zone for at least three or four broadcasts, thereby verifying the requirement is satisfied.	
WODEDOC-1 -- Inspection of ODE Design and Test Documents	ODE-REQ-2 -- Data Processing	The Operational Data Environment shall provide the VISA-related functions of CV Data as defined in Section 3.1.4.1 of the SDD.	WODEDOC-1 Verified by inspection of ODE certification and test documents. * Obtain ODE Certification and test documents from Vendor. * Verify ODE provide VISA-related functions of CV Data as defined in Section 3.1.4.1 of the SDD. * Verify requirement is satisfied.	Requirement Verification Confirmed by:
WODEDOC-1 -- Inspection of ODE Design and Test Documents	ODE-REQ-4 -- SCMS	The Operational Data Environment shall interface with the USDOT SCMS, as defined in SCMS-REQ-1.	* Perform Test Case WODEDOC-1 * Confirm ODE interfaces with the USDOT SCMS, as defined in SCMS-REQ-1 (Section 3.1.1). * Confirmation shows the Operational Data Environment interface with the USDOT SCMS, as defined in SCMS-REQ-1, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WODEDOC-1 -- Inspection of ODE Design and Test Documents	ODE-REQ-5 -- LTS	The Operational Data Environment shall interface with the USDOT LTS, as defined in LTS-REQ-1.	* Perform Test Case WODEDOC-1 * Confirm ODE interfaces with the USDOT LTS, as defined in LTS-REQ-1 (Section 3.2). * Confirmation shows the Operational Data Environment interface with the USDOT LTS, as defined in LTS-REQ-1, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDWDOC-1 -- Inspection of DW Design and Test Documents	DW-REQ-3.1 -- Maintain System Data Tables	The DW shall maintain (i.e., update data columns for additional data fields as necessary, build views for authorized audiences needing to interact with the data) tables of data coming from connected vehicles and other sources used by the connected vehicle pilot.	* Perform Test Case WDWDOC-1 * Confirm the DW maintains (e.g., update data columns for additional data fields as necessary, build views for authorized audiences needing to interact with the data) tables of data coming from connected vehicles and other sources used by the connected vehicle pilot * Confirmation shows the DW maintain (e.g., update data columns for additional data fields as necessary, build views for authorized audiences needing to interact with the data) tables of data coming from connected vehicles and other sources used by the connected vehicle pilot, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDWDOC-1 -- Inspection of DW Design and Test Documents	DW-REQ-3.1.1 -- CVE Data	The DW shall maintain the tables for CVE Data. This includes space for data from BSM related application data, driver/fleet related data, and performance management data.	* Perform Test Case WDWDOC-1 * Confirm the DW maintains the tables for CVE Data. This includes space for data from BSM related application data, driver/fleet related data, and performance management data * Confirmation shows the DW maintain the tables for CVE Data. This includes space for data from BSM related	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			application data, driver/fleet related data, and performance management data, thereby verifying the requirement is satisfied.	
WDWDOC-1 -- Inspection of DW Design and Test Documents	DW-REQ-3.2 -- Manage Data Storage Security	The Data Warehouse shall have a designated TMC data storage administrator who will maintain security for data collected by the CV pilot within compliance of Sections 7(D), 7(E), 7(F), 7(G) and Appendix 11 – SMOC (Section 6.2) of the Institutional Review Board (University of Wyoming, 2016).	* Perform Test Case WDWDOC-1 * Confirm the Data Warehouse has a designated TMC data storage administrator who will maintain security for data collected by the CV pilot within compliance of Sections 7(D), 7(E), 7(F), 7(G) and Appendix 11 Section 62 of the Institutional Review Board * Confirmation shows the Data Warehouse has a designated TMC data storage administrator who will maintain security for data collected by the CV pilot within compliance of Sections 7(D), 7(E), 7(F), 7(G) and Appendix 11 Section 62 of the Institutional Review Board, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDWDOC-1 -- Inspection of DW Design and Test Documents	DW-REQ-3.2.1 -- User Access	The DW shall be implemented to control granular access to the CV data storage at the column to the table space resolution to people with a need to know and that have been approved by the WYDOT program manager.	* Perform Test Case WDWDOC-1 * Confirm the DW is implemented to control granular access to the CV data storage at the column to the table space resolution to people with a need to know and that have been approved by the WYDOT program manager * Confirmation shows the DW is implemented to control granular access to the CV data storage at the column to the table space resolution to people with a need to know and that have been approved by the WYDOT program manager, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDWDOC-1 -- Inspection of DW Design and Test Documents	DW-REQ-3.2.2 -- Unauthorized Access	The DW shall be implemented to notify the TMC administrator of attempted access by unauthorized personnel to the CV data storage to all users that have not been specifically approved by the WYDOT program manager.	* Perform Test Case WDWDOC-1 * Confirm the DW is implemented to notify the TMC administrator of attempted access by unauthorized personnel to the CV data storage to all users that have not been specifically approved by the WYDOT program manager * Confirmation shows the DW is implemented to notify the TMC administrator of attempted access by unauthorized personnel to the CV data storage to all users that have not been specifically approved by the WYDOT program manager, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDWDOC-1 -- Inspection of DW Design and Test Documents	DW-REQ-3.3 -- Manage Data System	The Data Warehouse shall have a designated TMC data storage administrator who will manage the data systems for the CV pilot.	* Perform Test Case WDWDOC-1 * Confirm the Data Warehouse has a designated TMC data storage administrator who will manage the data systems for the CV pilot * Confirmation shows the Data Warehouse has a designated TMC data storage administrator who will manage the data systems for the CV pilot , thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDWDOC-1 -- Inspection of DW Design and Test Documents	DW-REQ-3.3.1 -- System Back-ups	The DW shall provide the TMC administrator the ability to back up the data, provided by the WYDOT CV System, using WYDOT best practices for data protection, as stated in Section 2.5 of the Data Management Plan (FHWA-JPO-17-470) (Kitchener et al., 2017).	* Perform Test Case WDWDOC-1 * Confirm the DW provides the TMC administrator the ability to back up the data, provided by the WYDOT CV System, using WYDOT best practices for data protection, as stated in Section 25 of the Data Management Plan * Confirmation shows the DW provide the TMC administrator the ability to back up the data, provided by the WYDOT CV System, using WYDOT best practices for data protection, as stated in Section 25 of the Data Management Plan, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		This will be done for the development, test, quality assurance and production environments.		
WDWDOC-1 -- Inspection of DW Design and Test Documents	DW-REQ-3.3.2 -- Import/Export	The DW shall provide the TMC administrator the ability to perform import/export operation as needed for the CV pilot data.	* Perform Test Case WDWDOC-1 * Confirm the DW provides the TMC administrator the ability to perform import/export operation as needed for the CV pilot data * Confirmation shows the DW provides the TMC administrator the ability to perform import/export operation as needed for the CV pilot data, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDWDOC-1 -- Inspection of DW Design and Test Documents	DW-REQ-3.3.3 -- Version Control	The DW shall provide the TMC administrator the ability to maintain version control for the data systems in use by the CV pilot.	* Perform Test Case WDWDOC-1 * Confirm the DW provides the TMC administrator the ability to maintain version control for the data systems in use by the CV pilot * Confirmation shows the DW provides the TMC administrator the ability to maintain version control for the data systems in use by the CV pilot, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDWDOC-1 -- Inspection of DW Design and Test Documents	DW-REQ-3.4 -- Manage Data Archive	The DW shall provide the TMC administrator the ability to archive data used by the CV pilot data to be retained using WYDOT best practices for data archival, as stated in Section 2.5 of the Data Management Plan (FHWA-JPO-17-470) (Kitchener et al., 2017).	* Perform Test Case WDWDOC-1 * Confirm the DW provides the TMC administrator the ability to archive data used by the CV pilot data to be retained using WYDOT best practices for data archival, as stated in Section 25 of the Data Management Plan * Confirmation shows the DW provide the TMC administrator the ability to archive data used by the CV pilot data to be retained using WYDOT best practices for data archival, as stated in Section 25 of the Data Management Plan, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	SCMS-REQ-1 -- Wyoming CV System (WCVS) SCMS Use	The Wyoming CV System shall interface with the USDOT SCMS based on the requirements in the current version of the Security Credential Management System Proof-of-Concept Implementation EE Requirements and Specifications Supporting SCMS Software (available at https://wiki.campllc.org/display/SCP/SCMS+CV+Pilots+Documentation).	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: SCMS-REQ-1.1-WI2VSAT-1-REP SCMS-REQ-1.2-WI2VSAT-1-REP SCMS-REQ-1.3-WI2VSAT-1-REP SCMS-REQ-1.4-WI2VSAT-1-REP RSU-REQ-3-WRSUDOC-1 ODE-REQ-4-WODEDOC-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	SCMS-REQ-2 -- Vehicle System SCMS Use	The Vehicle System used in the Wyoming Pilot shall be certified from a USDOT authorized testing facility based on the current version of the Security Credential Management System Proof-of-Concept Implementation EE Requirements and Specifications Supporting	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: SCMS-REQ-2.1-WV2IMCT-2(WFCWT-1) SCMS-REQ-2.2-WEXTSS-SCMSCRL SCMS-REQ-2.3-WEXTSS-SCMSCRL SCMS-REQ-2.4-WEXTSS-SCMSCRL	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		SCMS Software (available at https://wiki.campllc.org/display/SCP/SCMS+CV+Pilots+Documentation).		
Verified by Subrequirements or Peer Requirements	SDC-REQ-1 -- Data Provided to the SDC	The Wyoming CV System shall transmit information to the Secure Data Commons.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: ODE-REQ-3.6- WV2IMCT-2(WFCWT-1) DW-REQ-2.2-WI2VMCT-1(WI2VSAT-1-REP)	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	LTS-REQ-1 -- WCVS Time	The Wyoming CV System shall acquire time as specified below.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: LTS-REQ-1.1 - WI2VSAT-1-REP LTS-REQ-1.2 - WI2VSAT-1-REP RSU-REQ-4-WRSUDOC-1 ODE-REQ-5-WODEDOC-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	511-REQ-1 -- 511App Parking Data Collection	The Wyoming CV System shall receive parking status data from Wyoming 511 App.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: 511-REQ-1.1-WEXTSS-511 511-REQ-1.2-WEXTSS-511 511-REQ-1.3-WEXTSS-511 511-REQ-1.4-WEXTSS-511 511-REQ-1.5-WEXTSS-511 511-REQ-1.6-WEXTSS-511	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	TRAC-REQ-1 -- TRAC Updates	The Wyoming CV System shall transmit CV pilot events to the TRAC.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: TRAC-REQ-1.1-WDNR-1 TRAC-REQ-1.2-Multiple Subrequirement Test Cases	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	TRAC-REQ-1.2 -- Segment Alerts	The Wyoming CV System shall transmit segment-level alerts, defined in WCVS-REQ-4, to TRAC.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: TRAC-REQ-1.2.1-WI2VSAT-1-REP TRAC-REQ-1.2.2-WI2VSAT-1-Pikalert	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	RCRS-REQ-1 -- RCRS Data Sharing	The Wyoming CV System shall receive road condition information from the RCRS.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: RCRS-REQ-1.1 - WI2VSAT-1-RCRS RCRS-REQ-1.2 - WI2VSAT-1-RCRS RCRS-REQ-1.3 - WI2VSAT-1-RCRS RCRS-REQ-1.4 - WI2VSAT-1-RCRS	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			RCRS-REQ-1.5 - WI2VSAT-1-RCRS RCRS-REQ-1.6 - WI2VSAT-1-RCRS	
Verified by Subrequirements or Peer Requirements	WTI-REQ-1 -- WTI Inputs	The Wyoming CV System shall transmit CV Pilot event information to the WTI.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WTI-REQ-1.1-Multiple Subrequirement Test Cases WTI-REQ-1.2-WI2VSAT-1-Pikalert	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	WTI-REQ-1.1 -- Current Segment Alerts	The Wyoming CV System shall transmit current segment-specific alerts, defined in WCVS-REQ-4, to the WTI.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WTI-REQ-1.1.1-WI2VSAT-1-Pikalert	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	WTI-REQ-1.2 -- Forecast Segment Alerts	The Wyoming CV System shall transmit forecast segment-specific alerts, defined in WCVS-REQ-5, to the WTI.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WTI-REQ-1.2.1-WI2VSAT-1-Pikalert WTI-REQ-1.2.2-WI2VSAT-1-Pikalert	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	WTI-REQ-2 -- WTI Outputs	The Wyoming CV System shall receive the current information for corridor roadway segments available from the WTI within five minutes of generation. Roadway segments are defined by WYDOT as sections of roadway between variable mileposts.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WTI-REQ-2.1-WI2VSAT-1-WTI-Speed WTI-REQ-2.2-WI2VSAT-1-WTI-Restriction WTI-REQ-2.3-WI2VSAT-1-WTI-DMS WTI-REQ-2.4-WI2VSAT-1-WTI-Closure	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	WTI-REQ-2.2 -- Vehicle Restrictions	The Wyoming CV System shall receive the notification of vehicle restrictions that have been set for a roadway segment	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WTI-REQ-2.2.1-WI2VSAT-1-WTI-Restriction WTI-REQ-2.2.2-WI2VSAT-1-WTI-Restriction	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	WTI-REQ-2.4 -- Posted Closures	The Wyoming CV System shall receive the notification of closures that have been set for a roadway segment	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WTI-REQ-2.4.1-WI2VSAT-1-WTI-Closure WTI-REQ-2.4.2-WI2VSAT-1-WTI-Closure WTI-REQ-2.4.3-WI2VSAT-1-WTI-Closure	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	CVOP-REQ-1 -- CVOP Inputs	The Wyoming CV System shall transmit CV Pilot event information to the CVOP.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: CVOP-REQ-1.1-Multiple Subrequirement Test Cases CVOP-REQ-1.2-WI2VSAT-1-Pikalert	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
Verified by Subrequirements or Peer Requirements	CVOP-REQ-1.1 -- Current Segment Alerts	The Wyoming CV System shall transmit current segment-specific alerts, defined in WCVS-REQ-4, to the CVOP.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: CVOP-REQ-1.1.1-WI2VSAT-1-Pikalert	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	CVOP-REQ-1.2 -- Forecast Segment Alerts	The Wyoming CV System shall transmit forecast segment-specific alerts, defined in WCVS-REQ-5, to the CVOP.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: CVOP-REQ-1.2.1-WI2VSAT-1-Pikalert CVOP-REQ-1.2.2-WI2VSAT-1-Pikalert	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	ITSM-REQ-1 -- WYDOT ITS Alerts	The Wyoming CV System shall send alerts, defined in WCVS-REQ-16, to the WYDOT ITS Maintenance team within five minutes of a system becoming unavailable.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-16-WSYSAA-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	WCVS-REQ-1 -- Collect CV Data	The Wyoming CV System shall collect data from the Vehicle System.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-1.1-WV2IMCT-2 WCVS-REQ-1.2-WV2IMCT-2 WCVS-REQ-1.3-WDNR-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	VS-REQ-2 -- Receive TIM	The Vehicle System shall wirelessly receive a packet containing traveler information from the Wyoming CV System. Each packet may contain one or more individual traveler information message as defined in Section 5.16 of SAE J2735.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-2.1-WI2VMCT-1 VS-REQ-2.2-WI2VMCT-2	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	WCVS-REQ-3 -- Ingest Data for Road Weather information	The Wyoming CV System shall use one or more of the following sources of data to generate road weather information: • Collected CV Information defined in WCVS-REQ-1. • Segment road and weather conditions from the WYDOT RCRS in RCRS-REQ-1. • Weather conditions from weather interfaces defined in WI-REQ-1 and WI-REQ-2.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: RCRS-REQ-1-WI2VSAT-1-RCRS WI-REQ-1-WI2VSAT-1-Pikalert WI-REQ-2-WI2VSAT-1-Pikalert WCVS-REQ-1-WV2IMCT-2&WDNR-1	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
Verified by Subrequirements or Peer Requirements	WCVS-REQ-4 -- Contents of Alerts and Advisories	The Wyoming CV System shall generate alerts and advisories of roadway hazard conditions as defined in the following requirements.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-4.1-WI2VSAT-1-Pikalert WCVS-REQ-4.2-WI2VSAT-1-Pikalert WCVS-REQ-4.3-WI2VSAT-1-Pikalert WCVS-REQ-4.4-WI2VSAT-1-CA WCVS-REQ-4.5-WI2VSAT-1-IC WCVS-REQ-4.6-WI2VSAT-1-511	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	WCVS-REQ-5 -- Forecast Conditions	The Wyoming CV System shall generate forecasts of conditions as defined in the following requirements	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-5.1-WI2VSAT-1-Pikalert WCVS-REQ-5.2-WI2VSAT-1-Pikalert WCVS-REQ-5.3-WI2VSAT-1-Pikalert WCVS-REQ-5.4-WI2VSAT-1-Pikalert	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	WCVS-REQ-7 -- External Brokerage with WYDOT Interfaces	The Wyoming CV System shall transfer data with WYDOT systems as defined in WCVS-REQ-7.1 and WCVS-REQ-7.2.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-7.1-Multiple Test Cases WCVS-REQ-7.2-Multiple Test Cases	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	WCVS-REQ-7.1 -- Receive from WYDOT External Interfaces	The Wyoming CV System shall receive data from WYDOT systems as defined in 511-REQ-1, RCRS-REQ-1, WTI-REQ-2, IC-REQ-1, and CA-REQ-1.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: DB-REQ-1-Multiple WI2VSAT-1-Test Cases	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	WCVS-REQ-7.2 -- Distribute to WYDOT External Interfaces	The Wyoming CV System shall distribute information to WYDOT systems as defined in TPI-REQ-1, TRAC-REQ-1, WTI-REQ-1, CVOP-REQ-1, and ITSM-REQ-1.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: DB-REQ-2-Multiple WI2VSAT-1-Test Cases	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	WCVS-REQ-8 -- Internal Brokerage	The Wyoming CV System shall support internal brokerage of data as defined in RSU-REQ-1, RSU-REQ-2, ODE-REQ-1, ODE-REQ-3, PA-REQ-2, PA-REQ-4, DB-REQ-4, DB-REQ-5, DB-REQ-6, DB-REQ-7, DW-REQ-1, DW-REQ-2, DW-REQ-4, HSM-REQ-1, HSM-REQ-2, HSM-REQ-3, and HSM-REQ-4.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: RSU-REQ-1-WV2IMCT-2 RSU-REQ-2-WV2IMCT-2 ODE-REQ-1-WV2IMCT-2 ODE-REQ-1.1-WV2IMCT-2 ODE-REQ-3-WV2IMCT-1,2,3 ODE-REQ-7-WV2IMCT-1 PA-REQ-2-WV2IMCT-2	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			DB-REQ-4-WI2VSAT-1-Pikalert DB-REQ-5-WI2VSAT-1-REP DB-REQ-6-WV2IMCT-1 DB-REQ-7-WI2VSAT-1-Pikalert DW-REQ-1-Multiple WI2VSAT-1-Test Cases DW-REQ-2-Multiple WI2VSAT-1-Test Cases HSM-REQ-1-WI2VMCT-1(WI2VSAT-1-REP) HSM-REQ-2-WI2VMCT-1(WI2VSAT-1-REP) HSM-REQ-3-WI2VMCT-1(WI2VSAT-1-REP) HSM-REQ-4-WI2VMCT-1(WI2VSAT-1-REP)	
Verified by Subrequirements or Peer Requirements	WCVS-REQ-10 -- Distribute TIM	The Wyoming CV System shall distribute signed TIMs to the Vehicle System and the Situational Data Warehouse (SDW).	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-10.1-WI2VSAT-1-REP WCVS-REQ-10.2-WI2VSAT-1-5	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	WCVS-REQ-10.2 -- Distribute TIM to SDW	The Wyoming CV System shall distribute signed TIM to the SDW consistent with Section 3.5.8 (Traveler Information Requirements) of J3067. The SDW may not be available going forward. This requirement is for general compliance with the national communication of TIMs and is one way that the Wyoming pilot can get TIMs to third parties for broader distribution. If the SDW becomes unavailable, the pilot can directly send TIMs to the third parties for distribution. The SDW is not required for the Wyoming pilot.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: SDW-REQ-1-WI2VSAT-5	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	WCVS-REQ-11 -- Store VS Data	The Wyoming CV System shall store processed data collected by the Vehicle Systems and retain it for the duration of the CV Pilot. Data Processing is defined in ODE-REQ-2.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-11.1-WV2IMCT-2 WCVS-REQ-11.2-WV2IMCT-2 WCVS-REQ-11.3-WDNR-1	Requirement Verification Confirmed by:
Verified by Subrequirements	WCVS-REQ-12 -- Store	The Wyoming CV System shall store generated road weather alerts and advisories (defined	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: DW-REQ-1.1-WI2VSAT-1	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
or Peer Requirements	Generated Alerts/Advisories	WCVS-REQ-4) and retained for the duration of the CV Pilot.		
Verified by Subrequirements or Peer Requirements	WCVS-REQ-13 - - Store TIM	The Wyoming CV System shall store TIMs distributed to the Vehicle System and the Situational Data Warehouse (SDW) and retain it for the duration of the CV Pilot.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: DW-REQ-1.3-WI2VSAT-1-REP	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	WCVS-REQ-14 - - Store System Monitoring Data	The Wyoming CV System shall store system monitoring data, as defined by WCVS-REQ-16 Monitored Functions, and retain it for the duration of the CV Pilot.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: DW-REQ-1.4-WSYSAA-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	WCVS-REQ-15 - - Notifications	The Wyoming CV System shall notify designated personnel within five minutes of a monitored function becoming unavailable	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-16-WSYSAA-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	WCVS-REQ-16 - - Monitored Functions	The Wyoming CV System shall monitor the functions described in WCVS-REQ-16.1 through WCVS-REQ-16.4.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-16.1-WSYSAA-1 WCVS-REQ-16.2-WSYSAA-1 WCVS-REQ-16.3-WSYSAA-1 WCVS-REQ-16.4-WSYSAA-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	WCVS-REQ-18 - - Management and Performance Policy	The Wyoming CV System's infrastructure-related elements shall manage the policy for data collection and performance data following requirements defined in Appendix B.4 RSU Performance Data of the SyRS.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: MNG-REQ-1-WRSUDOC-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	WCVS-REQ-20 - - Manage Safe Communications	The Wyoming CV System's infrastructure-related elements shall conform to the core safety communications requirements defined in Appendix B.2 V2I Core Safety Communication Requirements of the SyRS.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: CSC-REQ-3-WRSUDOC-1 CSC-REQ-4-WRSUDOC-1 CSC-REQ-5-WRSUDOC-1	Requirement Verification Confirmed by:
Verified by Subrequirements	WCVS-REQ-25 - - Update VS Equipment	The Wyoming CV System shall provide the TMC administrator the ability to push out OTA updates to the OBU firmware.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: ODE-REQ-6-WEXTSS-OTA	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
or Peer Requirements				
Verified by Subrequirements or Peer Requirements	VS-REQ-2 -- Receive TIM	The Vehicle System shall wirelessly receive a packet containing traveler information from the Wyoming CV System. Each packet may contain one or more individual traveler information message as defined in Section 5.16 of SAE J2735.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-2.1-WI2VMCT-1 VS-REQ-2.2-WI2VMCT-2	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	VS-REQ-4 -- Collect Vehicle Data	The Vehicle System shall have the capability to collect vehicle information from the host vehicle and the driver as stated below	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-4.1-WV2IMCT-2 VS-REQ-4.2-WV2IMCT-2	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	VS-REQ-4.2 -- Collect Dimension Data	The Vehicle System shall have the capability to collect information from the host vehicle driver. The VS will maintain these values across power cycles and OTA updates. The data will be included in BSMs broadcasted by the Vehicle System. The list of fields which must be input are shown in Table 7-1 of the ICD, where column #1 contains the value "yes/driver".	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-4.2.1-WV2IMCT-2(WFCWT-1) VS-REQ-4.2.2-WV2IMCT-2(WFCWT-1)	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	VS-REQ-6 -- FCW Stopped Vehicles	The Vehicle System shall ingest BSM Parts I and II data received from remote vehicles to identify stopped remote vehicles directly ahead in the same lane and direction of travel (defined in J2945/1 section 4.2.4.2 (a)). Data ingest is defined as obtaining and importing data for use or storage.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: FCWP-REQ-1 - Test Case WFCWT-1 FCWP-REQ-2 - Test Case WFCWT-1 FCWP-REQ-6 - Test Case WFCWT-5 FCWP-REQ-7 - Test Case WFCWT-5 FCWP-REQ-8 - Test Case WFCWT-6	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	VS-REQ-7 -- FCW Decelerating/Slow Moving Vehicles	The Vehicle System shall ingest BSM Parts I and II data received from remote vehicles to identify decelerating or slower moving remote vehicles directly ahead in the same lane and direction of travel (defined in J2945/1 section	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: FCWP-REQ-5 - Test Case WFCWT-4 FCWP-REQ-9 - Test Case WFCWT-8 FCWP-REQ-10 - Test Case WFCWT-8	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		4.2.4.2 (c)). Data ingest is defined as obtaining and importing data for use or storage		
Verified by Subrequirements or Peer Requirements	VS-REQ-9 -- FCW Rear-End Crash	The Vehicle System shall ingest BSM Parts I and II data received from remote vehicles to identify imminent danger of a rear-end crash with a remote vehicle in its lane of travel (defined in J2945/1 section 4.2.4.3). Data ingest is defined as obtaining and importing data for use or storage.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-9.1 - Test Case WFCWT-5 VS-REQ-9.2 - Test Case WFCWT-5	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	VS-REQ-10 -- FCW No Warning	The Vehicle System shall ingest BSM Parts I and II data received from remote vehicles to identify when there is no need to display a warning on the HMI of the host vehicle. Data ingest is defined as obtaining and importing data for use or storage.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-10.1 - WVCWT-3 VS-REQ-10.2 - WVCWT-2 FCWP-REQ-3 - WVCWT-2 FCWP-REQ-4 - WVCWT-3	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	VS-REQ-15 -- Distress Notification ID	The Vehicle System shall identify received distress notifications. Distress information is a high priority messages loosely based on the mayday broadcast (defined in J3067 3.5.9.2.1), but has the content of the TIM (defined in J2735 5.16 Part III advisory ITIS data elements 6.1 from J2540_2 Accidents and Incidents).	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-15.1 - WDNR-2	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	VS-REQ-27 -- IVAA DN	The Vehicle System shall alert the vehicle operator for a distress message when the direction of travel of the host vehicle moving toward the distressed vehicle and is within five miles of the location of a distressed vehicle using an inform message. Distress Notification functionality is described in Section 2.6.3 of the SyRS.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: DNP-REQ-5 - WDNR-1 DNP-REQ-6 - WDNR-1 DNP-REQ-7 - WDNR-2 DNP-REQ-8 - WDNR-2	Requirement Verification Confirmed by:
Verified by Subrequirements	VS-REQ-32 -- HMI Characteristics	All Vehicle Sub-Systems shall contain a HMI that conforms to the following characteristics.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-32.1-WOBUDOC-1 VS-REQ-32.2-WOBUDOC-1	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
or Peer Requirements			VS-REQ-32.3-WOBUDOC-1 VS-REQ-32.4-WOBUDOC-1 VS-REQ-32.5-WOBUDOC-1 VS-REQ-32.6-WOBUDOC-1 VS-REQ-32.7-WOBUDOC-1 VS-REQ-32.8-WOBUDOC-1	
Verified by Subrequirements or Peer Requirements	VS-REQ-32.4 -- Visual and Auditory Interface	The HMI shall include both a visual and auditory interface for sharing traveler information	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-32.4.1-WOBUDOC-1 VS-REQ-32.4.2-WOBUDOC-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	VS-REQ-32.6 -- System Status	The HMI shall provide system status information to drivers. Information included in the system status includes power status, system settings, status of applications availability, and pending update status	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-32.6.1-WOBUDOC-1 VS-REQ-32.6.2-WOBUDOC-1 VS-REQ-32.6.3-WOBUDOC-1 VS-REQ-32.6.4-WOBUDOC-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	VS-REQ-32.8 -- Non-Distress Information	The HMI shall allow the driver to input data, as defined in VS-REQ-4.2	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-4.2-WV2IMCT-2	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	VS-REQ-34 -- BCVI Distress	The Vehicle System shall wirelessly broadcast distress messages to other connected devices.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-34.1 - WDNR-2 VS-REQ-34.2 - WDNR-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	VS-REQ-36 -- Transmit Data	The Vehicle System shall transmit data over DSRC.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-36.1-WV2IMCT-3 VS-REQ-36.2-WV2IMCT-4(WFCWT-1)	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	VS-REQ-49 -- Architectural	All Vehicle Sub-systems shall follow all core architectural requirements defined in Appendix A.2 OBU Core Architecture Requirements of the SyRS.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: ARQ-REQ-1	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
Verified by Subrequirements or Peer Requirements	VS-REQ-50 -- Safety Communication	All Vehicle Sub-systems shall follow all core safety communication requirements defined in Appendix A.3 V2V Core Safety Communication Requirements of the SyRS.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: CSC-REQ-1-WOBUDOC-1 CSC-REQ-2-WOBUDOC-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	RSU-REQ-1 -- Collect CV Data	The Roadside Units shall collect data from the Vehicle System, as defined in WCVS-REQ-1.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-1-WV2IMCT-2	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	RSU-REQ-2 -- Distribute TIM to VS	The Roadside Units shall distribute TIMs received from the ODE to the Vehicle System, as defined in WCVS-REQ-10.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-10-WI2VSAT-1-REP	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	RSU-REQ-6 -- Safety Communication	The Roadside Units shall follow all core safety communication requirements defined in Appendix B.2 V2I Core Safety Communication Requirements of the SyRS.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: CSC-REQ-3-WRSUDOC-1 CSC-REQ-4-WRSUDOC-1 CSC-REQ-5-WRSUDOC-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	RSU-REQ-7 -- Broadcast	The Roadside Units shall broadcast information following all requirements defined in Appendix B.3 RSU Broadcast Traveler Information of the SyRS.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: BC-REQ-3-WRSUDOC-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	RSU-REQ-10 -- Management and Performance	The Roadside Units shall manage the policy for data collection and performance data following all requirements defined in Appendix B.4 RSU Performance Data of the SyRS.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: MNG-REQ-1-WRSUDOC-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	ODE-REQ-1 -- Collect CV Data	The Operational Data Environment shall collect Vehicle System data, defined in WCVS-REQ-1, from the RSU and/or the Vehicle System.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-1-WV2IMCT-2	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	ODE-REQ-3 -- Distribute Data	The Operational Data Environment shall distribute processed CV information to other External Interfaces, Systems, and Sub-systems.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: ODE-REQ-3.1-WI2VSAT-1-REP ODE-REQ-3.2-WI2VSAT-5 ODE-REQ-3.3-WV2IMCT-2	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			ODE-REQ-3.4-WV2IMCT-2&WDNR-1 ODE-REQ-3.5-WDNR-1 ODE-REQ-3.6-WV2IMCT-2 ODE-REQ-3.7-WV2IMCT-2	
Verified by Subrequirements or Peer Requirements	ODE-REQ-3.1 -- Distribute TIM to RSU	The Operational Data Environment shall distribute TIMs to the RSU, to be later transmitted to the Vehicle System, as defined WCVS-REQ-10.1.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-10.1-WI2VSAT-1-REP	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	ODE-REQ-3.2 -- Distribute TIM to SDW	The Operational Data Environment shall distribute TIMs to the Situational Data Warehouse, as defined in WCVS-REQ-10.2.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-10.2-WI2VSAT-5	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	ODE-REQ-3.4 -- Distribute to Data Warehouse	The Operational Data Environment shall distribute all collected and processed information to the Data Warehouse, as described in Section 5.20 of the ICD.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: ODE-REQ-3.4.1-WV2IMCT-2 ODE-REQ-3.4.2-WDNR-1 ODE-REQ-3.4.3-WV2IMCT-2	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	ODE-REQ-8 -- Generate TIM for Connected Vehicles	The ODE shall generate traveler information messages (TIMs), as defined in J2735 (5.16 Message: MSG_Traveler Information Message (TIM)).	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-9-WI2VSAT-1-REP	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	PA-REQ-1 -- External Weather Data	The Pikalert System shall receive weather information, as defined in WI-REQ-1 and WI-REQ-2.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WI-REQ-1-WI2VSAT-1-Pikalert WI-REQ-2-WI2VSAT-1-Pikalert	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	PA-REQ-2 -- Wyoming CV Sub-Systems Data	The Pikalert System shall receive information from other Wyoming CV Sub-systems.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: PA-REQ-2.1-WV2IMCT-2 PA-REQ-2.2-WEXTSS-CAM	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	PA-REQ-3 -- Generate Alerts/Advisories and Forecasts	The Pikalert System shall generate alerts, advisories and forecasts, defined in WCVS-REQ-4. Detailed requirements for how the Pikalert System generates alerts are in the	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-4-including the following WCVS-REQ-4.1-WI2VSAT-1-Pikalert WCVS-REQ-4.2-WI2VSAT-1-Pikalert	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		reference document "Motorist Alert and Warning Application, Detailed System Requirements, Final Report — Feb 28, 2014", developed by NCAR for FHWA.	WCVS-REQ-4.3-WI2VSAT-1-Pikalert WCVS-REQ-4.4-WI2VSAT-1-CA WCVS-REQ-4.5-WI2VSAT-1-IC WCVS-REQ-4.6-WI2VSAT-1-511	
Verified by Subrequirements or Peer Requirements	PA-REQ-4 -- Distribute Alerts/Advisories and Forecasts	The Pikalert System shall distribute alerts, defined in WCVS-REQ-4 to other Sub-systems.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: PA-REQ-4.1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	DB-REQ-1 -- Receive from External Interfaces	The Data Broker shall receive data from WYDOT system as defined in the external interface requirements as defined in 511-REQ-1, RCRS-REQ-1, WTI-REQ-2, IC-REQ-1, and CA-REQ-1.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: 511-REQ-1-WEXTSS-511 RCRS-REQ-1-WI2VSAT-1-RCRS WTI-REQ-2-Multiple WI2VSAT-1-WTI Test Cases IC-REQ-1-WI2VSAT-1-IC CA-REQ-1-WI2VSAT-1-CA	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	DB-REQ-2 -- Distribute to External Interfaces	The Data Broker shall distribute information to WYDOT systems as defined in TPI-REQ-1, TRAC-REQ-1, WTI-REQ-1, CVOP-REQ-1, and ITSM-REQ-1.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: TPI-REQ-1-WI2VSAT-1-IC TRAC-REQ-1-Multiple WI2VSAT-1 Test Cases,WDNR-1 WTI-REQ-1-Multiple WI2VSAT-1 Test Cases CVOP-REQ-1-Multiple WI2VSAT-1 Test Cases ITSM-REQ-1-WSYSAA-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	DB-REQ-4 -- Receive from Pikalert	The DB shall receive all generated segment-level information from Pikalert.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: DB-REQ-4.1-WI2VSAT-1-Pikalert DB-REQ-4.2-WI2VSAT-1-Pikalert	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	DW-REQ-1 -- Store Data	The Data Warehouse shall store all data collected and generated by the Wyoming CV System, as defined in DW-REQ-1.1, DW-REQ-1.2, DW-REQ-1.3, and DW-REQ-1.4.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: DW-REQ-1.1-WI2VSAT-1 DW-REQ-1.2-WV2IMCT-2&WDNR-1 DW-REQ-1.3-WI2VSAT-1-REP DW-REQ-1.4-WSYSAA-1	Requirement Verification Confirmed by:
Verified by Subrequirements	DW-REQ-1.1 -- Store Alerts/Advisories	The Data Warehouse shall store all generated alerts, advisories and forecasts, as defined in WCVS-REQ-12.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: DW-REQ-1.1.1-WI2VSAT-1-Pikalert DW-REQ-1.1.2-WI2VSAT-1-Pikalert DW-REQ-1.1.3-WI2VSAT-1-Pikalert	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
or Peer Requirements			DW-REQ-1.1.4-WI2VSAT-1-CA DW-REQ-1.1.5-WI2VSAT-1-IC DW-REQ-1.1.6-WI2VSAT-1-511	
Verified by Subrequirements or Peer Requirements	DW-REQ-1.2 -- Store Vehicle System Data	The Data Warehouse shall store all data collected by the Vehicle Systems, as defined in WCVS-REQ-11.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-11-WV2IMCT-2&WDNR-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	DW-REQ-2 -- Share Data	The Data Warehouse shall provide access to stored information to Wyoming CV Sub-Systems and External Interfaces defined in DW-REQ-2.1, DW-REQ-2.2, DW-REQ-2.3 and DW-REQ-2.4.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: DW-REQ-2.1-WI2VSAT-1-IC DW-REQ-2.2-WI2VMCT-1 DW-REQ-2.3-WI2VMCT-1 DW-REQ-2.4-WI2VSAT-1-WTI-Speed	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	DW-REQ-3 -- Data Storage Administration	This requirement addresses administration of data storage. The DW shall perform the following administrative functions: Maintain System Data Tables, Administer Data Storage Security, Manage Data System, and Manage Archive.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: DW-REQ-3.1-WDWDOC-1 DW-REQ-3.1.1-WDWDOC-1 DW-REQ-3.2-WDWDOC-1 DW-REQ-3.2.1-WDWDOC-1 DW-REQ-3.2.2-WDWDOC-1 DW-REQ-3.3-WDWDOC-1 DW-REQ-3.3.1-WDWDOC-1 DW-REQ-3.3.2-WDWDOC-1 DW-REQ-3.3.3-WDWDOC-1 DW-REQ-3.4-WDWDOC-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	DW-REQ-4 -- Receive Data	The Data warehouse shall receive information sent from other Sub-systems.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: WCVS-REQ-8-Multiple Test Cases	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	MV-REQ-1 -- Environmental Sensors	WYDOT Maintenance Vehicles shall transmit environment information collected through equipped external environmental sensors to the Wyoming CV system. External environmental sensors will provide the information detailed in Table 7-4 of the ICD.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-36.1-WV2IMCT-3	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
Verified by Subrequirements or Peer Requirements	MV-REQ-2 -- Can Bus	WYDOT Maintenance Vehicles shall provide connection to the Can Bus as part of the Vehicle System. The information extracted from the Can Bus is detailed in Table 7-1 of the ICD, where column #1 contains the value "yes/CAN."	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-4.1-WV2IMCT-2	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	MV-REQ-4 -- Receive TIM over DSRC	WYDOT Maintenance Vehicles shall receive a packet containing traveler information from the Wyoming CV System over DSRC. Each packet may contain one or more individual traveler information message as defined in Section 5.16 of SAE J2735.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-2.1-WI2VMCT-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	MV-REQ-5 -- Receive TIM over Satellite	WYDOT Maintenance Vehicles shall receive a packet containing traveler information from the Wyoming CV System (via the Situational Data Warehouse) over Satellite communication. Each packet may contain one or more individual traveler information message as defined in Section 5.16 (SAE J2735).	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-2.2-WI2VMCT-2	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	MV-REQ-6 -- OTA Updates	WYDOT Maintenance Vehicles shall receive software updates OTA, as defined in Section 5.16.2 of the ICD.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-48-WEXTSS-OTA	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	MV-REQ-7 -- Time	WYDOT Maintenance Vehicles shall obtain time as defined in LTS-REQ-4.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: LTS-REQ-4-WFCWT-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	MV-REQ-8 -- Location	WYDOT Maintenance Vehicles shall obtain location as defined in LTS-REQ-6.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: LTS-REQ-6-WFCWT-1	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
Verified by Subrequirements or Peer Requirements	MV-REQ-10 -- OBU Equipment	MV OBU equipment shall conform to the characteristics described in Appendix A of the CAP	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-51-WOBUDOC-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	HP-REQ-3 -- Time	Highway Patrol vehicles shall obtain time as defined in LTS-REQ-4.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: LTS-REQ-4-WFCWT-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	HP-REQ-4 -- Location	Highway Patrol vehicles shall obtain location as defined in LTS-REQ-6.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: LTS-REQ-6-WFCWT-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	HP-REQ-5 -- OBU Equipment	Highway Patrol OBU equipment shall conform to the characteristics described in Appendix A of the CAP	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-51-WOBUDOC-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	HP-REQ-6 -- Receive TIM over Satellite	Highway Patrol vehicles shall receive a packet containing traveler information from the Wyoming CV System (via the Situational Data Warehouse) over Satellite communication. Each packet may contain one or more individual traveler information message as defined in Section 5.16 of SAE J2735.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-2.2-WI2VMCT-2	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	HP-REQ-7 -- OTA Updates	Highway Patrol vehicles shall receive software updates OTA, as defined in Section 5.16.2 of the ICD	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-48-WEXTSS-OTA	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	IT-REQ-1 -- Receive TIM over DSRC	Integrated Truck Fleet vehicles shall receive a packet containing traveler information from the Wyoming CV System over DSRC	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-2.1-WI2VMCT-1	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
Verified by Subrequirements or Peer Requirements	IT-REQ-2 -- Receive TIM over Satellite	Integrated Truck Fleet vehicles shall receive a packet containing traveler information from the Wyoming CV System (via the Situational Data Warehouse) over Satellite communication. Each packet may contain one or more individual traveler information message as defined in Section 5.16 of SAE J2735.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-2.2-WI2VMCT-2	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	IT-REQ-3 -- OTA Updates	Integrated Truck Fleet vehicles shall receive software updates OTA, as defined in Section 5.16.2 of the ICD.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-48-WEXTSS-OTA	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	IT-REQ-4 -- Time	Integrated Truck Fleet vehicles shall obtain time as defined in LTS-REQ-4.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: LTS-REQ-4-WFCWT-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	IT-REQ-5 -- Location	Integrated Truck Fleet vehicles shall obtain location as defined in LTS-REQ-6.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: LTS-REQ-6-WFCWT-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	IT-REQ-7 -- OBU Equipment	Integrated Truck OBU equipment shall conform to the characteristics described in Appendix A of the CAP.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-51-WOBUDOC-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	RFV-REQ-1 -- Receive TIM over DSRC	Retrofit Fleet vehicles shall receive traveler information from the Wyoming CV System over DSRC. Traveler information may contain one or more packets of traveler information as defined in Section 5.16 of SAE J2735.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-2.1-WI2VMCT-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	RFV-REQ-2 -- Receive TIM over Satellite	Retrofit Fleet vehicles shall receive a packet containing traveler information from the Wyoming CV System (via the Situational Data Warehouse) over Satellite communication.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-2.2-WI2VMCT-2	Requirement Verification Confirmed by:

1. Requirements Verification Methodology Sorted by Test Cases

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
Verified by Subrequirements or Peer Requirements	RFV-REQ-3 -- Time	Retrofit Fleet vehicles shall obtain time as defined in LTS-REQ-4.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: LTS-REQ-4-WFCWT-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	RFV-REQ-4 -- Location	Retrofit Fleet vehicles shall obtain location as defined in LTS-REQ-6.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: LTS-REQ-6-WFCWT-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	RFV-REQ-6 -- OBU Equipment	RFV OBU equipment shall conform to the characteristics described in Appendix A of the CAP	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-51-WOBUDOC-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	RFV-REQ-7 -- OTA Updates	Retrofit Fleet Vehicles shall receive software updates OTA, as defined in Section 5.16.2 of the ICD.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: VS-REQ-48-WEXTSS-OTA	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	BC-REQ-1 -- Traveler Information Requirements	(Source: J3067, 3.5.8). Traveler information is used to provide connected devices with travel advisories and information.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: BC-REQ-1.1 BC-REQ-1.2 BC-REQ-1.3	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	BC-REQ-1.2 -- Broadcast Traveler Information - Mandatory Requirements	(Source: J3067, 3.5.8.2). The following are the minimum requirements for a connected device to broadcast traveler information to connected devices.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: BC-REQ-1.2.1 BC-REQ-1.2.2	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	BC-REQ-1.3 -- Broadcast Traveler Information	(Source: J3067, 3.5.8.3). The following are the requirements for a connected device to broadcast traveler information to connected devices.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: BC-REQ-1.3.1-WOBUDOC-1 BC-REQ-1.3.2-WOBUDOC-1 BC-REQ-1.3.3-WOBUDOC-1 BC-REQ-1.3.4-WOBUDOC-1 BC-REQ-1.3.5-WOBUDOC-1	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			BC-REQ-1.3.6-WOBUDOC-1 BC-REQ-1.3.7-WOBUDOC-1	
Verified by Subrequirements or Peer Requirements	BC-REQ-3 -- Traveler Information Requirements	(Source: J3067, 3.5.8). Traveler information is used to provide connected devices with travel advisories and information	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: BC-REQ-3.1-WRSUDOC-1 BC-REQ-3.2-WRSUDOC-1 BC-REQ-3.3-WRSUDOC-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	BC-REQ-3.2 -- Broadcast Traveler Information - Mandatory Requirements	(Source: J3067, 3.5.8.2). The following are the minimum requirements for a connected device to broadcast traveler information to connected devices.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: BC-REQ-3.2.1-WRSUDOC-1 BC-REQ-3.2.2-WRSUDOC-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	BC-REQ-3.3 -- Broadcast Traveler Information	(Source: J3067, 3.5.8.3). The following are the requirements for a connected device to broadcast traveler information to connected devices.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: BC-REQ-3.3.1-WRSUDOC-1 BC-REQ-3.3.2-WRSUDOC-1 BC-REQ-3.3.3-WRSUDOC-1 BC-REQ-3.3.4-WRSUDOC-1 BC-REQ-3.3.5-WRSUDOC-1 BC-REQ-3.3.6-WRSUDOC-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	MNG-REQ-1 -- Performance Requirements – Message Transmission Rates	(Source: J3067, G.2). This section defines the range of allowable time intervals between consecutive transmissions of the same message between connected devices.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: MNG-REQ-1.6-WRSUDOC-1	Requirement Verification Confirmed by:
Verified by Subrequirements or Peer Requirements	MNG-REQ-1.6 -- Transmission Rate Requirements - Broadcast Traveler Information	(Source: J3067, G.2.11). The detailed transmission rate requirements for an RSU to broadcast traveler information to connected devices are as follows.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: MNG-REQ-1.6.1-WRSUDOC-1 MNG-REQ-1.6.2-WRSUDOC-1	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
NA - Feature not currently implemented.	VS-REQ-16 -- Create Distress Notification	The Vehicle System shall have the ability to generate a distress notification.	NA - Feature not currently implemented.	Requirement Verification Confirmed by:
NA - Feature not currently implemented.	VS-REQ-16.1 -- System-Generated Distress Notification	The Vehicle System shall have the ability to self-generate a distress notification when the vehicle Event Status reports airbag deployment or disabled vehicle code. Vehicle Status data is specified in Section 5.4.2 of the ICD.	NA - Feature not currently implemented.	Requirement Verification Confirmed by:

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FHWA-JPO-17-472B

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Connected Vehicle Pilot Deployment Program Phase 2

WYDOT CV Pilot – ORTP - V2V Message Communications Test Procedures and Test Cases

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Final

FHWA-JPO-17-472B.1

U.S. Department of Transportation

Produced by DTFH6116H00027

U.S. Department of Transportation

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Technical Report Documentation Page

1. Report No. FHWA-JPO-17-472B.1	**2. Government Accession No.**	**3. Recipient's Catalog No.**
4. Title and Subtitle WYDOT CV Pilot – ORTP - V2V Message Communications Test Procedures and Test Cases		**5. Report Date** 7/30/2018 **6. Performing Organization Code**
7. Author(s) Denny Stephens (Vital Assurance), Tony English (Trihydro), Shane Zumpf (Trihydro), Nayel Ureña Serulle (ICF), Deepak Gopalakrishna (ICF), Vince Garcia (Wyoming DOT)		**8. Performing Organization Report No.** Task 2G: Operational Readiness, Test/Demonstration Planning
9. Performing Organization Name and Address Wyoming DOT, 5300 Bishop Boulevard, Cheyenne, WY 82009 ICF International, 1725 Eye St NW, Washington DC, 20006 Trihydro Corporation, 1252 Commerce Drive, Laramie, WY 82070 Vital Assurance, 175 S. Third St., Suite 200, Columbus, OH 43215		**10. Work Unit No. (TRAIS)** **11. Contract or Grant No.** DTFH6116H00027
12. Sponsoring Agency Name and Address U.S Department of Transportation 1200 New Jersey Ave, SE Washington, DC 20590		**13. Type of Report and Period Covered** 09/01/2016 to 6/30/2018 **14. Sponsoring Agency Code**
15. Supplementary Notes Kate Hartman (COR), Sarah Tarpgaard (CO)		

16. Abstract

The Wyoming Department of Transportation's (WYDOT) Connected Vehicle (CV) Pilot Deployment Program is intended to develop a suite of applications that utilize vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communication technology to reduce the impact of adverse weather on truck travel in the I-80 corridor. These applications support a flexible range of services from advisories, roadside alerts, parking notifications and dynamic travel guidance. Information from these applications are made available directly to the equipped fleets or through data connections to fleet management centers (who will then communicate it to their trucks using their own systems). The pilot will be conducted in three Phases. Phase 1 includes the planning for the CV pilot including the concept of operations development. Phase 2 is the design, development, and testing phase. Phase 3 includes a real-world demonstration of the applications developed as part of this pilot.

This document presents the template for the *V2V Message Communications Test Procedures and Test Cases* of the Wyoming Department of Transportation (WYDOT) Connected Vehicle (CV) Pilot project as part of the United States Department of Transportation's (USDOT) CV program. These tests are part of the WYDOT CV Pilot Operational Test Plan - Attachment B.

17. Key Words Connected Vehicle Technology, I-80 Corridor, Road Weather, Truck Safety, System Architecture	**18. Distribution Statement** This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161

19. Security Classif. (of this report) None	**20. Security Classif. (of this page)** None	**21. No. of Pages** 11	**22. Price** NA

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

Acknowledgements

The Operational Readiness Plan development team would like to thank USDOT and Noblis for their technical assistance throughout the development of this document.

Table of Contents

1 Introduction 1
1.1 Project Scope 1
1.2 Purpose of this Test 2
2 V2V Message Communications Test Procedure and Test Cases 3
2.1 Table WV2VMCT-SUM V2V Message Communications Test Case Summary 4

List of Tables

Table 2-1. WV2VMCT-SUM V2V Message Communications Test Case Summary....................... 4

1 Introduction

1.1 Project Scope

Wyoming is one of the first wave of CV Pilot sites selected to showcase the value of and spur the adoption of CV technology in the United States. CV technology is a broad term to describe the applications and the systems that leverage dedicated short-range communications (DSRC) for vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I) and infrastructure-to-vehicle (I2V) communication to improve safety, mobility and productivity of the users of the nation's transportation system.

As one of the three selected pilots, WYDOT is focusing on improving safety and mobility by creating new ways to communicate road and travel information to commercial truck drivers and fleet managers along the 402 miles of Interstate 80 (I-80 henceforth) in the State. For the pilot project, WYDOT concluded Phase 1 (planning) in September 2016 and then initiated Phase 2 (deployment) which is scheduled to conclude in mid-2018. This will be followed by an 18-month demonstration period in the third phase.

Systems and applications developed in the pilot will enable drivers of connected vehicles to have improved awareness of potential hazards and of situations they cannot see. At a very high level, the pilot scope includes the following implementation elements:

- **Deploy about 75 roadside units (RSU)** that can receive and broadcast messages using DSRC along various sections on I-80.
- **Equip around 400 vehicles, a combination of fleet vehicles and commercial trucks, with on-board units (OBU).** Of the 400 vehicles, at least 150 are planned to be heavy trucks. All vehicles are expected to be regular users of I-80. Several types of OBUs are being procured as part of the pilot and differ based on their communication capabilities, ability to integrate with the in-vehicle network, and connectivity to ancillary devices and sensors. All OBUs will have the functionality to broadcast Basic Safety Messages (BSM) and will include a human-machine interface (HMI) to share alerts and advisories to drivers of these vehicles.
- **Develop several V2V, V2I, I2V applications** that will enable communication to drivers of alerts and advisories regarding various road conditions. These applications include support for in-vehicle dissemination of advisories for collision avoidance, speed management, detours, parking, and presence of work zones and maintenance and emergency vehicles downstream of their current location.
- **Enable overall improvements in WYDOT's traffic management and traveler information practices** by using data collected from connected vehicles. Targeted improvements include ingesting more location specific mobile road weather information system (RWIS) data, using Pikalert®[1] to provide for more accurate and road segment specific conditions to define better variable speed limits (VSLs), and improving road

[1] Pikalert is a trademark of the University Corporation for Atmospheric Research.

condition dissemination via 511, Dynamic Message Signs (DMS) and other WYDOT sources.

1.2 Purpose of this Test

This document presents the *V2V Message Communication Test Procedures and Test Cases* for the Wyoming Department of Transportation (WYDOT) Connected Vehicle (CV) Pilot project as part of the United States Department of Transportation's (USDOT) CV program. These test cases are part of the WYDOT CV Pilot Operational Test Plan - Attachment B.

The purpose of this document is to describe the sequence of end-to-end tests to be conducted to validate the successful operation of the system in terms of V2V communication.

2 V2V Message Communications Test Procedure and Test Cases

This chapter summarizes *Test Procedure ID WV2VMCT -- V2V Message Communications Test Procedures and Test Cases*. Table 2-1 WV2VMCT-SUM is a high-level summary of the test cases, providing an orientation for the reader. Performance of both WV2VMCT test cases are combined with application test cases, identified under the column "Integrated Test Case ID" in the table. Details of the Test Procedure, Test Configuration and Initialization, Test Cases, and Requirements verified are tabulated under the specified Integrated Test Case ID.

Appendix A of the ORPT provides a list of all system requirements, the test case in which they are verified, and their individual requirements verification methodology.

2.1 Table WV2VMCT-SUM V2V Message Communications Test Case Summary

Table 2-1. WV2VMCT-SUM V2V Message Communications Test Case Summary

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID	Requirements Verified
WV2VMCT-1	V2V exchange of BSMs	Verify V2V BSM Communication Range and Antenna Performance.	* Remote vehicle is stopped in travel lane, broadcasting BSMs. * Host vehicle approaches, broadcasting BSMs, initially traverse at 35 mph, slowing to stop 2 meters behind remote vehicle.	* A configurable threshold percentage of BSMs sent are received and logged by host and remote vehicle OBUs, when vehicles are at least 300 meters apart. * A configurable threshold percentage of BSMs continue to be received and logged until host vehicle stops. * Verified by inspection of logs.	WFCWT-1	Compiled in Table WFCWT-Requirements
WV2VMCT-2	V2V exchange of DNMs	Verify V2V DNM Communication Range and Antenna Performance	* Host and remote vehicle pass each other from opposite directions, each traveling at 35 mph, while host vehicle broadcasts DNMs.	* A configurable threshold percentage of DNMs are received and processed by remote vehicle OBU when vehicles are at least 300 meters apart. * Verified by inspection of logs.	WDNR-1	Compiled in Table WDNR-Requirements

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WYDOT CV Pilot – ORTP - V2I Message Communications Test Procedure and Test Cases

www.its.dot.gov/index.htm
Final Report — July 30, 2018
FHWA-JPO-17-472B.2

U.S. Department of Transportation

Produced by DTFH6116H00027

U.S. Department of Transportation

Notice

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA-JPO-17-472B.2		

4. Title and Subtitle WYDOT CV Pilot - V2I Message Communications Test Procedure and Test Cases	**5. Report Date** 7/30/2018 **6. Performing Organization Code**
7. Author(s) Denny Stephens (Vital Assurance), Tony English (Trihydro), Nayel Ureña Serulle (ICF), Deepak Gopalakrishna (ICF), Vince Garcia (Wyoming DOT)	**8. Performing Organization Report No.** Task 2G: Operational Readiness Test and Demonstration Planning
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15. Supplementary Notes
Kate Hartman (COR), Sarah Tarpgaard (CO)

16. Abstract
The Wyoming Department of Transportation's (WYDOT) Connected Vehicle (CV) Pilot Deployment Program is intended to develop a suite of applications that utilize vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communication technology to reduce the impact of adverse weather on truck travel in the I-80 corridor. These applications support a flexible range of services from advisories, roadside alerts, parking notifications and dynamic travel guidance. Information from these applications are made available directly to the equipped fleets or through data connections to fleet management centers (who will then communicate it to their trucks using their own systems). The pilot will be conducted in three Phases. Phase 1 includes the planning for the CV pilot including the concept of operations development. Phase 2 is the design, development, and testing phase. Phase 3 includes a real-world demonstration of the applications developed as part of this pilot.

This document presents the template for the *V2I Message Communications Test Procedure and Test Cases* of the Wyoming Department of Transportation (WYDOT) Connected Vehicle (CV) Pilot project as part of the United States Department of Transportation's (USDOT) CV program. These tests are part of the WYDOT CV Pilot Operational Test Plan - Attachment B.

17. Key Words	18. Distribution Statement
Connected Vehicle Technology, I-80 Corridor, Road Weather, Truck Safety, System Architecture	This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
None	None	24	NA

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

Acknowledgements

The Operational Readiness Plan development team would like to thank USDOT and Noblis for their technical assistance throughout the development of this document.

Table of Contents

1 Introduction 1

1.1 Project Scope 1

1.2 Purpose of this Test 2

2 V2I Message Communications Test Procedure and Test Cases 3

2.1 Table WV2IMCT-SUM V2I Message Communications Test Case Summary 4

2.2 Table WV2IMCT-TP V2I Message Communication Test Procedure 5

2.3 Table WV2IMCT-CI V2I Message Communications System Component Configuration and Initialization 7

2.4 Table WV2IMCT-3-Description V2I & End-to-end Communication of Environmental Sensor Data Test Case Description 11

2.5 Table WV2IMCT-3-Results V2I & End-to-end Communication of Environmental Sensor Data Test Case Results 13

2.6 Table WV2IMCT-Requirements V2I Message Communication Post Test Requirements Verification Analysis 14

List of Tables

Table 2-1. WV2IMCT-SUM V2I Message Communications Test Case Summary 4

Table 2-2. WV2IMCT-TP V2I Message Communication Test Procedure 5

Table 2-3. WV2IMCT-CI V2I Message Communications System Component Configuration and Initialization 7

Table 2-4. WV2IMCT-3-Description V2I & End-to-end Communication of Environmental Sensor Data Test Case Description.. 11

Table 2-5. WV2IMCT-3-Results V2I & End-to-end Communication of Environmental Sensor Data Test Case Results 13

Table 2-6. WV2IMCT-Requirements V2I Message Communication Post Test Requirements Verification Analysis 14

1 Introduction

1.1 Project Scope

Wyoming is one of the first wave of CV Pilot sites selected to showcase the value of and spur the adoption of CV technology in the United States. CV technology is a broad term to describe the applications and the systems that leverage dedicated short-range communications (DSRC) for vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I) and infrastructure-to-vehicle (I2V) communication to improve safety, mobility and productivity of the users of the nation's transportation system.

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- **Enable overall improvements in WYDOT's traffic management and traveler information practices** by using data collected from connected vehicles. Targeted improvements include ingesting more location specific mobile road weather information system (RWIS) data, using Pikalert®[1] to provide for more accurate and road segment specific conditions to define better variable speed limits (VSLs), and improving road

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condition dissemination via 511, Dynamic Message Signs (DMS) and other WYDOT sources.

1.2 Purpose of this Test

This document presents the test results of the *V2I Message Communications Test Procedure and Test Cases* for the Wyoming Department of Transportation (WYDOT) Connected Vehicle (CV) Pilot project as part of the United States Department of Transportation's (USDOT) CV program. These tests are part of the WYDOT CV Pilot Operational Test Plan - Attachment B.

The purpose of this document is to describe the results of a sequence of end-to-end tests conducted to validate the successful operation of the system in terms of V2I communications.

2 V2I Message Communications Test Procedure and Test Cases

This chapter describes *Test Procedure ID WV2IMCT -- V2I Message Communications Test Procedures and Test Cases*. Table 2-1 WV2IMCT-SUM is a high-level summary of the test cases, providing an orientation for the reader. Performance of Test Cases WV2IMCT-1, WV2IMCT-2, and WV2IMCT-4 are combined with application test cases, identified under the column “Integrated Test Case ID” in the table. Details of the Test Procedure, Test Configuration and Initialization, Test Cases, and Requirements verified are tabulated under the specified Integrated Test Case. For the remaining Test Case WV2IMCT-3, Table 2-2 WV2IMCT-TP details the Test Procedure itself. Table 2-3 WV2IMCT-CI describes the configuration of each of the WYDOT CV Pilot System components for the Test Procedure and the Initialization to be performed for each prior to conducting the Test Cases. Table 2-4 WV2IMCT-3-Description provides the detailed description of Test Case to be performed under this Test Procedure. Table 2-5 WV2IMCT-3-Results captures the results of each repetition of each Test Case. Finally, Table 2-6 WV2IMCT-Requirements describes the requirement verification methodology and captures the Test Engineer’s confirmation that each requirement is verified. Appendix A of the ORTP provides a list of all system requirements, the test case in which they are verified, and their individual requirements verification methodology.

2.1 Table WV2IMCT-SUM V2I Message Communications Test Case Summary

Table 2-1. WV2IMCT-SUM V2I Message Communications Test Case Summary

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID	Requirements Verified
WV2IMCT-1	V2I and End-to-end communication of DNMs	Verify End-to-end Communication of DNMs and V2I DNM communication range	* Host vehicle approaches RSU from outside of DSRC communication range.	* A configurable threshold percentage of DNMs are received and processed by RSUs when vehicle is at least 300 meters away. * DNMs are received and processed by Data Broker. * Verified by inspection of logs.	WDNR-1	Compiled in Table WDNR-Requirements
WV2IMCT-2	V2I & End-to-end Communication of BSMs	Verify End-to-end Communication of BSMs and V2I BSM communication range	* Host vehicle approaches RSU from outside of DSRC communication range.	* A configurable threshold percentage of BSMs are received and processed by RSU when vehicle is at least 300 meters away. * BSMs are received and processed by Data Warehouse. * Verified by inspection of logs.	WFCWT-6	Compiled in Table WFCWT-6-Requirements
WV2IMCT-3	V2I & End-to-end communication of Environmental Sensor Data	Verify End-to-end Communication of Environmental Sensor Data and V2I Environmental Sensor Data communication range	* Host vehicle approaches RSU from outside of DSRC communication range.	* Environmental Sensor Data are received and processed by ODE when vehicle is at least 150 meters away from RSU. * Environmental Sensor Data are received and processed by Pikalert.		Compiled in Table WV2IMCT-Requirements

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID	Requirements Verified
				* Verified by inspection of logs.		
WV2IMCT-4	V2I & End-to-end communication of log files	Verify End-to-end Communication of log files and V2I log files communication range	* Host vehicle approaches RSU from outside of DSRC communication range.	* Log files are received and processed by ODE when vehicle is at least 150 meters away from RSU. * Log files are received and processed by ODE and are stored by Data Warehouse. * Verified by inspection of logs.	WFCWT-6	Compiled in Table WFCWT-6-Requirements

2.2 Table WV2IMCT-TP V2I Message Communication Test Procedure

Table 2-2. WV2IMCT-TP V2I Message Communication Test Procedure

Test Procedure ID	WV2IMCT	Test Engineer Verification and Remarks
Test Procedure Name	V2I Message Communications Test Procedure	
Test Procedure Completion Date		
Priority	Required	
Objectives	• Verify End-to-end Communication of Environmental Sensor Data and V2I Environmental Sensor Data communication range • Verify requirements associated with each Test Case.	

Test Procedure ID	WV2IMCT	Test Engineer Verification and Remarks
Relationship to Other Procedures	• Precondition is successful development and integration of the WYDOT CV Pilot System, as described in the SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment. • WV2IMCT Test Cases may be combined with other Test Cases at the discretion of the test engineer under the condition that that there is no interference, confusion or conflict in interpretation of test results.	
Discussion, Guidance, and Rationales	• The test speed of 35 mph was selected from experience in prior tests (Bogard, 2014) as an V2V test speed that can be safely handled by test engineers. Higher test speeds require professionally trained test drivers and driver protection equipment such as that used by race car drivers. • 300m is the design communication range for DSRC SAE J2735 messages. • WYDOT Maintenance Vehicle is used as remote vehicle for all test cases to verify FCW and DSRC performance around large vehicle bodies.	
Test Cases Performed under This Procedure	The following Test Cases are to be performed under this Test Procedure. • WV2IMCT-3-L (Lear Roadstar OBU) Performance of Test Cases WV2IMCT-1, WV2IMCT-2, and WV2IMCT-4 are combined with application test cases, identified under the column “Integrated Test Case ID” in the Table WV2IMCT-SUM.	

2.3 Table WV2IMCT-CI V2I Message Communications System Component Configuration and Initialization

Table 2-3. WV2IMCT-CI V2I Message Communications System Component Configuration and Initialization

System Component	Applicable Test Procedures and Cases	Configuration for V2I Message Communication Test Procedure and Test Cases	Initialization for V2I Message Communication Test Procedure and Test Cases	Test Engineer Verification and Remarks
Track or Roadway	All WV2IMCT Test Cases	• Controlled environment "track" test facility. • RSU installed on track straightaway, to support straightforward measurement of vehicle to RSU distance. • Test case may be performed on a highway. If performed on a highway, test speed should be adjusted to be safe highway travel speeds.	• Identify RSU locations and place traffic cones on both sides of roadway clearly visible to drivers. • Place cautionary signage and boundary markers in advance of RSU to warn test staff and visitors • On roadway, place any additional signage required by WYDOT Safety Manager • Verify vehicle preparation and staging area is outside DSRC communication range from RSU location.	*Configuration Verified:* *Initialization Verified:*
Pikalert	WV2IMCT-3	Pikalert fully integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested with development environment or production environment, as long as it is ready for production deployment.	• Remove old log files • Verify Pikalert configuration files are correct for this test set • Download/Copy Pikalert configuration files to Test Case Folder for Test Record • Reinitialize, if practical	*Configuration Verified:* *Initialization Verified:*
Data Broker (DB)	All WV2IMCT Test Cases	DB fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development	• Remove old log files • Verify DB configuration files are correct for this test set	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for V2I Message Communication Test Procedure and Test Cases	Initialization for V2I Message Communication Test Procedure and Test Cases	Test Engineer Verification and Remarks
		environment or production environment, as long as it is ready for production deployment.	• Download/Copy DB configuration files to Test Case Folder for Test Record • Reinitialize, if practical	
Operational Data Environment (ODE)	All WV2IMCT Test Cases	ODE fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Remove old log files • Verify ODE configuration files are correct for this test case • Download/Copy ODE configuration files to Test Case Folder for Test Record • Reinitialize, if practical	*Configuration Verified:* *Initialization Verified:*
Data Warehouse (DW)	All WV2IMCT Test Cases	DW fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Verify DW configuration files are correct for this test case • Download/Copy DW configuration files to Test Case Folder for Test Record	*Configuration Verified:* *Initialization Verified:*
Security Credential Management System (SCMS)	All WV2IMCT Test Cases	SCMS fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment. All test cases may be performed without SCMS support during development for verification of functionality and performance of other components. Final, "for the record" testing must be performed with SCMS fully integrated with	• Verify SCMS configuration files are correct for this test case • Download/Copy SCMS configuration files to Test Case Folder for Test Record	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for V2I Message Communication Test Procedure and Test Cases	Initialization for V2I Message Communication Test Procedure and Test Cases	Test Engineer Verification and Remarks
		WYDOT TMC per SDD and ICD, ready for production deployment.		
RSU(s)	All WV2IMCT Test Cases	One RSU fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment. RSU installed on track straightaway, to support straightforward measurement of vehicle to RSU distance. RSU is located outside DSRC communication range from vehicle staging area.	• Verify RSU is located outside DSRC communication range from vehicle staging area. • Remove old log files • Verify RSU configuration files are correct for this test case • Download/Copy RSU configuration files to Test Case Folder for Test Record • Reboot RSU, if practical	*Configuration Verified:* *Initialization Verified:*
Data Logging	All WV2IMCT Test Cases	Data logging for each of the following components fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment: • OBU • RSU • ODE • Pikalert • Data broker	• Remove old log files after storage and archival • Initialize Test Log Folder with Unique Test Identifier	*Configuration Verified:* *Initialization Verified:*
External Storage Location for Each Test Set	All WV2IMCT Test Cases	Storage location external to the system for backup and archiving of log files and test records.	• Initialize Test Record Folder with Unique Test Identifier	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for V2I Message Communication Test Procedure and Test Cases	Initialization for V2I Message Communication Test Procedure and Test Cases	Test Engineer Verification and Remarks
Lear Roadstar OBU	WV2IMCT-3	Lear Roadstar OBU with antenna configuration planned for deployment and HMI fully developed, integrated with vehicle and CAN interface per SDD and ICD, ready for production deployment. May be tested with development environment or production environment, as long as it is ready for production deployment.	• Remove old log files • Initialize log file folders for this Test Case with Unique Identifier • Verify OBU and HMI configuration files are correct for this test case • Download/Copy OBU and HMI configuration files to Test Case Folder for Test Record	*Configuration Verified:* *Initialization Verified:*
Drivers	All WV2IMCT Test Cases	Drivers qualified and experienced in driving the assigned vehicles. Drivers trained in what to expect from V2I Applications and practiced in conducting driving scenarios safely and reliably with existing traffic.	• Conduct driver safety briefing • Review and practice test scenario, as required to ensure maneuvers can be conducted safely and reliably with existing traffic	*Configuration Verified:* *Initialization Verified:*
Test Staff	All WV2IMCT Test Cases	Test staff trained in what to expect from V2I Applications and practiced in supporting driving scenarios safely and reliably with existing traffic.	• Conduct safety briefing and review danger zones • Verify that Test Staff wear safety vests • Review and practice test scenario, as required to ensure maneuvers can be conducted safely and reliably with existing traffic	*Configuration Verified:* *Initialization Verified:*
Visitors and Non-Test Staff	All WV2IMCT Test Cases	Visitors and Non-Test Staff instructed in what to expect from V2I Applications and informed in observing driving scenarios safely and reliably with existing traffic.	• Review test scenario • Conduct safety briefing and review danger zones	*Configuration Verified:* *Initialization Verified:*

2.4 Table WV2IMCT-3-Description V2I & End-to-end Communication of Environmental Sensor Data Test Case Description

Table 2-4. WV2IMCT-3-Description V2I & End-to-end Communication of Environmental Sensor Data Test Case Description

Test Case ID	WV2IMCT-3-L	Test Engineer Verification and Remarks
Test Case Name	V2I & End-to-end communication of Environmental Sensor Data	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WV2IMCT-Requirements	
Objective	Verify End-to-end Communication of Environmental Sensor Data and V2I Environmental Sensor Data communication range	
Preconditions	• Verify configuration of each system and test component complies with Configuration for V2I Message Communication Test Procedure and Test Cases described in Table WV2IMCT-CI. • Prepare each system and test component in accordance with Initialization for V2I Message Communication Test Procedure and Test Cases described in Table WV2IMCT-CI. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff. • Verify condition of each system component in accordance with Table WV2IMCT-CI.	
Back Office Component	Pikalert	
Host Vehicle OBU/ Vehicle	Lear Roadstar OBU	
Host Vehicle Message Type (TC Input 1)	Environmental Sensor Data	

Test Case ID	**WV2IMCT-3-L**	**Test Engineer Verification and Remarks**
Host Vehicle Driving Scenario (TC Input 2)	Host vehicle approaches RSU from outside of DSRC communication range.	
TC Output	RSU, ODE, and Back Office Component Log files	
Expected Result (Pass/Fail Criteria)	All Environmental Sensor Data are received and processed by ODE when vehicle is at least 150 meters away from RSU. Environmental Sensor Data are received and processed by Pikalert. Verified by logs.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* **Verify Readiness for Test** **1.** Verify WYDOT CV Pilot TMC System is operational and ready for test **2.** Verify RSUs are operational and ready for test **3.** Cycle Host Vehicle power and reboot vehicle system. **4.** Verify Host vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix **5.** Conduct Safety Inspection of the test area and vehicle path and confirm ready for test a. No obstructions or interference b. All staff where they are supposed to be, no staff where they aren't supposed to be c. Weather is acceptable and will not lead to hazardous driving conditions d. Road surface is acceptable and will not lead to hazardous driving conditions **Test Start Up** **6.** Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational **7.** Host vehicle driver inspects driving area and confirm track is clear and ready for test.	

Test Case ID	**WV2IMCT-3-L**	**Test Engineer Verification and Remarks**
	8. Host Vehicle Driver and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure **Driving the Test** **9.** Host vehicle enters track from outside communication range and performs Test Case Host Vehicle Scenario.	

2.5 Table WV2IMCT-3-Results V2I & End-to-end Communication of Environmental Sensor Data Test Case Results

Table 2-5. WV2IMCT-3-Results V2I & End-to-end Communication of Environmental Sensor Data Test Case Results

Test Case ID	**WV2IMCT-3-L**	**Test Engineer Verification and Remarks**
Test Case Name	V2I & End-to-end communication of Environmental Sensor Data	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*

Test Case ID	WV2IMCT-3-L	Test Engineer Verification and Remarks
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.6 Table WV2IMCT-Requirements V2I Message Communication Post Test Requirements Verification Analysis

Table 2-6. WV2IMCT-Requirements V2I Message Communication Post Test Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WV2IMCT-3 -- V2I & End-to-end communication of Environmental Sensor Data	WCVS-REQ-1.2 -- Collect Environmental Sensor Data	The Wyoming CV System shall collect environment sensor data using secure copy (SCP) from the Vehicle System consistent with secure shell (SSH).	-Perform Test Case WV2IMCT-3 * Inspect HMI Logs and identify 1 or more instances of environmental sensor data copied to ODE * Inspect ODE logs and identify corresponding 1 or more instances of environmental sensor data copied from OBU to ODE * Confirmation shows Wyoming CV System collects environment sensor data using secure copy (SCP) from the Vehicle System consistent with secure shell (SSH), thereby verifying the requirement is satisfied. * (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	Requirement Verification Confirmed by:
WV2IMCT-3 -- V2I & End-to-end communication of	WCVS-REQ-11.2 -- Store Environment Sensor Data	The Wyoming CV System shall store processed environment sensor data consistent with Section 5.19.2 of the ICD.	* Perform Test Case WV2IMCT-3. * Inspect ODE logs and verify receipt (copy) of environmental sensor data from OBU. * Inspect DW logs and verify receipt (copy) of	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
Environmental Sensor Data			environmental sensor data from OBU for storage. * Receipt of environmental sensor data by DW confirms the Wyoming CV System stores processed environment sensor data consistent with Section 5.19.2 of the ICD, thereby verifying the requirement is satisfied.	
WV2IMCT-3 -- V2I & End-to-end communication of Environmental Sensor Data	VS-REQ-5 -- External Environment Sensor Data	The Vehicle System shall collect additional environmental sensor data from host vehicles equipped with external environmental sensors. Additional data collected from external environmental sensors is shown in Table 7-4 of the Interface Control Document.	* Perform Test Case WV2IMCT-3 * Inspect HMI Logs and identify 1 or more instances of environmental sensor data copied to ODE * Inspect ODE logs and identify corresponding 1 or more instances of environmental sensor data copied from OBU to ODE * Confirmation shows the Vehicle System collects additional environmental sensor data from host vehicles equipped with external environmental sensors, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-3 -- V2I & End-to-end communication of Environmental Sensor Data	VS-REQ-5.1 -- External Environment Sensor Data Configuration	The collection of sensor data by the Vehicle System shall be configurable as specified in Section 3.2.5.1 of the SDD.	* Perform Test Case WV2IMCT-3. * Inspect ODE Logs and locate and verify 1 or more instances of receipt of Environmental Sensor Data. * Inspect SDD and confirm configuration of Environmental Sensor Data * Inspect Environmental Sensor Data and confirm collection of sensor data by the Vehicle System is configurable * Confirmation shows the collection of sensor data by the Vehicle System is configurable as specified in Section 3251 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-3 -- V2I & End-to-end communication of Environmental Sensor Data	VS-REQ-5.2 -- External Environment Sensor Data Management	The application shall support a data management mechanism, specified in Section 3.2.5.1 of the SDD.	* Perform Test Case WV2IMCT-3. * Inspect ODE Logs and locate and verify 1 or more instances of receipt of Environmental Sensor Data. * Inspect SDD and confirm data management mechanism * Inspect Environmental Sensor Data and confirm application supports a data management mechanism	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			* Confirmation shows the application supports a data management mechanism, specified in Section 3251 of the SDD, thereby verifying the requirement is satisfied.	
WV2IMCT-3 -- V2I & End-to-end communication of Environmental Sensor Data	VS-REQ-36.1 -- Transmit Environmental Data	The Vehicle System shall transmit over DSRC environmental data, defined in Table 7-4 of the SDD, to the Wyoming CV System when available from a vehicle Sub-System.	* Perform Test Case WV2IMCT-3 * Confirm secure copy to the Wyoming CV System of Environmental Data. * Confirmation shows the Vehicle System transmits over DSRC environmental data, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-3 -- V2I & End-to-end communication of Environmental Sensor Data	ODE-REQ-3.3 -- Distribute to Pikalert	The Operational Data Environment shall distribute Environmental Data to the Pikalert System, as described in Section 5.19 of the ICD.	* Perform Test Case WV2IMCT-3 * Inspect HMI Logs and identify 1 or more instances of environmental sensor data copied to ODE * Inspect ODE logs and identify corresponding 1 or more instances of environmental sensor data copied from OBU to ODE * Inspect Pikalert logs and identify corresponding 1 or more instances of environmental sensor data received * Confirmation shows the Operational Data Environment distributes Environmental Data to the Pikalert System, as described in Section 5.19 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-3 -- V2I & End-to-end communication of Environmental Sensor Data	ODE-REQ-3.4.3 -- Distribute to Data Warehouse-ES	The Operational Data Environment shall distribute all collected and processed Environmental Sensor information to the Data Warehouse, as described in Section 5.20 of the ICD.	* Perform Test Case WV2IMCT-3 * Inspect DW logs * Confirm receipt of Environmental Sensor Data * Confirmation shows the Operational Data Environment distributes all collected and processed Environmental Sensor information to the Data Warehouse, as described in Section 5.20 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-3 -- V2I & End-to-end communication of Environmental Sensor Data	PA-REQ-2.1 -- ODE Data	The Pikalert System shall receive CV data from the Operational Data Environment as defined in ODE-REQ-3.3	* Perform Test Case WV2IMCT-3 * Inspect HMI Logs and identify 1 or more instances of environmental sensor data copied to ODE * Inspect ODE logs and identify corresponding 1 or more instances of environmental sensor data copied from OBU to ODE	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			* Inspect Pikalert logs and identify corresponding 1 or more instances of environmental sensor data received * Confirmation shows the Pikalert System receives CV data from the Operational Data Environment as defined in ODE-REQ-3.3, thereby verifying the requirement is satisfied.	

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FHWA-JPO-17-472B.2

U.S. Department of Transportation

Connected Vehicle Pilot Deployment Program Phase 2

WYDOT CV Pilot – I2V Message Communications Test Procedure and Test Cases

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Final

FHWA-JPO-17-472B.3

U.S. Department of Transportation

Produced by DTFH6116H00027

U.S. Department of Transportation

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Technical Report Documentation Page

<table>
<tr><td>1. Report No.
FHWA-JPO-17-472B.3</td><td>2. Government Accession No.</td><td>3. Recipient's Catalog No.</td></tr>
<tr><td colspan="2" rowspan="2">4. Title and Subtitle
WYDOT CV Pilot - I2V Message Communications Test Procedure and Test Cases</td><td>5. Report Date
7/30/2018</td></tr>
<tr><td>6. Performing Organization Code</td></tr>
<tr><td colspan="2">7. Author(s)
Denny Stephens (Vital Assurance), Tony English (Trihydro), Nayel Ureña Serulle (ICF), Deepak Gopalakrishna (ICF), Vince Garcia (Wyoming DOT)</td><td>8. Performing Organization Report No.
Task 2G: Operational Readiness, Test/Demonstration Planning</td></tr>
<tr><td colspan="2" rowspan="2">9. Performing Organization Name and Address
Wyoming DOT, 5300 Bishop Boulevard, Cheyenne, WY 82009
ICF International, 1725 Eye St NW, Washington DC, 20006
Trihydro Corporation, 1252 Commerce Drive, Laramie, WY 82070
Vital Assurance, 175 S. Third St., Suite 200, Columbus, OH 43215</td><td>10. Work Unit No. (TRAIS)</td></tr>
<tr><td>11. Contract or Grant No.
DTFH6116H00027</td></tr>
<tr><td colspan="2" rowspan="2">12. Sponsoring Agency Name and Address
U.S Department of Transportation 1200 New Jersey Ave, SE
Washington, DC 20590</td><td>13. Type of Report and Period Covered
09/01/2016 to 7/30/2018</td></tr>
<tr><td>14. Sponsoring Agency Code</td></tr>
<tr><td colspan="3">15. Supplementary Notes
Kate Hartman (COR), Sarah Tarpgaard (CO)</td></tr>
<tr><td colspan="3">16. Abstract
The Wyoming Department of Transportation's (WYDOT) Connected Vehicle (CV) Pilot Deployment Program is intended to develop a suite of applications that utilize vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communication technology to reduce the impact of adverse weather on truck travel in the I-80 corridor. These applications support a flexible range of services from advisories, roadside alerts, parking notifications and dynamic travel guidance. Information from these applications are made available directly to the equipped fleets or through data connections to fleet management centers (who will then communicate it to their trucks using their own systems). The pilot will be conducted in three Phases. Phase 1 includes the planning for the CV pilot including the concept of operations development. Phase 2 is the design, development, and testing phase. Phase 3 includes a real-world demonstration of the applications developed as part of this pilot.

This document presents the template for the I2V Message Communications Test Procedure and Test Cases of the Wyoming Department of Transportation (WYDOT) Connected Vehicle (CV) Pilot project as part of the United States Department of Transportation's (USDOT) CV program. These tests are part of the WYDOT CV Pilot Operational Test Plan - Attachment B.</td></tr>
<tr><td>17. Key Words
Connected Vehicle Technology, I-80 Corridor, Road Weather, Truck Safety, System Architecture</td><td colspan="2">18. Distribution Statement
This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161</td></tr>
<tr><td>19. Security Classif. (of this report)
None</td><td>20. Security Classif. (of this page)
None</td><td>21. No. of Pages
28

22. Price
NA</td></tr>
</table>

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

Acknowledgements

The Operational Readiness Plan development team would like to thank USDOT and Noblis for their technical assistance throughout the development of this document.

Table of Contents

1 Introduction 1

1.1 Project Scope 1

1.2 Purpose of this Test 2

2 I2V Message Communications Test Procedure and Test Cases 3

2.1 Table WI2VMCT-SUM I2V Message Communications Test Case Summary 4

2.2 Table WI2VMCT-TP I2V Message Communication Test Procedure 5

2.3 Table WI2VMCT-CI I2V Message Communications System Component Configuration and Initialization 7

2.4 Table WI2VMCT-3-L-Description Simultaneous Upload/Download of DSRC Communications Test Case Description 14

2.5 Table WI2VMCT-3-L-Results Simultaneous Upload/Download of DSRC Communications Test Case Results 16

2.6 Table WI2VMCT-3-S-Description Simultaneous Upload/Download of DSRC Communications Test Case Description 17

2.7 Table WI2VMCT-3-S-Results Simultaneous Upload/Download of DSRC Communications Test Case Results 20

2.8 Table WI2VMCT-Requirements I2V Message Communication Post Test Requirements Verification Analysis 21

List of Tables

Table 2-1. WI2VMCT-SUM I2V Message Communications Test Case Summary 4

Table 2-2. WI2VMCT-TP I2V Message Communication Test Procedure 5

Table 2-3. WI2VMCT-CI I2V Message Communications System Component Configuration and Initialization 7

Table 2-4. WI2VMCT-3-L-Description Simultaneous Upload/Download of DSRC Communications Test Case Description 14

Table 2-5. WI2VMCT-3-L-Results Simultaneous Upload/Download of DSRC Communications Test Case Results. 16

Table 2-6. WI2VMCT-3-S-Description Simultaneous Upload/Download of DSRC Communications Test Case Description 17

Table 2-7. WI2VMCT-3-S-Results Simultaneous Upload/Download of DSRC Communications Test Case Results 20

Table 2-8. WI2VMCT-Requirements I2V Message Communication Post Test Requirements Verification Analysis 21

1 Introduction

1.1 Project Scope

Wyoming is one of the first wave of CV Pilot sites selected to showcase the value of and spur the adoption of CV technology in the United States. CV technology is a broad term to describe the applications and the systems that leverage dedicated short-range communications (DSRC) for vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I) and infrastructure-to-vehicle (I2V) communication to improve safety, mobility and productivity of the users of the nation's transportation system.

As one of the three selected pilots, WYDOT is focusing on improving safety and mobility by creating new ways to communicate road and travel information to commercial truck drivers and fleet managers along the 402 miles of Interstate 80 (I-80 henceforth) in the State. For the pilot project, WYDOT concluded Phase 1 (planning) in September 2016 and then initiated Phase 2 (deployment) which is scheduled to conclude in mid-2018. This will be followed by an 18-month demonstration period in the third phase.

Systems and applications developed in the pilot will enable drivers of connected vehicles to have improved awareness of potential hazards and of situations they cannot see. At a very high level, the pilot scope includes the following implementation elements:

- **Deploy about 75 roadside units (RSU)** that can receive and broadcast messages using DSRC along various sections on I-80.
- **Equip around 400 vehicles, a combination of fleet vehicles and commercial trucks, with on-board units (OBU).** Of the 400 vehicles, at least 150 are planned to be heavy trucks. All vehicles are expected to be regular users of I-80. Several types of OBUs are being procured as part of the pilot and differ based on their communication capabilities, ability to integrate with the in-vehicle network, and connectivity to ancillary devices and sensors. All OBUs will have the functionality to broadcast Basic Safety Messages (BSM) and will include a human-machine interface (HMI) to share alerts and advisories to drivers of these vehicles.
- **Develop several V2V, V2I, I2V applications** that will enable communication to drivers of alerts and advisories regarding various road conditions. These applications include support for in-vehicle dissemination of advisories for collision avoidance, speed management, detours, parking, and presence of work zones and maintenance and emergency vehicles downstream of their current location.
- **Enable overall improvements in WYDOT's traffic management and traveler information practices** by using data collected from connected vehicles. Targeted improvements include ingesting more location specific mobile road weather information system (RWIS) data, using Pikalert®[1] to provide for more accurate and road segment

[1] Pikalert is a trademark of the University Corporation for Atmospheric Research.

specific conditions to define better variable speed limits (VSLs), and improving road condition dissemination via 511, Dynamic Message Signs (DMS) and other WYDOT sources.

1.2 Purpose of this Test

This document presents the test results of the *I2V Message Communications Test Procedure and Test Cases* for the Wyoming Department of Transportation (WYDOT) Connected Vehicle (CV) Pilot project as part of the United States Department of Transportation's (USDOT) CV program. These tests are part of the WYDOT CV Pilot Operational Test Plan - Attachment B.

The purpose of this document is to describe the results of a sequence of end-to-end tests conducted to validate the successful operation of the system in terms of I2V communication.

2 I2V Message Communications Test Procedure and Test Cases

This chapter describes *Test Procedure ID WI2VMCT -- I2V Message Communications Test Procedure and Test Cases*. Table 2-1 WI2VMCT-SUM is a high-level summary of the test cases, providing an orientation for the reader. Performance of Test Cases WI2VMCT-1 and WI2VMCT-2 are combined with application test cases, identified under the column “Integrated Test Case ID” in the table. Details of the Test Procedure, Test Configuration and Initialization, Test Cases, and Requirements verified are tabulated under the specified Integrated Test Case. For the remaining Test Case WI2VMCT-3, Table 2-2 WI2VMCT-TP details the Test Procedure itself. Table 2-3 WI2VMCT-CI describes the configuration of each of the WYDOT CV Pilot System components for the Test Procedure and the Initialization to be performed for each prior to conducting the Test Cases. Table 2-4 and Table 2-6 (WI2VMCT-3-Description) provides the detailed description of Test Case to be performed under this Test Procedure. Table 2-5 and Table 2-7 (WI2VMCT-3-Results) captures the results of each repetition of each Test Case. Finally, Table 2-8 WI2VMCT-Requirements describes the requirement verification methodology and captures the Test Engineer’s confirmation that each requirement is verified. Appendix A of the ORTP provides a list of all system requirements, the test case in which they are verified, and their individual requirements verification methodology.

2.1 Table WI2VMCT-SUM I2V Message Communications Test Case Summary

Table 2-1. WI2VMCT-SUM I2V Message Communications Test Case Summary

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID	Requirements Verified
WI2VMCT-1	End-to-end & DSRC Delivery of I2V SA TIMs	Verify End-to-end Communication (DB to OBU) of I2V SA TIMs via DSRC and I2V SA TIM DSRC communication range	* I2V SA TIM is formulated by Data Broker and distributed to test RSU. * Host vehicle approaches RSU from outside of DSRC communication range.	* A configurable threshold percentage of I2V SA TIMs are received and processed by OBU when vehicle is at least 300 meters away. * Verified by inspection of logs.	WI2VSAT-1-REP	Compiled in Table WI2VSAT-1-REP-Requirements
WI2VMCT-2	End-to-end & Satellite Delivery of I2V SA TIMs	Verify End-to-end Communication (DB to OBU) of I2V SA TIMs via satellite.	* I2V SA TIM is formulated by Data Broker and distributed to satellite service provider. * Five locations along Wyoming I-80 are selected for satellite testing. * Satellite test locations are between RSU locations.	* A configurable threshold percentage of I2V SA TIMs are received and processed by OBU at each of the 5 locations. * Verified by inspection of logs.	WI2VSAT-5	Compiled in Table WI2VSAT-5-Requirements
WI2VMCT-3	Simultaneous DSRC Upload/Download of messages and log files.	Verify simultaneous capture of BSMs, End-to-end Communication (DB to OBU) of I2V SA TIMs, and End-to-end Communication of log files (OBU to ODE) and DSRC	* I2V SA TIM is formulated by Data Broker and distributed to test RSU. * Host vehicle broadcasts BSMs and approaches RSU from outside of DSRC communication range.	* A configurable threshold percentage of BSMs are received and processed by RSU when vehicle is at least 300 meters away. * A configurable threshold percentage of I2V SA TIMs are received and processed by OBU when		Compiled in Table WI2VMCT-Requirements

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID	Requirements Verified
		communication range.		vehicle is at least 300 meters away. * All log files are received and processed by ODE when vehicle is at least 150 meters away from RSU. * Log files are received and processed by ODE and are stored by Data Warehouse. * Verified by inspection of logs.		

2.2 Table WI2VMCT-TP I2V Message Communication Test Procedure

Table 2-2. WI2VMCT-TP I2V Message Communication Test Procedure

Test Procedure ID	WI2VMCT	Test Engineer Verification and Remarks
Test Procedure Name	I2V Message Communications Test Procedure	
Test Procedure Completion Date		
Priority	Required	
Objectives	• Verify simultaneous End-to-end Communication (DB to OBU) of I2V SA TIMs and End-to-end Communication of log files (OBU to ODE and DW) and verify DSRC communication range. • Verify requirements associated with each Test Case.	

Test Procedure ID	WI2VMCT	Test Engineer Verification and Remarks
Relationship to Other Procedures	• Precondition is successful development and integration of the WYDOT CV Pilot System, as described in the SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment. • WI2VMCT Test cases should not be combined with each other to ensure there is no interference, confusion or conflict in interpretation of test results between delivery of messages via DSRC and via satellite. However, WI2VMCT may be combined with application Test Cases at the discretion of the test engineer under the condition that that there is no interference, confusion or conflict in interpretation of test results.	
Discussion, Guidance, and Rationales	• The test speed of 35 mph was selected from experience in prior tests (Bogard, 2014) as a track test speed that can be safely handled by test engineers. Higher test speeds require professionally trained test drivers and driver protection equipment such as that used by race car drivers. • 300m is the design communication range for DSRC SAE J2735 messages.	
Test Cases Performed under This Procedure	The following Test Cases are to be performed under this Test Procedure. • WI2VMCT-3-L (Lear) • WI2VMCT-3-S (SiriusXM) Performance of Test Cases WI2VMCT-1 and WI2VMCT-2 are combined with application test cases, identified under the column "Integrated Test Case ID" in the Table WI2VMCT-SUM.	

2.3 Table WI2VMCT-CI I2V Message Communications System Component Configuration and Initialization

Table 2-3. WI2VMCT-CI I2V Message Communications System Component Configuration and Initialization

System Component	Applicable Test Procedures and Cases	Configuration for I2V Message Communication Test Procedure and Test Cases	Initialization for I2V Message Communication Test Procedure and Test Cases	Test Engineer Verification and Remarks
Back office Component with Representative TIM	All WI2VMCT Test Cases	"Representative" TIM is defined as an example TIM whose successful test result indicates conducting this test case with other I2V SA TIMs is also likely to be successful. This TIM is selected empirically, by developers and test engineers. This TIM message is used when it is not necessary or efficient to repeat all message types from each back office component.	• Prepare applicable back office component inputs for Representative TIM • Formulate and document back office component inputs that will generate Representative I2V Message Communication TIM • Formulate and document back office component inputs (manual and computer input file) for distribution of Representative I2V Message Communication TIM through RSUs via DSRC and through Satellite.	*Configuration Verified:* *Initialization Verified:*
Track or Roadway	All WI2VMCT Test Cases	• Controlled environment "track" test facility.	• Identify RSU locations and place traffic cones on both sides of	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for I2V Message Communication Test Procedure and Test Cases	Initialization for I2V Message Communication Test Procedure and Test Cases	Test Engineer Verification and Remarks
		• RSU installed on track straightaway, to support straightforward measurement of vehicle to RSU distance. • Test case may be performed on a highway. If performed on a highway, test speed should be adjusted to be safe highway travel speeds.	roadway clearly visible to drivers. • Place cautionary signage and boundary markers in advance of geofence to warn test staff and visitors • On roadway, place any additional signage required by WYDOT Safety Manager • Verify vehicle preparation and staging area is outside RSU DSRC communication range.	
Data Broker (DB)	All WI2VMCT Test Cases	DB fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Delete (all) existing TIMs messages • Remove old log files • Verify DB configuration files are correct for this test set • Download/Copy DB configuration files to Test Case Folder for Test Record • Reinitialize, if practical	*Configuration Verified:* *Initialization Verified:*
Operational Data Environment (ODE)	All WI2VMCT Test Cases	ODE fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be	• Delete (all) existing TIMs messages • Remove old log files • Verify ODE configuration files are	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for I2V Message Communication Test Procedure and Test Cases	Initialization for I2V Message Communication Test Procedure and Test Cases	Test Engineer Verification and Remarks
		tested from development environment or production environment, as long as it is ready for production deployment.	correct for this test case • Download/Copy ODE configuration files to Test Case Folder for Test Record • Reinitialize, if practical	
Data Warehouse (DW)	All WI2VMCT Test Cases	DW fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Verify DW configuration files are correct for this test case • Download/Copy DW configuration files to Test Case Folder for Test Record	*Configuration Verified:* *Initialization Verified:*
Security Credential Management System (SCMS)	All WI2VMCT Test Cases	SCMS fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment. All test cases may be performed without SCMS support during development for verification of functionality	• Verify SCMS configuration files are correct for this test case • Download/Copy SCMS configuration files to Test Case Folder for Test Record	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for I2V Message Communication Test Procedure and Test Cases	Initialization for I2V Message Communication Test Procedure and Test Cases	Test Engineer Verification and Remarks
		and performance of other components. Final, "for the record" testing must be performed with SCMS fully integrated with WYDOT TMC per SDD and ICD, ready for production deployment.		
RSU(s)	All WI2VMCT Test Cases	One RSU fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment. RSU is located outside DSRC communication range from WI2VMCT geofence.	• Verify RSU is located outside DSRC communication range from vehicle staging area. • Remove old log files • Verify RSU configuration files are correct for this test case • Download/Copy RSU configuration files to Test Case Folder for Test Record • Reboot RSU, if practical	*Configuration Verified:* *Initialization Verified:*
Data Logging	All WI2VMCT Test Cases	Data logging for each of the following components fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment:	• Remove old log files after storage and archival • Initialize Test Log Folder with Unique Test Identifier	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for I2V Message Communication Test Procedure and Test Cases	Initialization for I2V Message Communication Test Procedure and Test Cases	Test Engineer Verification and Remarks
		• Back Office components • Data broker • ODE • RSU • OBU		
External Storage Location for Each Test Set	All WI2VMCT Test Cases	Storage location external to the system for backup and archiving of log files and test records.	• Initialize Test Record Folder with Unique Test Identifier	*Configuration Verified:* *Initialization Verified:*
Lear Roadstar OBU	Each WI2VMCT Test Case	Lear Roadstar OBU with antenna configuration planned for deployment and HMI fully developed, integrated with vehicle and CAN interface per SDD and ICD, ready for production deployment. May be tested with development environment or production environment, as long as it is ready for production deployment.	• Remove old log files • Initialize log file folders for this Test Case with Unique Identifier • Verify OBU and HMI configuration files are correct for this test case • Download/Copy OBU and HMI configuration files to Test Case Folder for Test Record	*Configuration Verified:* *Initialization Verified:*
SiriusXM OBU	Each WI2VMCT Test Case	SiriusXM OBU with antenna configuration planned for deployment and HMI fully developed, installed in vehicle per SDD and ICD, ready for production deployment. May be tested with	• Remove old log files • Initialize log file folders for this Test Case with Unique Identifier • Verify OBU and HMI configuration files are correct for this test case	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for I2V Message Communication Test Procedure and Test Cases	Initialization for I2V Message Communication Test Procedure and Test Cases	Test Engineer Verification and Remarks
		development environment or production environment, as long as it is ready for production deployment.	• Download/Copy OBU and HMI configuration files to Test Case Folder for Test Record	
Operators of Back office Component with Representative TIM	All WI2VMCT Test Cases	Back office System Operators trained in what to expect from I2V Applications and practiced in supporting Representative TIM I2V Message Communications.	• Train Back office System Operators to initiate TIM and distribute to RSU and satellite • Back office System Operators practice initiating TIM and distribution to RSU and satellite	*Configuration Verified:* *Initialization Verified:*
Drivers	All WI2VMCT Test Cases	Drivers qualified and experienced in driving the assigned vehicles. Drivers trained in what to expect from I2V Applications and practiced in conducting driving scenarios safely and reliably with existing traffic.	• Conduct driver safety briefing • Review and practice test scenario, as required to ensure maneuvers can be conducted safely and reliably with existing traffic	*Configuration Verified:* *Initialization Verified:*
Test Staff	All WI2VMCT Test Cases	Test staff trained in what to expect from I2V Applications and practiced in supporting driving scenarios safely and reliably with existing traffic.	• Conduct safety briefing and review danger zones • Verify that Test Staff wear safety vests • Review and practice test scenario, as	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for I2V Message Communication Test Procedure and Test Cases	Initialization for I2V Message Communication Test Procedure and Test Cases	Test Engineer Verification and Remarks
			required to ensure maneuvers can be conducted safely and reliably with existing traffic	
Visitors and Non-Test Staff	All WI2VMCT Test Cases	Visitors and Non-Test Staff instructed in what to expect from WI2V Applications and informed in observing driving scenarios safely and reliably with existing traffic.	• Review test scenario • Conduct safety briefing and review danger zones	*Configuration Verified:* *Initialization Verified:*

2.4 Table WI2VMCT-3-L-Description Simultaneous Upload/Download of DSRC Communications Test Case Description

Table 2-4. WI2VMCT-3-L-Description Simultaneous Upload/Download of DSRC Communications Test Case Description

Test Case ID	WI2VMCT-3-L	Test Engineer Verification and Remarks
Test Case Name	Simultaneous Upload/Download of DSRC Communications	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WI2VMCT-Requirements	
Objective	Verify simultaneous End-to-end Communication (DB to OBU) of I2V SA TIMs and End-to-end Communication of log files (OBU to ODE) and DSRC communication range	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Message Communication Test Procedure and Test Cases described in Table WI2VIMCT-CI. • Prepare each system and test component in accordance with Initialization for I2V Message Communication Test Procedure and Test Cases described in Table WI2VMCT-CI. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	Representative TIM Source	
Host Vehicle OBU/ Vehicle	Lear Roadstar OBU	

Test Case ID	**WI2VMCT-3-L**	**Test Engineer Verification and Remarks**
Host Vehicle Message Type (TC Input 1)	Representative TIM	
Host Vehicle Driving Scenario (TC Input 2)	I2V SA TIM is formulated by Data Broker and distributed to test RSU. Host vehicle approaches RSU from outside of DSRC communication range.	
TC Output	OBU Log Files	
Expected Result (Pass/Fail Criteria)	A configurable threshold percentage of I2V SA TIMs sent by the Data Broker are received and processed by OBU when vehicle is at least 300 meters away. All Log files are received and processed by ODE when vehicle is at least 150 meters away from RSU. Log files are received and processed by ODE and are stored by Data Warehouse. Verified by logs.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* **Verify Readiness for Test** **1.** Verify WYDOT CV Pilot TMC System is operational and ready for test **2.** Verify RSUs are operational and ready for test **3.** Cycle Host Vehicle power and reboot vehicle system. **4.** Verify Host vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix **5.** Conduct Safety Inspection of the test area and vehicle path and confirm ready for test a. No obstructions or interference b. All staff where they are supposed to be, no staff where they aren't supposed to be c. Weather is acceptable and will not lead to hazardous driving conditions d. Road surface is acceptable and will not lead to hazardous driving conditions **Test Start Up**	

Test Case ID	WI2VMCT-3-L	Test Engineer Verification and Remarks
	6. Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational **7.** Host vehicle driver inspects driving area and confirm track is clear and ready for test. **8.** Host Vehicle Driver and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure **Driving the Test** **9.** Host vehicle enters track from outside communication range and performs Test Case Host Vehicle Scenario.	

2.5 Table WI2VMCT-3-L-Results Simultaneous Upload/Download of DSRC Communications Test Case Results

Table 2-5. WI2VMCT-3-L-Results Simultaneous Upload/Download of DSRC Communications Test Case Results.

Test Case ID	WI2VMCT-3-L	Test Engineer Verification and Remarks
Test Case Name	Simultaneous Upload/Download of DSRC Communications	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*

Test Case ID	WI2VMCT-3-L	Test Engineer Verification and Remarks
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.6 Table WI2VMCT-3-S-Description Simultaneous Upload/Download of DSRC Communications Test Case Description

Table 2-6. WI2VMCT-3-S-Description Simultaneous Upload/Download of DSRC Communications Test Case Description

Test Case ID	WI2VMCT-3-S	Test Engineer Verification and Remarks
Test Case Name	Simultaneous Upload/Download of DSRC Communications	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WI2VMCT-Requirements	

Test Case ID	**WI2VMCT-3-S**	**Test Engineer Verification and Remarks**
Objective	Verify simultaneous End-to-end Communication (DB to OBU) of I2V SA TIMs and End-to-end Communication of log files (OBU to ODE) and DSRC communication range	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Message Communication Test Procedure and Test Cases described in Table WI2VIMCT-CI. • Prepare each system and test component in accordance with Initialization for I2V Message Communication Test Procedure and Test Cases described in Table WI2VMCT-CI. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	Representative TIM Source	
Host Vehicle OBU/ Vehicle	SiriusXM OBU	
Host Vehicle Message Type (TC Input 1)	Representative TIM	
Host Vehicle Driving Scenario (TC Input 2)	I2V SA TIM is formulated by Data Broker and distributed to test RSU. Host vehicle approaches RSU from outside of DSRC communication range.	
TC Output	OBU Log Files	
Expected Result (Pass/Fail Criteria)	A configurable threshold percentage of I2V SA TIMs sent by the Data Broker are received and processed by OBU when vehicle is at least 300 meters away. All Log files are received and processed by ODE when vehicle is at least 150 meters away from RSU. Log files are received and processed by ODE and are stored by Data Warehouse. Verified by logs.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* **Verify Readiness for Test**	

Test Case ID	**WI2VMCT-3-S**	**Test Engineer Verification and Remarks**
	1. Verify WYDOT CV Pilot TMC System is operational and ready for test **2.** Verify RSUs are operational and ready for test **3.** Cycle Host Vehicle power and reboot vehicle system. **4.** Verify Host vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix **5.** Conduct Safety Inspection of the test area and vehicle path and confirm ready for test a. No obstructions or interference b. All staff where they are supposed to be, no staff where they aren't supposed to be c. Weather is acceptable and will not lead to hazardous driving conditions d. Road surface is acceptable and will not lead to hazardous driving conditions **Test Start Up** **6.** Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational **7.** Host vehicle driver inspects driving area and confirm track is clear and ready for test. **8.** Host Vehicle Driver and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure **Driving the Test** **9.** Host vehicle enters track from outside communication range and performs Test Case Host Vehicle Scenario.	

2.7 Table WI2VMCT-3-S-Results Simultaneous Upload/Download of DSRC Communications Test Case Results

Table 2-7. WI2VMCT-3-S-Results Simultaneous Upload/Download of DSRC Communications Test Case Results

Test Case ID	**WI2VMCT-3-S**	**Test Engineer Verification and Remarks**
Test Case Name	Simultaneous Upload/Download of DSRC Communications	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.8 Table WI2VMCT-Requirements I2V Message Communication Post Test Requirements Verification Analysis

Table 2-8. WI2VMCT-Requirements I2V Message Communication Post Test Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VMCT-3 -- Simultaneous DSRC Upload/Download of messages and log files.	I2VSAP-REQ-13 -- Simultaneous I2V and V2I DSRC Communications	The WYDOT CV Pilot System shall support simultaneous capture of vehicle system BSMs, capture of vehicle system log files, and broadcast of I2V SA TIMs via DSRC.	* Perform Test Case WI2VMCT-3 * Inspect OBU logs * Confirm receipt of broadcast of I2V SA TIMs. * Inspect ODE logs * Confirm receipt of vehicle system BSMs and capture of vehicle system log files * Confirmation shows the WYDOT CV Pilot System supports simultaneous capture of vehicle system BSMs, capture of vehicle system log files, and broadcast of I2V SA TIMs via DSRC, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

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www.its.dot.gov

FHWA-JPO-17-472B.3

U.S. Department of Transportation

Connected Vehicle Pilot Deployment Program Phase 2

WYDOT CV Pilot – Forward Collision Warning Test Procedure and Test Cases

www.its.dot.gov/index.htm
Final Report — July 30, 2018
FHWA-JPO-17-472B.4

U.S. Department of Transportation

Produced by DTFH6116H00027
U.S. Department of Transportation

Notice

Technical Report Documentation Page

1. Report No. FHWA-JPO-17-472B.4	**2. Government Accession No.**	**3. Recipient's Catalog No.**
4. Title and Subtitle WYDOT CV Pilot - Forward Collision Warning Test Procedure and Test Cases		**5. Report Date** 7/30/2018 **6. Performing Organization Code**
7. Author(s) Denny Stephens (Vital Assurance), Tony English (Trihydro), Nayel Ureña Serulle (ICF), Deepak Gopalakrishna (ICF), Vince Garcia (Wyoming DOT)		**8. Performing Organization Report No.** Task 2G: Operational Readiness, Test/Demonstration Planning
9. Performing Organization Name and Address Wyoming DOT, 5300 Bishop Boulevard, Cheyenne, WY 82009 ICF International, 1725 Eye St NW, Washington DC, 20006 Trihydro Corporation, 1252 Commerce Drive, Laramie, WY 82070 Vital Assurance, 175 S. Third St., Suite 200, Columbus, OH 43215		**10. Work Unit No. (TRAIS)** **11. Contract or Grant No.** DTFH6116H00027
12. Sponsoring Agency Name and Address U.S Department of Transportation 1200 New Jersey Ave, SE Washington, DC 20590		**13. Type of Report and Period Covered** 09/01/2016 to 7/30/2018 **14. Sponsoring Agency Code**
15. Supplementary Notes Kate Hartman (COR), Sarah Tarpgaard (CO)		

16. Abstract

The Wyoming Department of Transportation's (WYDOT) Connected Vehicle (CV) Pilot Deployment Program is intended to develop a suite of applications that utilize vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communication technology to reduce the impact of adverse weather on truck travel in the I-80 corridor. These applications support a flexible range of services from advisories, roadside alerts, parking notifications and dynamic travel guidance. Information from these applications are made available directly to the equipped fleets or through data connections to fleet management centers (who will then communicate it to their trucks using their own systems). The pilot will be conducted in three Phases. Phase 1 includes the planning for the CV pilot including the concept of operations development. Phase 2 is the design, development, and testing phase. Phase 3 includes a real-world demonstration of the applications developed as part of this pilot.

This document presents the template of the *Forward Collision Warning Test Procedure and Test Cases* of the Wyoming Department of Transportation (WYDOT) Connected Vehicle (CV) Pilot project as part of the United States Department of Transportation's (USDOT) CV program. These tests are part of the WYDOT CV Pilot Operational Test Plan - Attachment B.

17. Key Words Connected Vehicle Technology, I-80 Corridor, Road Weather, Truck Safety, System Architecture	**18. Distribution Statement** This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161		
19. Security Classif. (of this report) None	**20. Security Classif. (of this page)** None	**21. No. of Pages** 156	**22. Price** NA

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

Acknowledgements

The Operational Readiness Plan development team would like to thank USDOT and Noblis for their technical assistance throughout the development of this document.

Table of Contents

1 Introduction 1

1.1 Project Scope 1

1.2 Purpose of this Test 2

2 Forward Collision Warning Test Procedure and Test Cases 3

2.1 Table WFCWT-SUM Forward Collision Warning Test Case Summary 4

2.2 Table WFCWT-TP Forward Collision Warning (FCW) Test Procedure 7

2.3 Table WFCWT-CI Forward Collision Warning (FCW) Test Configuration and Initialization 12

2.4 Table WFCWT-1-LL-Description - FCW Stopped Vehicle Ahead Test Case Description (Lear Remote/Lear Host) 17

2.5 Table WFCWT-1-LL-Results FCW Stopped Vehicle Ahead Test Case Results (Lear Remote/Lear Host) 22

2.6 Table WFCWT-1-LS-Description - FCW Stopped Vehicle Ahead Test Case Description (Lear Remote/SiriusXM Host) 24

2.7 Table WFCWT-1-LS-Results FCW Stopped Vehicle Ahead Test Case Results (Lear Remote/Lear Host) 28

2.8 Table WFCWT-1-SL-Description - FCW Stopped Vehicle Ahead Test Case Description (SiriusXM Remote/Lear Host) 31

2.9 Table WFCWT-1-SL-Results FCW Stopped Vehicle Ahead Test Case Results (SiriusXM Remote/Lear Host) 35

2.10 Table WFCWT-1-MVL-Description FCW Stopped Vehicle Ahead Test Case Description (Maintenance Vehicle Lear Remote/Lear Host) 37

2.11 Table WFCWT-1-MVL-Results FCW Stopped Vehicle Ahead Test Case Results (Maintenance Vehicle Lear Remote/Lear Host) 40

2.12 Table WFCWT-1-Requirements FCW Stopped Vehicle Ahead Requirements Verification Analysis 43

2.13 Table WFCWT-2-LL-Description FCW Passing Stopped Vehicle Test Case Description (Lear Remote/Lear Host) 49

2.14 Table WFCWT-2-LL-Results FCW Passing Stopped Vehicle Test Case Results (Lear Remote/Lear Host) 54

2.15 Table WFCWT-2-LS-Description FCW Passing Stopped Vehicle Test Case Description 55

2.16 Table WFCWT-2-LS-Results FCW Passing Stopped Vehicle Test Case Results 59

2.17 Table WFCWT-2-Requirements FCW Passing Stopped Vehicle Requirements Verification Analysis 60

2.18 Table WFCWT-3-LL-Description FCW Steady State Test Case Description (Lear Remote/Lear Host) 62

2.19 Table WFCWT-3-LL-Results FCW Steady State Test Case Results (Lear Remote/Lear Host) 67

2.20 Table WFCWT-3-LS-Description FCW Steady State Test Case Description 68

2.21 Table WFCWT-3-LS-Results FCW Steady State Test Case Results 72

2.22 Table WFCWT-3-Requirements FCW Steady State Requirements Verification Analysis 73

2.23 Table WFCWT-4-LL-Description FCW Braking Vehicle Ahead Test Case Description (Lear Remote/Lear Host) 75

2.24 Table WFCWT-4-LL-Results FCW Braking Vehicle Ahead Test Case Results (Lear Remote/Lear Host) 80

2.25 Table WFCWT-4-LS-Description FCW Braking Vehicle Ahead Test Case Description 82

2.26 Table WFCWT-4-LS-Results FCW Braking Vehicle Ahead Test Case Results 87

2.27 Table WFCWT-4-Requirements FCW Braking Vehicle Ahead Requirements Verification Analysis 88

2.28 Table WFCWT-5 -LL-Description FCW Stopped Vehicle in a Curve Test Case Description (Lear Remote/Lear Host) 88

2.29 Table WFCWT-5 -LL-Results FCW Stopped Vehicle in a Curve Test Case Results (Lear Remote/Lear Host) 94

2.30 Table WFCWT-5-LS-Description FCW Stopped Vehicle in a Curve Test Case Description 95

2.31 Table WFCWT-5-LS-Results FCW Stopped Vehicle in a Curve Test Case Results .. 100

2.32 Table WFCWT-5-Requirements FCW Stopped Vehicle in a Curve Requirements Verification Analysis 101

2.33 Table WFCWT-6 -LL-Description FCW Passing Stopped Vehicle in a Curve Test Case Description (Lear Remote/Lear Host) 102

2.34 Table WFCWT-6-LL-Results FCW Passing Stopped Vehicle in a Curve Test Case Results (Lear Remote/Lear Host) 109

2.35 Table WFCWT-6-LS-Description FCW Passing Stopped Vehicle in a Curve Test Case Description 111

2.36 Table WFCWT-6-LS-Results FCW Passing Stopped Vehicle in a Curve Test Case Results 116

2.37 Table WFCWT-6-Requirements FCW Passing Stopped Vehicle in a Curve Requirements Verification Analysis 117

2.38 Table WFCWT-7 -LL-Description FCW Stopped and Obstructed Remote Vehicle Ahead Test Case Description (Lear Remote/Lear Host) 119

2.39 Table WFCWT-7 -LL-Results FCW Stopped and Obstructed Remote Vehicle Ahead Test Case Results (Lear Remote/Lear Host) ... 121

2.40 Table WFCWT-7-LS-Description FCW Stopped and Obstructed Remote Vehicle Ahead Test Case Description ... 123

2.41 Table WFCWT-7-LS-Results FCW Stopped and Obstructed Remote Vehicle Ahead Test Case Results ... 125

2.42 Table WFCWT-7-Requirements FCW Stopped and Obstructed Remote Vehicle Ahead Requirements Verification Analysis ... 126

2.43 Table WFCWT-8 -LL-Description FCW Slow Moving Vehicle Ahead Test Case Description (Lear Remote/Lear Host) ... 129

2.44 Table WFCWT-8 -LL-Results FCW Slow Moving Vehicle Ahead Test Case Results (Lear Remote/Lear Host) ... 134

2.45 Table WFCWT-8-LS-Description FCW Slow Moving Vehicle Ahead Test Case Description ... 135

2.46 Table WFCWT-8-LS-Results FCW Slow Moving Vehicle Ahead Test Case Results . 137

2.47 Table WFCWT-8-Requirements FCW Slow Moving Vehicle Ahead Requirements Verification Analysis ... 138

2.48 Table WFCWT-9-LL-Description Simultaneous Message Prioritization Test Case Description (Lear Remote/Lear Host) ... 139

2.49 Table WFCWT-9-LL-Results Simultaneous Message Prioritization Test Case Results (Lear Remote/Lear Host) ... 141

2.50 Table WFCWT-9-LS-Description Simultaneous Message Prioritization Test Case Description ... 142

2.51 Table WFCWT-9-LS-Results Simultaneous Message Prioritization Test Case Results 144

2.52 Table WFCWT-9-Requirements Simultaneous Message Prioritization Requirements Verification Analysis ... 145

List of Tables

Table 2-1. WFCWT-SUM Forward Collision Warning Test Case Summary 4
Table 2-2. WFCWT-TP Forward Collision Warning (FCW) Test Procedure 7
Table 2-3. WFCWT-CI Forward Collision Warning (FCW) Test Configuration and Initialization .. 12
Table 2-4. WFCWT-1-LL-Description - FCW Stopped Vehicle Ahead Test Case Description (Lear Remote/Lear Host) 17
Table 2-5. WFCWT-1-LL-Results FCW Stopped Vehicle Ahead Test Case Results (Lear Remote/Lear Host) 22
Table 2-6. WFCWT-1-LS-Description - FCW Stopped Vehicle Ahead Test Case Description (Lear Remote/SiriusXM Host) 24
Table 2-7. WFCWT-1-LS-Results FCW Stopped Vehicle Ahead Test Case Results (Lear Remote/Lear Host) 28
Table 2-8. WFCWT-1-SL-Description - FCW Stopped Vehicle Ahead Test Case Description (SiriusXM Remote/Lear Host) 31
Table 2-9. WFCWT-1-SL-Results FCW Stopped Vehicle Ahead Test Case Results (SiriusXM Remote/Lear Host) 35
Table 2-10. WFCWT-1-MVL-Description FCW Stopped Vehicle Ahead Test Case Description (Maintenance Vehicle Lear Remote/Lear Host) 37
Table 2-11. WFCWT-1-MVL-Results FCW Stopped Vehicle Ahead Test Case Results (Maintenance Vehicle Lear Remote/Lear Host) 40
Table 2-12. WFCWT-1-Requirements FCW Stopped Vehicle Ahead Requirements Verification Analysis 43
Table 2-13. WFCWT-2-LL-Description FCW Passing Stopped Vehicle Test Case Description (Lear Remote/Lear Host) 49
Table 2-14. WFCWT-2-LL-Results FCW Passing Stopped Vehicle Test Case Results (Lear Remote/Lear Host) 54
Table 2-15. WFCWT-2-LS-Description FCW Passing Stopped Vehicle Test Case Description .. 55
Table 2-16. WFCWT-2-LS-Results FCW Passing Stopped Vehicle Test Case Results 59
Table 2-17. WFCWT-2-Requirements FCW Passing Stopped Vehicle Requirements Verification Analysis 60
Table 2-18. WFCWT-3-LL-Description FCW Steady State Test Case Description (Lear Remote/Lear Host) 62
Table 2-19. WFCWT-3-LL-Results FCW Steady State Test Case Results (Lear Remote/Lear Host) 67
Table 2-20. WFCWT-3-LS-Description FCW Steady State Test Case Description 68
Table 2-21. WFCWT-3-LS-Results FCW Steady State Test Case Results 72
Table 2-22 WFCWT-3-Requirements FCW Steady State Requirements Verification Analysis 73

Table 2-23. WFCWT-4-LL-Description FCW Braking Vehicle Ahead Test Case Description (Lear Remote/Lear Host) ... 75
Table 2-24. WFCWT-4-LL-Results FCW Braking Vehicle Ahead Test Case Results (Lear Remote/Lear Host) ... 80
Table 2-25. WFCWT-4-LS-Description FCW Braking Vehicle Ahead Test Case Description ... 82
Table 2-26. WFCWT-4-LS-Results FCW Braking Vehicle Ahead Test Case Results ... 87
Table 2-27. WFCWT-4-Requirements FCW Braking Vehicle Ahead Requirements Verification Analysis ... 88
Table 2-28. WFCWT-5 -LL-Description FCW Stopped Vehicle in a Curve Test Case Description (Lear Remote/Lear Host) ... 88
Table 2-29. WFCWT-5 -LL-Results FCW Stopped Vehicle in a Curve Test Case Results (Lear Remote/Lear Host) ... 94
Table 2-30. WFCWT-5-LS-Description FCW Stopped Vehicle in a Curve Test Case Description 95
Table 2-31. WFCWT-5-LS-Results FCW Stopped Vehicle in a Curve Test Case Results ... 100
Table 2-32. WFCWT-5-Requirements FCW Stopped Vehicle in a Curve Requirements Verification Analysis ... 101
Table 2-33. WFCWT-6 -LL-Description FCW Passing Stopped Vehicle in a Curve Test Case Description (Lear Remote/Lear Host) ... 102
Table 2-34. WFCWT-6-LL-Results FCW Passing Stopped Vehicle in a Curve Test Case Results (Lear Remote/Lear Host) ... 109
Table 2-35. WFCWT-6-LS-Description Passing FCW Passing Stopped Vehicle in a Curve Test Case Description ... 111
Table 2-36. WFCWT-6-LS-Results FCW Passing Stopped Vehicle in a Curve Test Case Results ... 116
Table 2-37/ WFCWT-6-Requirements FCW Passing Stopped Vehicle in a Curve Requirements Verification Analysis ... 117
Table 2-38. WFCWT-7 -LL-Description FCW Stopped and Obstructed Remote Vehicle Ahead Test Case Description (Lear Remote/Lear Host) ... 119
Table 2-39. WFCWT-7 -LL-Results FCW Stopped and Obstructed Remote Vehicle Ahead Test Case Results (Lear Remote/Lear Host) ... 121
Table 2-40. WFCWT-7-LS-Description FCW Stopped and Obstructed Remote Vehicle Ahead Test Case Description ... 123
Table 2-41. WFCWT-7-LS-Results FCW Stopped and Obstructed Remote Vehicle Ahead Test Case Results ... 125
Table 2-42. WFCWT-7-Requirements FCW Stopped and Obstructed Remote Vehicle Ahead Requirements Verification Analysis ... 126
Table 2-43. WFCWT-8 -LL-Description FCW Slow Moving Vehicle Ahead Test Case Description (Lear Remote/Lear Host) ... 129
Table 2-44. WFCWT-8 -LL-Results FCW Slow Moving Vehicle Ahead Test Case Results (Lear Remote/Lear Host) ... 134
Table 2-45. WFCWT-8-LS-Description FCW Slow Moving Vehicle Ahead Description ... 135
Table 2-46. WFCWT-8-LS-Results FCW Slow Moving Vehicle Ahead Test Case Results ... 137

Table 2-47. WFCWT-8-Requirements FCW Slow Moving Vehicle Ahead Requirements Verification Analysis 138

Table 2-48. WFCWT-9-LL-Description Simultaneous Message Prioritization Test Case Description (Lear Remote/Lear Host)........ 139

Table 2-49. WFCWT-9-LL-Results Simultaneous Message Prioritization Test Case Results (Lear Remote/Lear Host) 141

Table 2-50. WFCWT-9-LS-Description Simultaneous Message Prioritization Test Case Description........ 142

Table 2-51. WFCWT-9-LS-Results Simultaneous Message Prioritization Test Case Results ... 144

Table 2-52. WFCWT-9-Requirements Simultaneous Message Prioritization Requirements Verification Analysis 145

1 Introduction

1.1 Project Scope

Wyoming is one of the first wave of CV Pilot sites selected to showcase the value of and spur the adoption of CV technology in the United States. CV technology is a broad term to describe the applications and the systems that leverage dedicated short-range communications (DSRC) for vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I) and infrastructure-to-vehicle (I2V) communication to improve safety, mobility and productivity of the users of the nation's transportation system.

As one of the three selected pilots, WYDOT is focusing on improving safety and mobility by creating new ways to communicate road and travel information to commercial truck drivers and fleet managers along the 402 miles of Interstate 80 (I-80 henceforth) in the State. For the pilot project, WYDOT concluded Phase 1 (planning) in September 2016 and then initiated Phase 2 (deployment) which is scheduled to conclude in mid-2018. This will be followed by an 18-month demonstration period in the third phase.

Systems and applications developed in the pilot will enable drivers of connected vehicles to have improved awareness of potential hazards and of situations they cannot see. At a very high level, the pilot scope includes the following implementation elements:

- **Deploy about 75 roadside units (RSU)** that can receive and broadcast messages using DSRC along various sections on I-80.
- **Equip around 400 vehicles, a combination of fleet vehicles and commercial trucks, with on-board units (OBU).** Of the 400 vehicles, at least 150 are planned to be heavy trucks. All vehicles are expected to be regular users of I-80. Several types of OBUs are being procured as part of the pilot and differ based on their communication capabilities, ability to integrate with the in-vehicle network, and connectivity to ancillary devices and sensors. All OBUs will have the functionality to broadcast Basic Safety Messages (BSM) and will include a human-machine interface (HMI) to share alerts and advisories to drivers of these vehicles.
- **Develop several V2V, V2I, I2V applications** that will enable communication to drivers of alerts and advisories regarding various road conditions. These applications include support for in-vehicle dissemination of advisories for collision avoidance, speed management, detours, parking, and presence of work zones and maintenance and emergency vehicles downstream of their current location.
- **Enable overall improvements in WYDOT's traffic management and traveler information practices** by using data collected from connected vehicles. Targeted improvements include ingesting more location specific mobile road weather information system (RWIS) data, using Pikalert®[1] to provide for more accurate and road segment specific conditions to define better variable speed limits (VSLs), and improving road

[1] Pikalert is a trademark of the University Corporation for Atmospheric Research.

condition dissemination via 511, Dynamic Message Signs (DMS) and other WYDOT sources.

1.2 Purpose of this Test

This document presents the test results of the *Forward Collision Warning Test Procedure and Test Cases* for the Wyoming Department of Transportation (WYDOT) Connected Vehicle (CV) Pilot project as part of the United States Department of Transportation's (USDOT) CV program. These tests are part of the WYDOT CV Pilot Operational Test Plan - Attachment B.

The purpose of this document is to describe the results of a sequence of end-to-end tests conducted to validate the successful operation of the system in terms of forward collision warning.

2 Forward Collision Warning Test Procedure and Test Cases

This chapter describes *Test Procedure ID WFCWT -- Forward Collision Warning Test Procedures and Test Cases*. Table 2-1 WFCWT-SUM is a high-level summary of the test cases addressed in this test procedure, providing a summary and orientation for the reader. Table 2-2 WFCWT-TP details the Test Procedure itself. Table 2-3 WFCWT-CI describes the configuration of each of the WYDOT CV Pilot System components for the Test Procedure and the Initialization to be performed for each prior to conducting the Test Cases. Tables WFCWT-1-LL-Description through WFCWT-9-LS-Description provide the detailed description of Test Cases to be performed under this Test Procedure. Tables WFCWT-1-LL-Results through WFCWT-9-LS-Results capture the results of each repetition of each Test Case. Finally, Tables WFCWT-1-Requirements through WFCWT-9-Requirements describe the requirement verification methodology and capture the Test Engineer's confirmation that each requirement is verified. Appendix A of the ORTP provides a list of all system requirements, the test case in which they are verified, and their individual requirements verification methodology.

In this chapter, the same Message Communication Test Cases are integrated with Forward Collision Test cases for efficiency in conducting the tests.

WFCWT-6 Passing Stopped Vehicle in a Curve

- WV2IMCT-2 - V2I & End-to-end Communication of BSMs
- WV2IMCT-4 - V2I & End-to-end communication of log files

WFCWT-9 Simultaneous Message Prioritization

- WV2VMCT-1 V2V exchange of BSMs

2.1 Table WFCWT-SUM Forward Collision Warning Test Case Summary

Table 2-1. WFCWT-SUM Forward Collision Warning Test Case Summary

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID	Requirements Verified
WFCWT-1	FCW Stopped Vehicle Ahead	* Verify FCW application issues a warning in time for driver to avoid forward collision. * This test case is used to "tune" FCW to deliver timely warnings, while avoiding nuisance warnings.	* Host vehicle approaches stopped remote vehicle at 35 mph. * After receiving warnings, vehicle slows to stop 2 meters behind remote vehicle or veers to clear adjacent lane.	* FCW application issues a warning in time for driver to take action to avoid collision. Verified visually and by inspection of logs.		Compiled in Table WFCWT-Requirements
WFCWT-2	FCW Passing Stopped Vehicle	* FCW does NOT issue a warning when there are no FCW threats in the host vehicle path.	* Host vehicle passes stopped remote vehicle at 35 mph.	* FCW does NOT issue a warning when there are no FCW threats in the Host vehicle path. * Verified visually and by inspection of logs.		Compiled in Table WFCWT-Requirements
WFCWT-3	FCW Steady State	* FCW does NOT issue a warning when host vehicle follows closely. * This test case is used to "tune" FCW to deliver timely warnings, while avoiding nuisance warnings.	* Host vehicle follows remote vehicle closely at 35 mph.	* FCW does NOT issue a warning. * Verified visually and by inspection of logs.		Compiled in Table WFCWT-Requirements

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID	Requirements Verified
WFCWT-4	FCW Braking Vehicle Ahead	* When remote vehicle brakes heavily FCW application issues a warning in time for driver to avoid forward collision.	* Host vehicle follows braking remote vehicle slowing from 35 mph.	* FCW issues an alert after the remote vehicle brakes heavily in time for driver to take action to avoid collision. * Verified visually and by inspection of logs.		Compiled in Table WFCWT-Requirements
WFCWT-5	FCW Stopped Vehicle in a Curve	* When there is a stopped vehicle in the same lane of travel in a curve, FCW application issues a warning in time for driver to avoid forward collision.	* Host vehicle approaches remote vehicle stopped in a curve.	* FCW issues a warning when there is a stopped vehicle in the same lane of travel in a curve in time for driver to take action to avoid collision. * Verified visually and by inspection of logs.		Compiled in Table WFCWT-Requirements
WFCWT-6	FCW Passing Stopped Vehicle in a Curve	* FCW does NOT issue a warning when there are no FCW threats in the host vehicle path in curve.	* Host vehicle passes remote vehicle stopped in a curve at 35 mph.	* FCW does NOT issue a warning when there are no FCW threats in the Host vehicle path. * Verified visually and by inspection of logs.		Compiled in Table WFCWT-Requirements
WFCWT-7	FCW Stopped and Obstructed Remote Vehicle Ahead	* FCW application issues a warning, in time for driver to avoid forward collision, when following an obstructing vehicle that changes lanes to reveal a stopped vehicle ahead in the same lane of travel.	* Remote vehicle enters track, approaches and stops at designated test location. * Obstructing Vehicle (with or without active OBU) enters track from outside communication range. * Obstructing Vehicle approaches stopped remote at 35 mph. When nearing the	* FCW issues a warning in time for driver to take action to avoid collision, when obstructing vehicle veers out of lane and there is a stopped vehicle ahead in the same lane of travel. * Verified visually and by inspection of logs.		Compiled in Table WFCWT-Requirements

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID	Requirements Verified
			stopped remote vehicle, the Obstructing vehicle veers to clear adjacent lane and proceeds past stopped vehicle. * Host vehicle enters track from outside communication range and follows Obstructing Vehicle at 35 mph. * After Obstructing Vehicle veers out of the lane, Host Vehicle continues until receiving FCW warning when driver stops or veers to clear adjacent lane and proceeds past stopped vehicle.			
WFCWT-8	FCW Slow Moving Vehicle	* FCW application issues a warning when approaching a slow moving remote vehicle in time for driver to avoid forward collision.	* Host vehicle traveling at 35 mph approaches remote vehicle traveling at 15 mph.	* FCW issues a warning when there is a slow-moving vehicle in the same lane of travel in a curve in time for driver to take action to avoid collision. * Verified visually and by inspection of logs.		Compiled in Table WFCWT-Requirements
WFCWT-9	Simultaneous Message Prioritization	* Verify prioritization of simultaneous FCW, Distress Notification, and I2V SA messages.	* I2V SA TIM is configured with geofence beginning outside DSRC communication range of planned remote vehicle location. * Remote vehicle stops	* I2V SA Message displays within 8 meters of beginning of specified geofence. * DNM message displays at specified distance from distressed vehicle, prioritized over I2V SA		Compiled in Table WFCWT-Requirements

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID	Requirements Verified
			in travel lane in the middle of geofence and issues Manual Distress Notification, along with broadcasting BSMs. * Host vehicle passes RSU and downloads I2V SA TIM and enters I2V SA TIM geofence. * Host vehicle then approaches distressed vehicle, downloads DNM. * Finally Host vehicle continues approaching stopped distressed remote vehicle at 35 mph. * (all while still in I2V SA and DNM geofence)	message. * As host vehicle approaches remote vehicle, FCW advisory alert is issued, followed by FCW imminent alert, prioritized over I2V SA and DNM, in time for driver to avoid collision. * Verified visually and by inspection of logs.		

2.2 Table WFCWT-TP Forward Collision Warning (FCW) Test Procedure

Table 2-2. WFCWT-TP Forward Collision Warning (FCW) Test Procedure

Test Procedure ID	**WFCWT**	**Test Engineer Verification and Remarks**
Test Procedure Name	Forward Collision Warning Test Procedure	
Test Procedure	Winter/Spring 2018.	

Test Procedure ID	WFCWT	Test Engineer Verification and Remarks
Completion Date		
Priority	Required	
Objectives	1. Verify the FCW application issues an advisory FCW alert when there is a potential for forward collision with a vehicle directly ahead in the same lane of travel. 2. Verify the FCW application issues an imminent FCW alert when there is an imminent threat of forward collision with a vehicle directly ahead in the same lane of travel and immediate action is required from the driver to avoid the collision. 3. Verify that the FCW application does not issue an FCW alert if vehicle is stopped in adjacent lane. 4. Verify requirements associated with each Test Case.	
Relationship to Other Procedures	• Precondition is successful development and integration of the WYDOT CV Pilot System, as described in the SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment. • WFCWT Test cases may not be performed concurrently with each other to avoid interaction between multiple host vehicles, although WV2VMCT and WV2IMCT Test Cases may be integrated with them at the discretion of the test engineer under the condition that that there is no interference, confusion or conflict in interpretation of test results.	
Discussion, Guidance, and Rationales	• The test speed of 35 mph was selected by experience in prior tests (Bogard, 2014) as an FCW test speed that can be safely handled by test engineers. Higher test speeds for FCW require professionally trained test drivers and driver protection equipment such as that used by race car drivers. • 300m is the design communication range for DSRC SAE J2735 messages. • WYDOT Maintenance Vehicle is used as remote vehicle for all test cases because a primary WYDOT use case is collision of passenger vehicles into slow moving WYDOT snow plows in inclement weather. WYDOT Maintenance Vehicle is also used as remote to verify FCW and DSRC performance around large vehicle bodies. • Test cases in which FCW issues warnings must be performed with each type of vehicle as host vehicle, because of different stopping characteristics. Test cases in which FCW does not issue warnings must be performed with each vendor's OBU (not each type of vehicle).	

Test Procedure ID	WFCWT	Test Engineer Verification and Remarks
	• The FCW application alerts the driver when there is imminent danger of a forward collision with a stopped or slowing vehicle ahead in its lane of travel, helping drivers avoid or mitigate rear-end vehicle crashes. • The FCW alerts are issued when stopped or slowing vehicles are in the same lane of travel, whether on straight or curved roads. • FCW alerts are based upon time-to-collision (TTC), which depends upon vehicle stopping distance. Because stopping distance varies with vehicle weight, braking ability, and dynamics, FCW alert timing must be adjusted for different classes of vehicles. • FCW alert timing is tuned to deliver alerts quickly enough for the driver to take action to avoid collision, but not so quickly that they become a nuisance for the driver. • Because large vehicle bodies can block DSRC signals, remote vehicle DSRC antennas must be located on an elevated structure on top of the tractor portion an integrated truck to ensure following host vehicles receive sufficient BSMs to support FCW applications. • Positioning accuracy of host and remote vehicles must be sufficient to minimize nuisance alerts when passing stopped or slowing vehicles on straight or curved roads. • Typically, FCW alerts must be tuned for each class of vehicles to alert the driver in time to avoid collision, while avoiding alerting the driver so frequently that they become a nuisance. • Total Time to Collision is the sum of the Driver Brake Reaction Time and the Vehicle Response Time. Driver Response Time includes Driver Mental Processing Time (Sensation+Percetiption+Response Selection & Preparation) plus movement time. Values from research [2] indicate that a primed (expectant of the cue) driver under optimal conditions may have a brake reaction time of under 1 s, while analysis of naturalistic data [7] suggest that brake reaction time could range from 1.5 s to 2.5 s (and occasionally greater depending on driver state, such as distraction). (Campbell, 2016, Section Providing Forward Collision Warnings that Accommodate Driver Brake Reaction Time) • Vehicle Response Time is the vehicle's braking or deceleration capacity for its given weight. NHTSA FMVSS specifies a maximum stopping distance of 250 ft to safely stop a fully loaded (new) tractor trailer from 60 mph, equivalent to a 0.48g uniform deceleration rate and a 5.67 sec vehicle response (stopping) time. NHTSA FMVSS 135 specifies a maximum stopping distance of 230 ft to safely stop a passenger vehicle from 62.1 mpg, equivalent to a 0.56g uniform deceleration rate and a 5.06 sec vehicle response (stopping) time.	

Test Procedure ID	WFCWT	Test Engineer Verification and Remarks
	• Vehicle Response Only Time to Collision (TTC) = t-(1/(2v))*a*t^2 where t is the time prior to impact when braking initiated, v is vehicle speed when braking initiated, a is the constant braking deceleration. (Kusano, 2011) • The AASHTO Policy on Geometric Design of Highways and Streets indicates that most drivers decelerate at a rate that is greater than 14.8 ft/s2 (4.5 m/s2) (0.46g) when there is a sudden need to stop for an unexpected object in the roadway, while 90 percent of drivers decelerate at a rate over 11.2 ft/s2 (3.4 m/s2) (0.35g). These deceleration rates account for the comfort level of drivers, the ability of the driver to maintain steering control on wet surfaces in tandem with tire-pavement friction levels, and vehicle braking systems capabilities • Bogard uses a Total Time-to-Collision criterion of 6.5 ± 1.0 s for imminent FCW alert for an unloaded commercial vehicle stopping behind a passenger vehicle. (Bogard, 2014). • Industry guidelines and/or local policy should provide guidance on deceleration rates for specific circumstances. • The following references are provided for guidance: o Campbell, J. L., Brown. J. L., Graving, J. S., Richard, C. M., Lichty, M. G., Sanquist, T., & Morgan, J. L.. (2016, December). Human factors design guidance for driver-vehicle interfaces (Report No. DOT HS 812 360). Washington, DC: National Highway Traffic Safety Administration. o Title 49 Code of Federal Regulations Part 571.121 and Part 571.135 o Kusano, K.D., and Gabler, H., Method for Estimating Time to Collision at Braking in Real-World, Lead Vehicle Stopped Rear-End Crashes for Use in Pre-Crash System Design, SAE International, 2011-01-0576, Published 4/12/2011) o Policy on Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials, Fourth Edition, 2001. o Bogard, S and LeBlanc, D., Connected Commercial Vehicles—Retrofit Safety Device Kit Project: Applications Performance and Functional Test Report FHWA-JPO-14-108, Federal Highway Administration, March 2014. o Kusano, K.D., and Gabler, H., Method for Estimating Time to Collision at Braking in Real-World, Lead Vehicle Stopped Rear-End Crashes for Use in Pre-Crash System Design, SAE International, 2011-01-0576, Published 4/12/2011	

<table>
<tr><th>Test Procedure ID</th><th>WFCWT</th><th>Test Engineer Verification and Remarks</th></tr>
<tr><td>Test Cases Performed under This Procedure</td><td>
<table>
<tr><th>Test Case ID</th><th>Integrated with</th><th>Remote Vehicle OBU</th><th>Host Vehicle OBU</th></tr>
<tr><td rowspan="2">WFCWT-1-LL</td><td></td><td>Lear Roadstar OBU</td><td>Lear Roadstar OBU</td></tr>
<tr><td></td><td></td><td>Lear Roadstar OBU</td></tr>
<tr><td rowspan="2">WFCWT-1-LS</td><td>*WV2VMCT-1-LS</td><td>Lear Roadstar OBU</td><td>SiriusXM OBU</td></tr>
<tr><td>*WV2IMCT-2-S
*WV2IMCT-4-S</td><td></td><td>SiriusXM OBU</td></tr>
<tr><td>WFCWT-1-SL</td><td>*WV2VMCT-1-SL</td><td>SiriusXM OBU</td><td>Lear Roadstar OBU</td></tr>
<tr><td>WFCWT-1-MVL</td><td>*WV2VMCT-1-MVL</td><td>Lear Roadstar OBU in WYDOT Maintenance Vehicle</td><td>Lear Roadstar OBU in sedan</td></tr>
<tr><td>WFCWT-2-LL</td><td></td><td>Lear Roadstar OBU</td><td>Lear Roadstar OBU</td></tr>
<tr><td>WFCWT-2-LS</td><td></td><td>Lear Roadstar OBU</td><td>SiriusXM OBU</td></tr>
<tr><td>WFCWT-3-LL</td><td></td><td>Lear Roadstar OBU</td><td>Lear Roadstar OBU</td></tr>
<tr><td>WFCWT-3-LS</td><td></td><td>Lear Roadstar OBU</td><td>SiriusXM OBU</td></tr>
<tr><td>WFCWT-4-LL</td><td></td><td>Lear Roadstar OBU</td><td>Lear Roadstar OBU</td></tr>
<tr><td>WFCWT-4-LS</td><td></td><td>Lear Roadstar OBU</td><td>SiriusXM OBU</td></tr>
<tr><td>WFCWT-5 -LL</td><td></td><td>Lear Roadstar OBU</td><td>Lear Roadstar OBU</td></tr>
<tr><td>WFCWT-5-LS</td><td></td><td>Lear Roadstar OBU</td><td>SiriusXM OBU</td></tr>
<tr><td>WFCWT-6 -LL</td><td>*WV2IMCT-2-L
*WV2IMCT-4-L</td><td>Lear Roadstar OBU</td><td>Lear Roadstar OBU</td></tr>
<tr><td>WFCWT-6-LS</td><td></td><td>Lear Roadstar OBU</td><td>SiriusXM OBU</td></tr>
<tr><td>WFCWT-7 -LL</td><td>*WV2VMCT-1-LL</td><td>Lear Roadstar OBU</td><td>Lear Roadstar OBU</td></tr>
<tr><td>WFCWT-7-LS</td><td></td><td>Lear Roadstar OBU</td><td>SiriusXM OBU</td></tr>
<tr><td>WFCWT-8 -LL</td><td></td><td>Lear Roadstar OBU</td><td>Lear Roadstar OBU</td></tr>
<tr><td>WFCWT-8-LS</td><td></td><td>Lear Roadstar OBU</td><td>SiriusXM OBU</td></tr>
</table>
Notes:

Base cases LL and LS test the FCW functionality of the Lear and SiriusXM OBUs as Host Vehicles while using Lear as the Remote Vehicle.
Test Case WFCWT-1-SL verifies the BSM broadcast of SiriusXM OBUs, received and processed by Lear OBUs
Test Case WFCWT-1-MVL verifies the ability of host vehicles to receive BSMs from OBUs installed on (large) WYDOT Maintenance Vehicles, and to issue FCW alerts.

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</table>

2.3 Table WFCWT-CI Forward Collision Warning (FCW) Test Configuration and Initialization

Table 2-3. WFCWT-CI Forward Collision Warning (FCW) Test Configuration and Initialization

System Component	Applicable Test Procedures and Cases	Configuration for Forward Collision Warning Test Procedure and Test Cases	Initialization for Forward Collision Warning Test Procedure and Test Cases	Test Engineer Verification and Remarks
Track or Roadway	All WFCWT Test Cases	• Controlled environment track test facility. • For collision tests in a curve, the Test track curve should be as tight as practical and be safely traversed by test vehicles at 25 mph. • Staging area outside DSRC communication range from stopped or slowing remote vehicle location.	• Identify FCW interaction event location and place traffic cones on both sides of roadway clearly visible to drivers where remote vehicle is to be stopped and approximate location of FCW alert • Place cautionary signage and boundary markers in advance of geofence to warn test staff and visitors • On roadway, place any additional signage required by WYDOT Safety Manager • Verify vehicle preparation and staging area is outside DSRC communication range of FCW interaction event location	

System Component	Applicable Test Procedures and Cases	Configuration for Forward Collision Warning Test Procedure and Test Cases	Initialization for Forward Collision Warning Test Procedure and Test Cases	Test Engineer Verification and Remarks
Operational Data Environment (ODE)	All WFCWT Test Cases	ODE fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Archive and Delete (all) existing Event Log Files • Remove old log files • Verify ODE configuration files are correct for this test case • Download/Copy ODE configuration files to Test Case Folder for Test Record • Reinitialize, if practical	
Data Warehouse (DW)	All WFCWT Test Cases	DW fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Verify DW configuration files are correct for this test case • Download/Copy DW configuration files to Test Case Folder for Test Record	
Security Credential Management System (SCMS)	All WFCWT Test Cases	SCMS fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment. All test cases may be performed without SCMS	• Verify SCMS configuration files are correct for this test case • Download/Copy SCMS configuration files to Test Case Folder for Test Record	

System Component	Applicable Test Procedures and Cases	Configuration for Forward Collision Warning Test Procedure and Test Cases	Initialization for Forward Collision Warning Test Procedure and Test Cases	Test Engineer Verification and Remarks
		support during development for verification of functionality and performance of other components. Final, for the record testing must be performed with SCMS fully integrated with WYDOT TMC per SDD and ICD, ready for production deployment.		
RSU(s)	All WFCWT Test Cases	One RSU fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment. RSU is located outside DSRC communication range from WFCWT stopped or slowing remote vehicle event location.	• Verify RSU is located outside DSRC communication range from WFCWT stopped or slowing remote vehicle event location. • Delete (all) existing TIMs on RSU (avoid interfere with V2V communications) • Remove old log files • Verify RSU configuration files are correct for this test case • Download/Copy RSU configuration files to Test Case Folder for Test Record • Reboot RSU, if practical	
Data Logging	All WFCWT Test Cases	Data logging for each of the following components	• Remove old log files after storage and archival	

System Component	Applicable Test Procedures and Cases	Configuration for Forward Collision Warning Test Procedure and Test Cases	Initialization for Forward Collision Warning Test Procedure and Test Cases	Test Engineer Verification and Remarks
		fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment: • ODE (for Event Log Files) • OBU (all vehicles) • HMI (all vehicles) • Back Office components • Data broker	• Initialize Test Log Folder with Unique Test Identifier	
Lear Roadstar OBU	As specified in each Test Case.	Lear Roadstar OBU with antenna configuration planned for deployment and HMI fully developed, integrated with vehicle and CAN interface per SDD and ICD, ready for production deployment. May be tested with development environment or production environment, as long as it is ready for production deployment.	• Remove old log files • Initialize log file folders for this Test Case with Unique Identifier • Verify OBU and HMI configuration files are correct for this test case • Download/Copy OBU and HMI configuration files to Test Case Folder for Test Record	
Serious XM OBU	As specified in each Test Case.	SiriusXM OBU with antenna configuration planned for deployment and HMI fully developed, installed in vehicle per SDD and ICD, ready for production deployment. May be tested with	• Remove old log files • Initialize log file folders for this Test Case with Unique Identifier • Verify OBU and HMI configuration files are correct for this test case	

System Component	Applicable Test Procedures and Cases	Configuration for Forward Collision Warning Test Procedure and Test Cases	Initialization for Forward Collision Warning Test Procedure and Test Cases	Test Engineer Verification and Remarks
		development environment or production environment, as long as it is ready for production deployment.	• Download/Copy OBU and HMI configuration files to Test Case Folder for Test Record	
Drivers	All WFCWT Test Cases	Drivers qualified and experienced in driving the assigned vehicles. Drivers trained in what to expect from WFCWT Applications and practiced in conducting driving scenarios safely and reliably with existing traffic.	• Conduct driver safety briefing • Review and practice test scenario, as required to ensure maneuvers can be conducted safely and reliably with existing traffic	
Test Staff	All WFCWT Test Cases	Test staff trained in what to expect from WFCWT Applications and practiced in supporting driving scenarios safely and reliably with existing traffic.	• Conduct safety briefing and review danger zones • Verify that Test Staff wear safety vests • Review and practice test scenario, as required to ensure maneuvers can be conducted safely and reliably with existing traffic	
Visitors and Non-Test Staff	All WFCWT Test Cases	Visitors and Non-Test Staff instructed in what to expect from WFCWT Applications and informed in observing driving scenarios safely and reliably with existing traffic.	• Review test scenario • Conduct safety briefing and review danger zones	

2.4 Table WFCWT-1-LL-Description - FCW Stopped Vehicle Ahead Test Case Description (Lear Remote/Lear Host)

Table 2-4. WFCWT-1-LL-Description - FCW Stopped Vehicle Ahead Test Case Description (Lear Remote/Lear Host)

Test Case ID	WFCWT-1-LL	Test Engineer Verification and Remarks
Test Case Name	FCW Stopped Vehicle Ahead (Lear Remote/Lear Host)	
Test Case Completion Date	December 7, 2017	
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WFCWT-1-Requirements	
Objectives	• WFCWT-1 - FCW Stopped Vehicle Ahead - Verify FCW application issues a warning in time for driver to avoid forward collision. This test case is used to “tune” FCW to deliver timely warnings, while avoiding nuisance warnings.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Prepare each system and test component in accordance with Initialization for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Host Vehicle OBU/ Firmware/ Vehicle	Lear LocoMate 300 OBU/Pro 10/Light Truck Test Vehicle	
Remote Vehicle OBU/ Vehicle	Lear LocoMate 300 OBU/Pro 10/Light Truck Test Vehicle	

Test Case ID	WFCWT-1-LL	Test Engineer Verification and Remarks
Roadway Geometry	Straight	
Remote Vehicle Scenario (Test Case Input 1)	Remote vehicle enters track/roadway, approaches and stops at designated test location.	
Host Vehicle Scenario (Test Case Input 2)	Host vehicle enters track/roadway from outside communication range. Host Vehicle approaches stopped remote vehicle at 35 mph. After receiving FCW Advisory (Level 1) and FCW Imminent Alert (Level 2), driver stops or veers to clear adjacent lane and proceeds past stopped vehicle.	
WFCWT-1-LL Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Driver confirms host vehicle issues FCW Advisory and FCW Imminent Alert FCW Advisory (Level 1) FCW Imminent Alert (Level 2)	
WFCWT-1-LL Log File Analysis and Verification Method (Test Case Output 2)	- Test engineer analyzes results to determine Time-to-collision when FCW Advisory is issued - Test engineer analyzes results to determine Time-to-collision when FCW Imminent Alert is issued	
WFCWT-1-LL Expected Result (Pass/Fail Criteria)	- FCW application issues a FCW Advisory (Level 1) at approximately 10 seconds - Time-to-Collision and FCW Imminent Alert (Level 2) at approximately 5 seconds Time-to-Collision.	
Detailed Execution Steps	**Verify Readiness** 1. Host and remote vehicle have Lear LocoMate 300 OBU's installed with antenna and HMI, configured according to the WYDOT CV Pilot OBU configuration. A lap top computer must be connected via an Ethernet cable or WiFi to the OBU to implement initial log file offload verification. 2. Confirm that the test Lear LocoMate 300 RSU is installed and configured according to the WYDOT CV Pilot RSU configuration. 3. Identify offload location where vehicles can drive to, to be within the offload range of the test RSU.	*Performed and Confirmed by:*

Test Case ID	WFCWT-1-LL	Test Engineer Verification and Remarks
	4. Identify specific test location for remote vehicle to stop and be stationary. Identify path that host vehicle will use to approach stationary remote vehicle. The approach path must start at least 300 meters from stationary vehicle location. **Test Start Up** 5. Drive both the host and remote vehicles to the offload location, power up each OBU in the host and remote vehicle. 6. Confirm that each OBU powers up correctly and is linked to its corresponding HMI. Confirm this by driving a short distance and validating that the vehicle speed and location are updated on the HMI to reflect the short drive. 7. While parked at the offload location execute the following steps to confirm log file generation and offload. a. Log into each OBU and from the system shell issue a ping6 command to the backend host server for the WYDOT CV Pilot environment. This will confirm the full IPv6 connectivity from the OBU through the RSU to the WYDOT backend server. The ping command to issue is: i. #ping6 <backend server IPv6 address> b. For each OBU confirm that log files are being generated. Confirm this by reviewing the event log directory on the OBU and checking that various log files are increasing in size. The specific log files to see increasing are: i. /var/eventlog/bsmLogDuringEvent.csv ii. /var/eventlog/rxMsg.csv iii. /var/eventlog/driverAlert.csv c. For each OBU confirm that log files are being offloaded, when vehicle is at the designated offload location. Confirm this by reviewing the offload subdirectories on the OBU and ensuring that they do not continuously accumulate log files. A few log files may accumulate (2-3), but within 30 seconds they should all offload and be removed from the log directory. The specific offload subdirectories to check are: i. /var/storage/bsmLogDuringEvent ii. /var/storage/rxMsg	

Test Case ID	**WFCWT-1-LL**	**Test Engineer Verification and Remarks**
	iii. /var/storage/driverAlert Once the log file generation and offload are confirmed the test repetitions can begin. **Driving the Test** 8. Begin by driving the remote vehicle to the designated stationary position on the test track. 9. Once the remote vehicle is stationary, the host vehicle enters the test track, this entry onto the track must be at least 300 meters driving distance from the stationary remote vehicle. The host vehicle should follow the same path that the remote vehicle did when driving to the stationary position on the test track. 10. Accelerate the host vehicle up to 35 miles per hour driving on the test track towards the stationary remote vehicle. The host driver should initially focus on achieving and maintaining the test speed of 35 mph. 11. As the host vehicle approaches the stationary remote vehicle the driver maintains the vehicle speed and monitors the approach to the remote vehicle to ensure the host vehicle stops or avoids the remote vehicle before any collision. 12. During the approach to the remote vehicle, the host vehicle driver identifies any forward collision advisory and/or imminent forward collision warnings issued to the driver. 13. After safely stopping behind the remote vehicle or avoiding the remote vehicle, the host vehicle driver should come to a complete stop and manually record the types of driver alerts received during the prior approach sequence. 14. The host vehicle then returns to the previously defined start location to repeat the test again. 15. The remote vehicle may remain stationary between multiple repetitions of the test and the host vehicle begins each new repetition at step two of this driving sequence. If the remote vehicle moves after a test repetition completes, then the next repetition of the test driving sequence must start at the first step of the driving test.	

Test Case ID	WFCWT-1-LL	Test Engineer Verification and Remarks
	16. After final test repetition, both the remote and host vehicles drive to offload location and confirm that generated log files are offloaded (see test startup step 3). **Analysis Procedure** 17. Execute a set of queries on the DW to extract bsm and driver alert log records for the period of time around each FCW test run. These queries are implemented in a script that generates a KML file for display in Google Earth. This allows each bsm and driver alert record from each test vehicle to be plotted in the Google Earth application. The follow example command line runs the query script to generate the KML file for a test executed at the Archer test track that started 07 Dec 2017 03:15:10 pm MST and ended at 03:16:00 pm MST. python create_kml.py circle --lat 41.150576 --long -104.654964 --distance 1000 --beginTime '2017-12-07 22:15:10' --endTime '2017-12-07 22:16:00' 18. Open the resulting KML file in Google Earth. The bsm records and driver alert records for each vehicle will be visible along the paths they traveled at the test site location. Bsm records from each vehicle will be in a different color. Driver alert records will be shown as white arrows at each point in the vehicle trajectory that the driver alert was issued. Adjust the time slider so that appropriate bsm and driver alerts around the FCW test are visible. 19. Using the Google Earth ruler tool, measure the distance in meters from the first advisory FCW (stationary vehicle alert) to the location of the stationary remote vehicle. Record the host vehicle speed in mph that is associated with this first advisory FCW. 20. Calculate the time to collision (ttc) at the point where the advisory FCW is issued. The constant 0.44704 converts speed from mph to m/s. Time to collision (sec) ttc = distance /(speed * 0.44704) 21. Confirm that this ttc is close to the configured collision advisory time. 22. Use the same measurement process to calculate a time to collision from the first driver alert that is an imminent FCW (forward collision warning). Identify the first	

Test Case ID	WFCWT-1-LL	Test Engineer Verification and Remarks
	imminent FCW driver alert based on the alert type defined in each alert record data. Using the Google Earth ruler tool, measure the distance in meters from the first imminent FCW to the location of the stationary remote vehicle. 23. Confirm that this ttc is close to the configured collision imminent time.	

2.5 Table WFCWT-1-LL-Results FCW Stopped Vehicle Ahead Test Case Results (Lear Remote/Lear Host)

Table 2-5. WFCWT-1-LL-Results FCW Stopped Vehicle Ahead Test Case Results (Lear Remote/Lear Host)

Test Case ID	Rep	WFCWT-1-LL	Test Engineer Verification and Remarks
Test Case Name		FCW Stopped Vehicle Ahead – Lear Roadstar Remote/Lear Roadstar Host	
Test Case Completion Date			*Performed and Confirmed by:*
WFCWT-1-LL Driver Advisory/ Warning Visual Results	**Rep 1**		*Performed and Confirmed by:*
WFCWT-1-LL Log Analysis Test Case Results	**Rep 1**		*Performed and Confirmed by:*
WFCWT-1-LL Driver Advisory/ Warning Visual Results	**Rep 2**		*Performed and Confirmed by:*

Test Case ID	Rep	WFCWT-1-LL	Test Engineer Verification and Remarks
WFCWT-1-LL Log Analysis Test Case Log File Analysis Results	**Rep 2**		*Performed and Confirmed by:*
WFCWT-1-LL Driver Advisory/ Warning Visual Results	**Rep 3**		*Performed and Confirmed by:*
WFCWT-1-LL Log Analysis Test Case Log File Analysis Results	**Rep 3**		*Performed and Confirmed by:*
WFCWT-1-LL Driver Advisory/ Warning Visual Results	**Rep 4**		*Performed and Confirmed by:*
WFCWT-1-LL Log Analysis Test Case Log File Analysis Results	**Rep 4**		*Performed and Confirmed by:*
WFCWT-1-LL Driver Advisory/ Warning Visual Results	**Rep 5**		*Performed and Confirmed by:*
WFCWT-1-LL Log Analysis Test Case Log File Analysis Results	**Rep 5**		*Performed and Confirmed by:*
Test Case Analysis Tables			*Performed and Confirmed by:*
WFCWT-1-LL Pass/Fail Assessment			*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.6 Table WFCWT-1-LS-Description - FCW Stopped Vehicle Ahead Test Case Description (Lear Remote/SiriusXM Host)

Table 2-6. WFCWT-1-LS-Description - FCW Stopped Vehicle Ahead Test Case Description (Lear Remote/SiriusXM Host)

Test Case ID	**WFCWT-1-LS**	**Test Engineer Verification and Remarks**
Test Case Name	FCW Stopped Vehicle Ahead (Lear Remote/SiriusXM Host)	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WFCWT-1-Requirements	
Objectives	• WFCWT-1 - FCW Stopped Vehicle Ahead - Verify FCW application issues a warning in time for driver to avoid forward collision. This test case is used to “tune” FCW to deliver timely warnings, while avoiding nuisance warnings. • WV2VMCT-1 V2V exchange of BSMs - Verify V2V BSM Communication Range and Antenna Performance. • WV2IMCT-2 - V2I & End-to-end Communication of BSMs - Verify End-to-end Communication of BSMs and V2I BSM communication range • WV2IMCT-4 - V2I & End-to-end communication of log files - Verify End-to-end Communication of log files and V2I log files communication range	
Preconditions	• Verify configuration of each system and test component complies with Configuration for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Prepare each system and test component in accordance with Initialization for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	

Test Case ID	WFCWT-1-LS	Test Engineer Verification and Remarks
Host Vehicle OBU/ Firmware/ Vehicle	SiriusXM OBU	
Remote Vehicle OBU/ Vehicle	Lear Roadstar OBU	
Roadway Geometry	Straight	
Remote Vehicle Scenario (Test Case Input 1)	Remote vehicle enters track/roadway, approaches and stops at designated test location.	
Host Vehicle Scenario (Test Case Input 2)	Host vehicle enters track/roadway from outside communication range. Host Vehicle approaches stopped remote vehicle at 35 mph. After receiving FCW Advisory (Level 1) and FCW Imminent Alert (Level 2), driver stops or veers to clear adjacent lane and proceeds past stopped vehicle.	
WFCWT-1-LS Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Driver confirms host vehicle issues FCW Advisory and FCW Imminent Alert FCW Advisory (Level 1) FCW Imminent Alert (Level 2) (Note: Test Cases WV2VMCT-1, WV2IMCT-2, and WV2IMCT-4 do not issue advisories or alerts.)	
WFCWT-1-LS Log File Analysis and Verification Method (Test Case Output 2)	- Test engineer analyzes results to determine Time-to-collision when FCW Advisory is issued - Test engineer analyzes results to determine Time-to-collision when FCW Imminent Alert is issued	
WV2VMCT-1-LS Log File Analysis and Verification Method (Test Case Output 2)	- Test engineer analyzes logs to confirm a configurable threshold percentage of BSMs sent are received and logged by host and remote vehicle OBUs, when vehicles are at least 300 meters apart.	
WV2IMCT-2-S Log File Analysis and Verification Method (Test Case Output 2)	- Test engineer analyzes logs to confirm a configurable threshold percentage of BSMs are received and processed by RSU when vehicle is at least 300 meters away. - Test engineer analyzes logs to confirm a BSMs are received and processed by Pikalert.	

Test Case ID	WFCWT-1-LS	Test Engineer Verification and Remarks
WV2IMCT-4-S Log File Analysis and Verification Method (Test Case Output 2)	- Test engineer analyzes logs to confirm a Log files are received by ODE. - Test engineer analyzes logs to confirm a Log files are stored by Data Warehouse.	
WFCWT-1-LS Expected Result (Pass/Fail Criteria)	- FCW application issues a FCW Advisory (Level 1) at approximately 10 seconds - Time-to-Collision and FCW Imminent Alert (Level 2 at approximately 5 seconds Time-to-Collision.	
WV2VMCT-1-LS Expected Result (Pass/Fail Criteria)	- A configurable threshold percentage of BSMs sent are received and logged by host and remote vehicle OBUs, when vehicles are at least 300 meters apart.	
WV2IMCT-2-S Expected Result (Pass/Fail Criteria)	- A configurable threshold percentage of BSMs are received and processed by RSU when vehicle is at least 300 meters away. - BSMs are received and processed by Pikalert.	
WV2IMCT-4-S Expected Result (Pass/Fail Criteria)	- Log files are received by ODE. - Log files are stored by Data Warehouse.	
Detailed Execution Steps	**Verify Readiness for Test** **1.** Verify WYDOT CV Pilot TMC System is operational and ready for test **2.** Verify RSUs are operational and ready for test **3.** Cycle Host Vehicle power and reboot vehicle system. **4.** Verify Host vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix **5.** Cycle Remote Vehicle power and reboot vehicle system. **6.** Verify Remote Vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix **7.** Conduct Safety Inspection of the test area and vehicle path and confirm ready for test	*Performed and Confirmed by:*

Test Case ID	WFCWT-1-LS	Test Engineer Verification and Remarks
	a. No obstructions or interference b. All staff where they are supposed to be, no staff where they aren't supposed to be c. Weather is acceptable and will not lead to hazardous driving conditions d. Road surface is acceptable and will not lead to hazardous driving conditions **Test Start Up** **8.** Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational **9.** Host vehicle driver inspects driving area and confirm track is clear and ready for test. **10.** Remote vehicle driver inspects visual indicators to confirm that vehicle system is fully operational **11.** Remote vehicle driver inspects driving area and confirm track is clear and ready for test. **12.** Host and Remote Vehicle Drivers and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure **Driving the Test** **13.** Remote vehicle enters track from outside communication range and performs Test Case Host Vehicle Scenario. **14.** Host vehicle enters track from outside communication range and performs Test Case Host Vehicle Scenario.	

2.7 Table WFCWT-1-LS-Results FCW Stopped Vehicle Ahead Test Case Results (Lear Remote/Lear Host)

Table 2-7. WFCWT-1-LS-Results FCW Stopped Vehicle Ahead Test Case Results (Lear Remote/Lear Host)

Test Case ID	Rep	WFCWT-1-LS	Test Engineer Verification and Remarks
Test Case Name		FCW Stopped Vehicle Ahead – Lear Roadstar Remote/Lear Roadstar Host	*Performed and Confirmed by:*
Test Case Completion Date			*Performed and Confirmed by:*
WFCWT-1-LS Driver Advisory/ Warning Visual Results	**Rep 1**		*Performed and Confirmed by:*
WFCWT-1-LS Log Analysis Test Case Log File Analysis Results	**Rep 1**		*Performed and Confirmed by:*
WV2VMCT-1-S Log Analysis Test Case Log File Analysis Results	**Rep 1**		*Performed and Confirmed by:*
WV2IMCT-2-S Log Analysis Test Case Log File Analysis Results	**Rep 1**		*Performed and Confirmed by:*
WV2IMCT-4-S Log Analysis Test Case Log File Analysis Results	**Rep 1**		*Performed and Confirmed by:*
WFCWT-1-LS Driver Advisory/ Warning Visual Results	**Rep2**		*Performed and Confirmed by:*

Test Case ID	Rep	WFCWT-1-LS	Test Engineer Verification and Remarks
WFCWT-1-LS Log Analysis Test Case Log File Analysis Results	**Rep2**		*Performed and Confirmed by:*
WV2VMCT-1-S Log Analysis Test Case Log File Analysis Results	**Rep2**		*Performed and Confirmed by:*
WV2IMCT-2-L Log Analysis Test Case Log File Analysis Results	**Rep2**		*Performed and Confirmed by:*
WV2IMCT-4-S Log Analysis Test Case Log File Analysis Results	**Rep2**		*Performed and Confirmed by:*
WFCWT-1-LS Driver Advisory/ Warning Visual Results	**Rep3**		*Performed and Confirmed by:*
WFCWT-1-LS Log Analysis Test Case Log File Analysis Results	**Rep3**		*Performed and Confirmed by:*
WV2VMCT-1-S Log Analysis Test Case Log File Analysis Results	**Rep3**		*Performed and Confirmed by:*
WV2IMCT-2-S Log Analysis Test Case Log File Analysis Results	**Rep3**		*Performed and Confirmed by:*
WV2IMCT-4-S Log Analysis Test Case Log File Analysis Results	**Rep3**		*Performed and Confirmed by:*

Test Case ID	Rep	WFCWT-1-LS	Test Engineer Verification and Remarks
WFCWT-1-LS Driver Advisory/ Warning Visual Results	**Rep 4**		*Performed and Confirmed by:*
WFCWT-1-LS Log Analysis Test Case Log File Analysis Results	**Rep 4**		*Performed and Confirmed by:*
WV2VMCT-1-S Log Analysis Test Case Log File Analysis Results	**Rep 4**		*Performed and Confirmed by:*
WV2IMCT-2-S Log Analysis Test Case Log File Analysis Results	**Rep 4**		*Performed and Confirmed by:*
WV2IMCT-4-S Log Analysis Test Case Log File Analysis Results	**Rep 4**		*Performed and Confirmed by:*
WFCWT-1-LS Driver Advisory/ Warning Visual Results	**Rep 5**		*Performed and Confirmed by:*
WFCWT-1-LS Log Analysis Test Case Log File Analysis Results	**Rep 5**		*Performed and Confirmed by:*
WV2VMCT-1-S Log Analysis Test Case Log File Analysis Results	**Rep 5**		*Performed and Confirmed by:*
WV2IMCT-2-S Log Analysis Test Case Log File Analysis Results	**Rep 5**		*Performed and Confirmed by:*

Test Case ID	Rep	WFCWT-1-LS	Test Engineer Verification and Remarks
WV2IMCT-4-S Log Analysis Test Case Log File Analysis Results	**Rep 5**		*Performed and Confirmed by:*
Test Case Analysis Tables			*Performed and Confirmed by:*
WFCWT-1-LS Pass/Fail Assessment			*Performed and Confirmed by:*
WV2VMCT-1-LS Pass/Fail Assessment			*Performed and Confirmed by:*
WV2IMCT-2-S Pass/Fail Assessment			*Performed and Confirmed by:*
WV2IMCT-4-S Pass/Fail Assessment			*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.8 Table WFCWT-1-SL-Description - FCW Stopped Vehicle Ahead Test Case Description (SiriusXM Remote/Lear Host)

Table 2-8. WFCWT-1-SL-Description - FCW Stopped Vehicle Ahead Test Case Description (SiriusXM Remote/Lear Host)

Test Case ID	WFCWT-1-SL	Test Engineer Verification and Remarks
Test Case Name	FCW Stopped Vehicle Ahead (SiriusXM Remote/Lear Host)	
Test Case Completion Date		

Test Case ID	WFCWT-1-SL	Test Engineer Verification and Remarks
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WFCWT-1-Requirements	
Objectives	• WFCWT-1 - FCW Stopped Vehicle Ahead - Verify FCW application issues a warning in time for driver to avoid forward collision. This test case is used to “tune” FCW to deliver timely warnings, while avoiding nuisance warnings. • WV2VMCT-1 V2V exchange of BSMs - Verify V2V BSM Communication Range and Antenna Performance.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Prepare each system and test component in accordance with Initialization for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Host Vehicle OBU/ Firmware/ Vehicle	Lear Roadstar OBU	
Remote Vehicle OBU/ Vehicle	SiriusXM OBU	
Roadway Geometry	Straight	
Remote Vehicle Scenario (Test Case Input 1)	Remote vehicle enters track/roadway, approaches and stops at designated test location.	
Host Vehicle Scenario (Test Case Input 2)	Host vehicle enters track/roadway from outside communication range. Host Vehicle approaches stopped remote vehicle at 35 mph. After receiving FCW Advisory (Level 1) and FCW Imminent Alert (Level 2), driver stops or veers to clear adjacent lane and proceeds past stopped vehicle.	
WFCWT-1-LL Driver Advisory/	Driver confirms host vehicle issues FCW Advisory and FCW Imminent Alert FCW Advisory (Level 1)	

Test Case ID	WFCWT-1-SL	Test Engineer Verification and Remarks
Warning Visual Verification (Test Case Output 1)	FCW Imminent Alert (Level 2) (Note: Test Cases WV2VMCT-1, WV2IMCT-2, and WV2IMCT-4 do not issue driver advisories or alerts.)	
WFCWT-1-LL Log File Analysis and Verification Method (Test Case Output 2)	- Test engineer analyzes results to determine Time-to-collision when FCW Advisory is issued - Test engineer analyzes results to determine Time-to-collision when FCW Imminent Alert is issued	
WV2VMCT-1-LL Log File Analysis and Verification Method (Test Case Output 2)	- Test engineer analyzes logs to confirm a configurable threshold percentage of BSMs sent are received and logged by host and remote vehicle OBUs, when vehicles are at least 300 meters apart.	
WFCWT-1-LL Expected Result (Pass/Fail Criteria)	- FCW application issues a FCW Advisory (Level 1) at approximately 10 seconds - Time-to-Collision and FCW Imminent Alert (Level 2 at approximately 5 seconds Time-to-Collision.	
WV2VMCT-1-LL Expected Result (Pass/Fail Criteria)	- A configurable threshold percentage of BSMs sent are received and logged by host and remote vehicle OBUs, when vehicles are at least 300 meters apart.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* **Verify Readiness for Test** **1.** Verify WYDOT CV Pilot TMC System is operational and ready for test **2.** Verify RSUs are operational and ready for test **3.** Cycle Host Vehicle power and reboot vehicle system. **4.** Verify Host vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix **5.** Cycle Remote Vehicle power and reboot vehicle system. **6.** Verify Remote Vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix	

Test Case ID	WFCWT-1-SL	Test Engineer Verification and Remarks
	7. Conduct Safety Inspection of the test area and vehicle path and confirm ready for test a. No obstructions or interference b. All staff where they are supposed to be, no staff where they aren't supposed to be c. Weather is acceptable and will not lead to hazardous driving conditions d. Road surface is acceptable and will not lead to hazardous driving conditions **Test Start Up** **8.** Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational **9.** Host vehicle driver inspects driving area and confirm track is clear and ready for test. **10.** Remote vehicle driver inspects visual indicators to confirm that vehicle system is fully operational **11.** Remote vehicle driver inspects driving area and confirm track is clear and ready for test. **12.** Host and Remote Vehicle Drivers and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure **Driving the Test** **13.** Remote vehicle enters track from outside communication range and performs Test Case Host Vehicle Scenario. **14.** Host vehicle enters track from outside communication range and performs Test Case Host Vehicle Scenario.	

2.9 Table WFCWT-1-SL-Results FCW Stopped Vehicle Ahead Test Case Results (SiriusXM Remote/Lear Host)

Table 2-9. WFCWT-1-SL-Results FCW Stopped Vehicle Ahead Test Case Results (SiriusXM Remote/Lear Host)

Test Case ID	Rep	WFCWT-1-SL	Test Engineer Verification and Remarks
Test Case Name		FCW Stopped Vehicle Ahead – Lear Roadstar Remote/Lear Roadstar Host	*Performed and Confirmed by:*
Test Case Completion Date			*Performed and Confirmed by:*
WFCWT-1- SL Driver Advisory/ Warning Visual Results	**Rep 1**		*Performed and Confirmed by:*
WFCWT-1- SL Log Analysis Test Case Log File Analysis Results	**Rep 1**		*Performed and Confirmed by:*
WV2VMCT-1- SL Log Analysis Test Case Log File Analysis Results	**Rep 1**		*Performed and Confirmed by:*
WFCWT-1- SL Driver Advisory/ Warning Visual Results	**Rep 2**		*Performed and Confirmed by:*
WFCWT-1- SL Log Analysis Test Case Log File Analysis Results	**Rep 2**		*Performed and Confirmed by:*
WV2VMCT-1- SL Log Analysis Test Case Log File Analysis Results	**Rep 2**		*Performed and Confirmed by:*

Test Case ID	Rep	WFCWT-1-SL	Test Engineer Verification and Remarks
WFCWT-1- SL Driver Advisory/ Warning Visual Results	**Rep 3**		*Performed and Confirmed by:*
WFCWT-1- SL Log Analysis Test Case Log File Analysis Results	**Rep 3**		*Performed and Confirmed by:*
WV2VMCT-1- SL Log Analysis Test Case Log File Analysis Results	**Rep 3**		*Performed and Confirmed by:*
WFCWT-1- SL Driver Advisory/ Warning Visual Results	**Rep 4**		*Performed and Confirmed by:*
WFCWT-1- SL Log Analysis Test Case Log File Analysis Results	**Rep 4**		*Performed and Confirmed by:*
WV2VMCT-1- SL Log Analysis Test Case Log File Analysis Results	**Rep 4**		*Performed and Confirmed by:*
WFCWT-1- SL Driver Advisory/ Warning Visual Results	**Rep 5**		*Performed and Confirmed by:*
WFCWT-1- SL Log Analysis Test Case Log File Analysis Results	**Rep 5**		*Performed and Confirmed by:*
WV2VMCT-1- SL Log Analysis Test Case Log File Analysis Results	**Rep 5**		*Performed and Confirmed by:*
Test Case Analysis Tables			*Performed and Confirmed by:*

Test Case ID	Rep	WFCWT-1-SL	Test Engineer Verification and Remarks
WFCWT-1-SL Pass/Fail Assessment			*Performed and Confirmed by:*
WV2VMCT-1-SL Pass/Fail Assessment			*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.10 Table WFCWT-1-MVL-Description FCW Stopped Vehicle Ahead Test Case Description (Maintenance Vehicle Lear Remote/Lear Host)

Table 2-10. WFCWT-1-MVL-Description FCW Stopped Vehicle Ahead Test Case Description (Maintenance Vehicle Lear Remote/Lear Host)

Test Case ID	WFCWT-1-MVL	Test Engineer Verification and Remarks
Test Case Name	FCW Stopped Vehicle Ahead (Maintenance Vehicle Lear Remote/Lear Host)	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WFCWT-1-Requirements	
Objectives	• WFCWT-1 - FCW Stopped Vehicle Ahead - Verify FCW application issues a warning in time for driver to avoid forward collision. This test case is used to “tune” FCW to deliver timely warnings, while avoiding nuisance warnings. • WV2VMCT-1 V2V exchange of BSMs - Verify V2V BSM Communication Range and Antenna Performance.	

Test Case ID	**WFCWT-1-MVL**	**Test Engineer Verification and Remarks**
Preconditions	• Verify configuration of each system and test component complies with Configuration for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Prepare each system and test component in accordance with Initialization for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Host Vehicle OBU/ Firmware/ Vehicle	Lear Roadstar OBU	
Remote Vehicle OBU/ Vehicle	Lear Roadstar OBU/ Maintenance Vehicle	
Roadway Geometry	Straight	
Remote Vehicle Scenario (Test Case Input 1)	Remote vehicle enters track/roadway, approaches and stops at designated test location.	
Host Vehicle Scenario (Test Case Input 2)	Host vehicle enters track/roadway from outside communication range. Host Vehicle approaches stopped remote vehicle at 35 mph. After receiving FCW Advisory (Level 1) and FCW Imminent Alert (Level 2), driver stops or veers to clear adjacent lane and proceeds past stopped vehicle.	
WFCWT-1-MVL Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Driver confirms host vehicle issues FCW Advisory and FCW Imminent Alert FCW Advisory (Level 1) FCW Imminent Alert (Level 2) (Note: Test Cases WV2VMCT-1, WV2IMCT-2, and WV2IMCT-4 do not issue driver advisories or alerts.)	
WFCWT-1-MVL Log File Analysis and Verification Method (Test Case Output 2)	- Test engineer analyzes results to determine Time-to-collision when FCW Advisory is issued - Test engineer analyzes results to determine Time-to-collision when FCW Imminent Alert is issued	
WV2VMCT-1-MVL Log File Analysis and Verification	- Test engineer analyzes logs to confirm a configurable threshold percentage of BSMs sent are received and logged by host and remote vehicle OBUs, when vehicles are at least 300 meters apart.	

Test Case ID	WFCWT-1-MVL	Test Engineer Verification and Remarks
Method (Test Case Output 2)		
WFCWT-1-MVL Expected Result (Pass/Fail Criteria)	- FCW application issues a FCW Advisory (Level 1) at approximately 10 seconds - Time-to-Collision and FCW Imminent Alert (Level 2 at approximately 5 seconds Time-to-Collision.	
WV2VMCT-1-MVL Expected Result (Pass/Fail Criteria)	- A configurable threshold percentage of BSMs sent are received and logged by host and remote vehicle OBUs, when vehicles are at least 300 meters apart.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* **Verify Readiness for Test** 1. Verify WYDOT CV Pilot TMC System is operational and ready for test 2. Verify RSUs are operational and ready for test 3. Cycle Host Vehicle power and reboot vehicle system. 4. Verify Host vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix 5. Cycle Remote Vehicle power and reboot vehicle system. 6. Verify Remote Vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix 7. Conduct Safety Inspection of the test area and vehicle path and confirm ready for test a. No obstructions or interference b. All staff where they are supposed to be, no staff where they aren't supposed to be c. Weather is acceptable and will not lead to hazardous driving conditions d. Road surface is acceptable and will not lead to hazardous driving conditions **Test Start Up** 8. Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational 9. Host vehicle driver inspects driving area and confirm track is clear and ready for test.	

Test Case ID	WFCWT-1-MVL	Test Engineer Verification and Remarks
	10. Remote vehicle driver inspects visual indicators to confirm that vehicle system is fully operational **11.** Remote vehicle driver inspects driving area and confirm track is clear and ready for test. **12.** Host and Remote Vehicle Drivers and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure **Driving the Test** **13.** Remote vehicle enters track from outside communication range and performs Test Case Host Vehicle Scenario. **14.** Host vehicle enters track from outside communication range and performs Test Case Host Vehicle Scenario.	

2.11 Table WFCWT-1-MVL-Results FCW Stopped Vehicle Ahead Test Case Results (Maintenance Vehicle Lear Remote/Lear Host)

Table 2-11. WFCWT-1-MVL-Results FCW Stopped Vehicle Ahead Test Case Results (Maintenance Vehicle Lear Remote/Lear Host)

Test Case ID	Rep	WFCWT-1-MVL	Test Engineer Verification and Remarks
Test Case Name		FCW Stopped Vehicle Ahead (Maintenance Vehicle Lear Remote/Lear Host)	*Performed and Confirmed by:*
Test Case Completion Date			*Performed and Confirmed by:*
WFCWT-1-MVL Driver Advisory/ Warning Visual Results	**Rep 1**		*Performed and Confirmed by:*
WFCWT-1-MVL Log Analysis Test Case Log File Analysis Results	**Rep 1**		*Performed and Confirmed by:*

Test Case ID	Rep	WFCWT-1-MVL	Test Engineer Verification and Remarks
WV2VMCT-1-MVL Log Analysis Test Case Log File Analysis Results	**Rep 1**		*Performed and Confirmed by:*
WFCWT-1-MVL Driver Advisory/ Warning Visual Results	**Rep 2**		*Performed and Confirmed by:*
WFCWT-1-MVL Log Analysis Test Case Log File Analysis Results	**Rep 2**		*Performed and Confirmed by:*
WV2VMCT-1-MVL Log Analysis Test Case Log File Analysis Results	**Rep 2**		*Performed and Confirmed by:*
WFCWT-1-MVL Driver Advisory/ Warning Visual Results	**Rep 3**		*Performed and Confirmed by:*
WFCWT-1-MVL Log Analysis Test Case Log File Analysis Results	**Rep 3**		*Performed and Confirmed by:*
WV2VMCT-1-MVL Log Analysis Test Case Log File Analysis Results	**Rep 3**		*Performed and Confirmed by:*
WFCWT-1- MVLDriver Advisory/ Warning Visual Results	**Rep 4**		*Performed and Confirmed by:*
WFCWT-1-MVL Log Analysis Test Case Log File Analysis Results	**Rep 4**		*Performed and Confirmed by:*

Test Case ID	Rep	WFCWT-1-MVL	Test Engineer Verification and Remarks
WV2VMCT-1-MVL Log Analysis Test Case Log File Analysis Results	**Rep 4**		*Performed and Confirmed by:*
WFCWT-1-MVL Driver Advisory/ Warning Visual Results	**Rep 5**		*Performed and Confirmed by:*
WFCWT-1-MVL Log Analysis Test Case Log File Analysis Results	**Rep 5**		*Performed and Confirmed by:*
WV2VMCT-1-MVL Log Analysis Test Case Log File Analysis Results	**Rep 5**		*Performed and Confirmed by:*
Test Case Analysis Tables			*Performed and Confirmed by:*
WFCWT-1-MVL Pass/Fail Assessment			*Performed and Confirmed by:*
WV2VMCT-1-MVL Pass/Fail Assessment			*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.12 Table WFCWT-1-Requirements FCW Stopped Vehicle Ahead Requirements Verification Analysis

Table 2-12. WFCWT-1-Requirements FCW Stopped Vehicle Ahead Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WFCWT-1 -- FCW Stopped Vehicle Ahead	LTS-REQ-4 -- VS LTS Time	The Vehicle System shall acquire time from the LTS interface in accordance with Section 5.3.1 of the ICD.	Perform Test Case WFCWT-1 * Inspect vehicle system logs and locate 1 or more instances of formation of BSMs * Determine time BSM was formulated * Identify located BSMs and inspect time and compare * Confirm message contains correct time message was sent, verifying requirement is satisfied.	Requirement Verification Confirmed by:
WFCWT-1 -- FCW Stopped Vehicle Ahead	LTS-REQ-5 -- VS LTS Time Standard	The Vehicle System shall use Coordinated Universal Time (UTC) time for logged data (e.g., events logs and environmental data) based on the format defined in J2735 section 6.19 and epoch of January 1st 1970.	* Perform Test Case WFCWT-1 * Inspect event logs and locate 1 or more instances of events * Inspect event(s) located and determine reported time(s) * Confirm time reported is Coordinated Universal Time (UTC), verifying requirement is satisfied.	Requirement Verification Confirmed by:
WFCWT-1 -- FCW Stopped Vehicle Ahead	LTS-REQ-6 -- VS LTS Location	The Vehicle System shall acquire location from the LTS interface in accordance with J2945/1 section 6.2.1.	* Perform Test Case WFCWT-1 * Inspect OBU logs and locate 1 or more instances of BSMs sent * Inspect BSMs and determine location * Confirm message contains correct location, verifying requirement is satisfied.	Requirement Verification Confirmed by:
WFCWT-1 -- FCW Stopped Vehicle Ahead	VS-REQ-9.1 -- Rear-End Crash in Straight Road	The Vehicle System shall identify imminent danger of a rear-end crash with a remote vehicle lead vehicle in its lane of travel in a straight roadway geometry.	* Perform Test Case WFCWT-1 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped remote vehicle ahead * Confirm issuance of imminent danger alert * Issuance of imminent danger alert verifies Vehicle System identifies imminent danger of a rear-end crash with a remote vehicle lead vehicle in its lane of travel in a straight roadway geometry, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WFCWT-1 -- FCW Stopped Vehicle Ahead	VS-REQ-26 -- IVAA FCW	The Vehicle System shall alert the vehicle operator for forward collision warning based on the warning distance calculation algorithm in section 3.1 of the Connected Commercial Vehicles—Retrofit Safety Device Kit Project Safety Applications and Development Plan (FHWA-JPO-14-106) and guidance for FCW Time-to Collision, Advisories and Alerts provided in SyRS Section 6.1.1. This could be an inform message, warning 1 or warning 2 based on the calculated deceleration rate required. During the design phase a deceleration rate will be selected for a warning 1 and for warning 2 based on vehicle type and weight.	* Perform Test Case WFCWT-1 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped remote vehicle ahead * Confirm issuance of imminent danger alert * Issuance of imminent danger alert verifies the Vehicle System alerts the vehicle operator for forward collision warning based on the warning distance calculation algorithm in section 3.1 of the Connected Commercial Vehicles—Retrofit Safety Device Kit Project Safety Applications and Development Plan (FHWA-JPO-14-106) and guidance for FCW Time-to Collision, Advisories and Alerts provided in SyRS Section 6.1.1, thereby verifying the requirement is satisfied. (Note: As a system integrator, WYDOT Team tests to verify basic functionalities are present in vendor supplied systems, but does not have the resources to verify detailed implementation of algorithms.)	Requirement Verification Confirmed by:
WFCWT-1 -- FCW Stopped Vehicle Ahead	FCWP-REQ-1 -- FCW Advisory Alert Performance	The Vehicle System shall issue an advisory FCW alert when the Time-to-Collision is below a configurable threshold for advising the driver of potential for collision with a stopped vehicle ahead in the same lane of travel. Guidance for FCW Time-to Collision, Advisories and Alerts is provided in SyRS Section 6.1.1.	* Perform Test Case WFCWT-1 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped remote vehicle ahead * Confirm issuance of advisory alert * Issuance of advisory alert verifies Vehicle System issues an advisory FCW alert when the Time-to-Collision is below a configurable threshold for advising the driver of potential for collision with a stopped vehicle ahead in the same lane of travel, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WFCWT-1 -- FCW Stopped Vehicle Ahead	FCWP-REQ-2 -- FCW Imminent Alert Performance	The Vehicle System shall issue an imminent FCW alert when the Time-to-Collision is below a configurable threshold for alerting the driver that there is an imminent threat of forward collision with a stopped vehicle	* Perform Test Case WFCWT-1 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped remote vehicle ahead * Confirm issuance of imminent FCW alert * Issuance of imminent FCW verifies Vehicle System issues an imminent FCW alert when the Time-to-Collision is below a configurable threshold	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		ahead in the same lane of travel and immediate action is required from the driver to avoid the collision. Guidance for FCW Time-to Collision, Advisories and Alerts is provided in SyRS Section 6.1.1.	for alerting the driver that there is an imminent threat of forward collision with a stopped vehicle ahead in the same lane of travel and immediate action is required from the driver to avoid the collision, thereby verifying the requirement is satisfied.	
WV2VMCT-1 -- V2V exchange of BSMs (Integrated with WFCWT-1)	VS-REQ-1 -- Receive BSM	The Vehicle System shall receive Basic Safety Message (as defined in SAE J2945/1) over DSRC from other connected vehicles consistent with Section 6.3.8 of SAE J2945/1 (BSM Scheduling and Congestion Control).	* Perform Test Case WFCWT-1 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped remote vehicle ahead * Confirm issuance of imminent danger alert * Issuance of imminent danger alert verifies Vehicle System receives Basic Safety Message (as defined in SAE J2945/1) over DSRC from other connected vehicles consistent with Section 6.3.8 of SAE J2945/1 (BSM Scheduling and Congestion Control), thereby verifying requirement. (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	Requirement Verification Confirmed by:
WV2VMCT-1 -- V2V exchange of BSMs (Integrated with WFCWT-1)	VS-REQ-33 -- BCVI Messages	The Vehicle System shall wirelessly broadcast over DSRC a basic safety message (BSM) to other connected devices.	* Perform Test Case WV2VMCT-1(WFCWT-1) * Inspect Host Vehicle OBU Logs and identify 1 or more instances of BSMs sent from Host Vehicle to Remote Vehicle * Inspect Remote Vehicle OBU logs and identify corresponding receipt of BSMs * Confirmation shows the Vehicle System wirelessly broadcasts over DSRC a basic safety message (BSM) to other connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-1)	SCMS-REQ-2.1 -- SCMS Vehicle System Certificates	The Vehicle System shall download certificates from the USDOT SCMS.	* Conduct Test WV2IMCT-2(WFCWT-1) * Inspect Vehicle System SCMS logs * Confirm Vehicle System downloads certificates from the USDOT SCMS, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-1)	WCVS-REQ-1.1 -- Collect BSM Data	The Wyoming CV System shall collect Basic Safety Message Parts I and II (as defined in J2945/1) from the Vehicle System consistent with Section 6.3.8 (BSM Scheduling and Congestion Control) of J2945/1	* Perform Test Case WV2IMCT-2(WFCWT-1) * Inspect OBU Logs and identify 1 or more instances of BSMs sent to RSUs * Inspect RSU logs and identify corresponding 1 or more instances of BSMs received * Inspect ODE Logs and identify corresponding 1 or more instances of BSMs received * Inspect Pikalert logs and identify corresponding 1 or more instances BSMs received Confirmation shows Wyoming CV System collects Basic Safety Message Parts I and II (as defined in J2945/1) from the Vehicle System consistent with Section 6.3.8 (BSM Scheduling and Congestion Control) of J2945/1, thereby verifying the requirement is satisfied. (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	Requirement Verification Confirmed by:
WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-1)	WCVS-REQ-11.1 -- Store BSM	The Wyoming CV System shall store processed BSM Parts I and II data received from the Vehicle System. As the BSM will be previously validated, only core data elements will be stored (defined in sections 6.8, 6.147, 6.128, and 6.133 of J2735).	* Perform Test Case WV2IMCT-2(WFCWT-1) * Inspect ODE logs and confirm receipt of BSM Part 1 and 2 from OBU. * Inspect DW logs and confirm receipt of BSM Part 1 and 2 from OBU for storage. * Receipt of BSM by DW confirms the Wyoming CV System stores processed BSM Parts I and II data received from the Vehicle System, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-1)	VS-REQ-4.1 -- Collect Vehicle Status Data	The Vehicle System shall have the capability to collect vehicle status information from the host vehicle, as stated in Section 5.4.2 of the ICD.	* Perform Test Case WV2IMCT-2(WFCWT-1) * Inspect OBU Logs and identify 1 or more instances of BSMs sent to RSUs * Inspect BSMs and identify CAN data elements, identified as "yes/CAN" in WYDOT ICD Table 7 1: BSM Message Fields * Confirmation shows the Vehicle System has the capability to collect vehicle status information from	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			the host vehicle, as stated in Section 542 of the ICD, thereby verifying the requirement is satisfied.	
WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-1)	VS-REQ-4.2.1 -- Vehicle Dimension Data	The Vehicle System shall have the capability to collect vehicle dimension from the host vehicle driver through the Human Machine Interface.	* Perform Test Case WV2IMCT-2(WFCWT-1) * Inspect OBU Logs and identify 1 or more instances of BSMs sent to RSUs * Inspect BSMs and identify vehicle dimension data elements, identified in WYDOT ICD Table 7 1: BSM Message Fields * Confirmation shows the Vehicle System has the capability to collect vehicle dimension from the host vehicle driver through the Human Machine Interface, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-1)	VS-REQ-4.2.2 -- Vehicle Trailer Data	The Vehicle System shall have the capability to collect information from the host vehicle driver regarding the dimensions of attached trailers, including capability to indicate that no trailer is present, through the Human Machine Interface.	* Perform Test Case WV2IMCT-2(WFCWT-1) * Inspect OBU Logs and identify 1 or more instances of BSMs sent to RSUs * Inspect BSMs and identify vehicle trailer data elements, identified in WYDOT ICD Table 7 1: BSM Message Fields * Confirmation shows the Vehicle System has the capability to collect information from the host vehicle driver regarding the dimensions of attached trailers, including capability to indicate that no trailer is present, through the Human Machine Interface, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-1)	RSU-REQ-11 -- Distribute to ODE	The Roadside Units shall share all collected information with the Operational Data Environment, as described in Section 5.18.1 of the ICD.	* Perform Test Case WV2IMCT-2(WFCWT-1) * Inspect RSU logs and identify 1 or more instances of BSMs received from Vehicles * Inspect ODE logs and identify receipt of corresponding BSMs. * Confirmation shows the Roadside Units share all collected information with the Operational Data Environment, as described in Section 5.18.1 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-1)	ODE-REQ-3.4.1 -- Distribute to Data Warehouse-BSM	The Operational Data Environment shall distribute all collected and processed BSM information to the Data	* Perform test case WV2IMCT-2(WFCWT-1) * Inspect DW logs * Confirm receipt of BSMs * Confirmation shows the Operational Data Environment distributes all collected and processed	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		Warehouse, as described in Section 5.20 of the ICD.	BSM information to the Data Warehouse, as described in Section 5.20 of the ICD, thereby verifying the requirement is satisfied. * Confirmation shows the Operational Data Environment distribute all collected and processed BSM information to the Data Warehouse, as described in Section 520 of the ICD , thereby verifying the requirement is satisfied.	
WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-1)	ODE-REQ-3.6 -- Distribute to SDC	The Operational Data Environment shall distribute CV data to the Secure Data Commons, as defined in Section 5.37.1 of the ICD	* Perform Test Case WV2IMCT-2(WFCWT-1) * Inspect ODE logs * Confirm 1 or more instances of BSMs received. * Confirm corresponding 1 or more instances of BSMs sent to Secure Data Commons * Confirmation shows the Operational Data Environment distributes CV data to the Secure Data Commons, as defined in Section 5.37.1 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-1)	ODE-REQ-3.7 -- Distribute to RDE	The Operational Data Environment shall distribute CV data to the Research Data Exchange, as defined in Section 5.40.1 of the ICD	* Perform Test Case WV2IMCT-2(WFCWT-1) * Inspect ODE logs * Confirm 1 or more instances of BSMs received. * Confirm corresponding 1 or more instances of BSMs sent to RDE * Confirmation shows the Operational Data Environment distributes CV data to the Research Data Exchange, as defined in Section 5.37.1 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-1)	MV-REQ-3 -- Static Identifier	WYDOT Maintenance Vehicles' DSRC communications shall have a static identifier.	* Perform Test Case WV2IMCT-2(WFCWT-1) * Inspect OBU Logs and identify 1 or more instances of BSMs sent to RSUs * Inspect BSMs and identify static identifier * Confirmation shows the WYDOT Fleet vehicles' DSRC communications have a static identifier, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-4 -- V2I & End-to-end communication of log files (Integrated with WFCWT-1)	VS-REQ-36.2 -- TVI Data Management-Log	The Vehicle System shall transmit log files via secure copy (SCP) to the Wyoming CV System over DSRC that contain	* Perform Test Case WV2IMCT-4(WFCWT-1) * Confirm secure copy to the Wyoming CV System of Event Logs. * Confirmation shows the Vehicle System transmits log files via secure copy (SCP) to the Wyoming CV	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		event logs data defined in VS-REQ-41.	System over DSRC that contain event logs data, thereby verifying the requirement is satisfied.	

2.13 Table WFCWT-2-LL-Description FCW Passing Stopped Vehicle Test Case Description (Lear Remote/Lear Host)

Table 2-13. WFCWT-2-LL-Description FCW Passing Stopped Vehicle Test Case Description (Lear Remote/Lear Host)

Test Case ID	WFCWT-2-LL	Test Engineer Verification and Remarks
Test Case Name	FCW Passing Stopped Vehicle	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WFCWT-2-Requirements	
Objective	FCW does NOT issue a warning when there are no FCW threats in the host vehicle path.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Prepare each system and test component in accordance with Initialization for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Host Vehicle OBU/ Firmware/ Vehicle		

Test Case ID	WFCWT-2-LL	Test Engineer Verification and Remarks
Remote Vehicle OBU/ Vehicle		
Roadway Geometry		
Remote Vehicle Scenario (Test Case Input 1)		
Host Vehicle Scenario (Test Case Input 2)		
Driver Advisory/ Warning Visual Verification (Test Case Output 1)		
Log File Analysis and Verification Method (Test Case Output 2)		
Expected Result (Pass/Fail Criteria)		
Detailed Execution Steps	**Verify Readiness** 1. Host and remote vehicle have Lear LocoMate 300 OBU's installed with antenna and HMI, configured according to the WYDOT CV Pilot OBU configuration. A lap top computer must be connected via an Ethernet cable to the OBU to implement initial log file offload verification. 2. Confirm that the test Lear LocoMate 300 RSU is installed and configured according to the WYDOT CV Pilot RSU configuration. 3. Identify offload location where vehicles can drive to, to be within the offload range of the test RSU. 4. Identify specific test location for remote vehicle to stop and be stationary and have an adjacent lane for the host vehicle to pass. Identify path that host vehicle will use	

Test Case ID	WFCWT-2-LL	Test Engineer Verification and Remarks
	to approach stationary remote vehicle. The approach path must start at least 300 meters from stationary vehicle location. **Test Start Up** 5. Drive both the host and remote vehicles to the offload location, power up each OBU in the host and remote vehicle. 6. Confirm that each OBU powers up correctly and is linked to its corresponding HMI. Confirm this by driving a short distance and validating that the vehicle speed and location are updated on the HMI to reflect the short drive. 7. While parked at the offload location execute the following steps to confirm log file generation and offload. a. Log into each OBU and from the system shell issue a ping6 command to the backend host server for the WYDOT CV Pilot environment. This will confirm the full IPv6 connectivity from the OBU through the RSU to the WYDOT backend server. The ping command to issue is: #ping6 <backend server IPv6 address> b. For each OBU confirm that log files are being generated. Confirm this by reviewing the event log directory on the OBU and checking that various log files are increasing in size. The specific log files to see increasing are: /var/eventlog/bsmLogDuringEvent.csv /var/eventlog/rxMsg.csv /var/eventlog/driverAlert.csv c. For each OBU confirm that log files are being offloaded, when vehicle is at the designated offload location. Confirm this by reviewing the offload subdirectories on the OBU and ensuring that they do not continuously accumulate log files. A few log files may accumulate (2-3), but within 30 seconds they should all offload and be removed from the log directory. The specific offload subdirectories to check are:	

Test Case ID	WFCWT-2-LL	Test Engineer Verification and Remarks
	/var/storage/bsmLogDuringEvent /var/storage/rxMsg /var/storage/driverAlert Once the log file generation and offload are confirmed the test repetitions can begin. **Driving the Test** 8. Begin by driving the remote vehicle to the designated stationary position on the test track. 9. Once the remote vehicle is stationary, the host vehicle enters the test track, this entry onto the track must be at least 300 meters driving distance from the stationary remote vehicle. The host vehicle should follow the same path that the remote vehicle did, but in the adjacent lane to the remote vehicle. As it approaches the stationary remote vehicle, the host vehicle should always remain in the lane adjacent to the remote vehicle. 10. Accelerate the host vehicle up to 35 miles per hour driving on the test track in the lane adjacent to the stationary remote vehicle. The host driver should initially focus on achieving and maintaining the test speed of 35 mph. 11. As the host vehicle approaches the stationary remote vehicle the driver maintains the vehicle speed and monitors the approach to the remote vehicle to ensure the host vehicle remains in the adjacent lane and there is no chance of collision with the stationary remote vehicle. 12. During the approach to the remote vehicle, the host vehicle driver monitors the HMI to identify any advisory or warning messages issued to the driver. 13. After safely passing the stationary remote vehicle, the host vehicle driver should come to a complete stop and manually record any types of driver alerts (or lack of alerts) received during the prior approach and passing sequence. 14. The host vehicle then returns to the previously defined start location to repeat the test again. 15. The remote vehicle may remain stationary between multiple repetitions of the test and the host vehicle begins each new repetition at step two of this driving	

Test Case ID	WFCWT-2-LL	Test Engineer Verification and Remarks
	sequence. If the remote vehicle moves after a test repetition completes, then the next repetition of the test driving sequence must start at step one. 16. After final test repetition, both the remote and host vehicles drive to offload location and confirm that generated log files are offloaded (see test startup step 7). **Analysis Procedure** 17. Execute a set of queries on the DW to extract bsm and driver alert log records for the period of time around each FCW test run. These queries are implemented in a script that generates a KML file for display in Google Earth. This allows each bsm and driver alert record from each test vehicle to be plotted in the Google Earth application. The follow example command line runs the query script to generate the KML file for a test executed at the Archer test track that started 08 Jan 2018 02:15:10 pm MST and ended at 02:16:00 pm MST. Note that the time boundaries in the query are in Coordinated Universal Time (UTC). a. python create_kml.py circle --lat 41.150576 --long -104.654964 --distance 1000 --beginTime '2018-01-08 21:15:10' --endTime '2018-01-08 21:16:00' 18. Open the resulting KML file in Google Earth. The bsm records and driver alert records for each vehicle will be visible along the paths they traveled at the test site location. Bsm records from each vehicle will be in a different color. Driver alert records (if any) will be shown as white arrows at each point in the vehicle trajectory that the driver alert was issued. Adjust the time slider so that appropriate bsm and driver alerts around the FCW test are visible. 19. Confirm that no forward collision alerts were issued to the host vehicle during its approach and passing of the remote vehicle.	

2.14 Table WFCWT-2-LL-Results FCW Passing Stopped Vehicle Test Case Results (Lear Remote/Lear Host)

Table 2-14. WFCWT-2-LL-Results FCW Passing Stopped Vehicle Test Case Results (Lear Remote/Lear Host)

Test Case ID	**Rep**	**WFCWT-2-LL**	**Test Engineer Verification and Remarks**
Test Case Name		FCW Passing Stopped Vehicle	
Test Case Completion Date			*Performed and Confirmed by:*
Test Case Driver Visual and Log File Analysis Results	**Rep 1**		*Performed and Confirmed by:*
Test Case Driver Visual and Log File Analysis Results	**Rep 2**		*Performed and Confirmed by:*
Test Case Driver Visual and Log File Analysis Results	**Rep 3**		*Performed and Confirmed by:*
Test Case Driver Visual and Log File Analysis Results	**Rep 4**		*Performed and Confirmed by:*
Test Case Driver Visual and Log File Analysis Results	**Rep 5**		*Performed and Confirmed by:*
Test Case Analysis Tables			*Performed and Confirmed by:*
Pass/Fail Assessment			*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.15 Table WFCWT-2-LS-Description FCW Passing Stopped Vehicle Test Case Description

Table 2-15. WFCWT-2-LS-Description FCW Passing Stopped Vehicle Test Case Description

Test Case ID	**WFCWT-2-LS**	**Test Engineer Verification and Remarks**
Test Case Name	FCW Passing Stopped Vehicle	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WFCWT-2-Requirements	
Objective	FCW does NOT issue a warning when there are no FCW threats in the host vehicle path.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Prepare each system and test component in accordance with Initialization for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Host Vehicle OBU/ Firmware/ Vehicle	SiriusXM OBU	
Remote Vehicle OBU/ Vehicle	Lear Roadstar OBU	

Test Case ID	WFCWT-2-LS	Test Engineer Verification and Remarks
Roadway Geometry	Straight	
Remote Vehicle Scenario (Test Case Input 1)	Remote vehicle enters track, approaches and stops at designated test location.	
Host Vehicle Scenario (Test Case Input 2)	Host vehicle enters track from outside communication range. Host Vehicle passes stopped remote vehicle in adjacent lane.	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	None	
Log File Analysis and Verification Method (Test Case Output 2)	FCW does NOT issue a warning when there are no FCW threats in the Host vehicle path.	
Expected Result (Pass/Fail Criteria)		
Detailed Execution Steps	**Verify Readiness** 1. Host and remote vehicle have Lear LocoMate 300 OBU's installed with antenna and HMI, configured according to the WYDOT CV Pilot OBU configuration. A lap top computer must be connected via an Ethernet cable to the OBU to implement initial log file offload verification. 2. Confirm that the test Lear LocoMate 300 RSU is installed and configured according to the WYDOT CV Pilot RSU configuration. 3. Identify offload location where vehicles can drive to, to be within the offload range of the test RSU. 4. Identify specific test location for remote vehicle to stop and be stationary and have an adjacent lane for the host vehicle to pass. Identify path that host vehicle will use to approach stationary remote vehicle. The approach path must start at least 300 meters from stationary vehicle location.	*Performed and Confirmed by:*

<table>
<tr><th>Test Case ID</th><th>WFCWT-2-LS</th><th>Test Engineer Verification and Remarks</th></tr>
<tr><td></td><td>Test Start Up
5. Drive both the host and remote vehicles to the offload location, power up each OBU in the host and remote vehicle.
6. Confirm that each OBU powers up correctly and is linked to its corresponding HMI. Confirm this by driving a short distance and validating that the vehicle speed and location are updated on the HMI to reflect the short drive.
7. While parked at the offload location execute the following steps to confirm log file generation and offload.
a. Log into each OBU and from the system shell issue a ping6 command to the backend host server for the WYDOT CV Pilot environment. This will confirm the full IPv6 connectivity from the OBU through the RSU to the WYDOT backend server. The ping command to issue is:
#ping6 <backend server IPv6 address>
b. For each OBU confirm that log files are being generated. Confirm this by reviewing the event log directory on the OBU and checking that various log files are increasing in size. The specific log files to see increasing are:
/var/eventlog/bsmLogDuringEvent.csv
/var/eventlog/rxMsg.csv
/var/eventlog/driverAlert.csv
c. For each OBU confirm that log files are being offloaded, when vehicle is at the designated offload location. Confirm this by reviewing the offload subdirectories on the OBU and ensuring that they do not continuously accumulate log files. A few log files may accumulate (2-3), but within 30 seconds they should all offload and be removed from the log directory. The specific offload subdirectories to check are:
/var/storage/bsmLogDuringEvent
/var/storage/rxMsg</td><td></td></tr>
</table>

Test Case ID	WFCWT-2-LS	Test Engineer Verification and Remarks
	/var/storage/driverAlert Once the log file generation and offload are confirmed the test repetitions can begin. **Driving the Test** 8. Begin by driving the remote vehicle to the designated stationary position on the test track. 9. Once the remote vehicle is stationary, the host vehicle enters the test track, this entry onto the track must be at least 300 meters driving distance from the stationary remote vehicle. The host vehicle should follow the same path that the remote vehicle did, but in the adjacent lane to the remote vehicle. As it approaches the stationary remote vehicle, the host vehicle should always remain in the lane adjacent to the remote vehicle. 10. Accelerate the host vehicle up to 35 miles per hour driving on the test track in the lane adjacent to the stationary remote vehicle. The host driver should initially focus on achieving and maintaining the test speed of 35 mph. 11. As the host vehicle approaches the stationary remote vehicle the driver maintains the vehicle speed and monitors the approach to the remote vehicle to ensure the host vehicle remains in the adjacent lane and there is no chance of collision with the stationary remote vehicle. 12. During the approach to the remote vehicle, the host vehicle driver monitors the HMI to identify any advisory or warning messages issued to the driver. 13. After safely passing the stationary remote vehicle, the host vehicle driver should come to a complete stop and manually record any types of driver alerts (or lack of alerts) received during the prior approach and passing sequence. 14. The host vehicle then returns to the previously defined start location to repeat the test again. 15. The remote vehicle may remain stationary between multiple repetitions of the test and the host vehicle begins each new repetition at step two of this driving sequence. If the remote vehicle moves after a test repetition completes, then the next repetition of the test driving sequence must start at step one.	

Test Case ID	WFCWT-2-LS	Test Engineer Verification and Remarks
	16. After final test repetition, both the remote and host vehicles drive to offload location and confirm that generated log files are offloaded (see test startup step 7). **Analysis Procedure** 17. Execute a set of queries on the DW to extract BSM and driver alert log records for the period of time around each FCW test run. These queries are implemented in a script that generates a KML file for display in Google Earth. This allows each BSM and driver alert record from each test vehicle to be plotted in the Google Earth application. The follow example command line runs the query script to generate the KML file for a test executed at the Archer test track that started 08 Jan 2018 02:15:10 pm MST and ended at 02:16:00 pm MST. Note that the time boundaries in the query are in Coordinated Universal Time (UTC). a. python create_kml.py circle --lat 41.150576 --long -104.654964 --distance 1000 --beginTime '2018-01-08 21:15:10' --endTime '2018-01-08 21:16:00' 18. Open the resulting KML file in Google Earth. The BSM records and driver alert records for each vehicle will be visible along the paths they traveled at the test site location. BSM records from each vehicle will be in a different color. Driver alert records (if any) will be shown as white arrows at each point in the vehicle trajectory that the driver alert was issued. Adjust the time slider so that appropriate BSM and driver alerts around the FCW test are visible. 19. Confirm that no forward collision alerts were issued to the host vehicle during its approach and passing of the remote vehicle.	

2.16 Table WFCWT-2-LS-Results FCW Passing Stopped Vehicle Test Case Results

Table 2-16. WFCWT-2-LS-Results FCW Passing Stopped Vehicle Test Case Results

Test Case ID	WFCWT-2-LS	Test Engineer Verification and Remarks
Test Case Name	FCW Passing Stopped Vehicle	*Performed and Confirmed by:*

Test Case ID	WFCWT-2-LS	Test Engineer Verification and Remarks
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.17 Table WFCWT-2-Requirements FCW Passing Stopped Vehicle Requirements Verification Analysis

Table 2-17. WFCWT-2-Requirements FCW Passing Stopped Vehicle Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WFCWT-2 -- FCW Passing Stopped Vehicle	VS-REQ-10.2 -- Passing a Stopped Vehicle	The Vehicle System shall identify when no imminent danger of a rear-end crash is present with a remote vehicle that is stopped	* Perform Test Case WFCWT-2 * Inspect Host Vehicle OBU Event Logs, determine location, speed, and heading path of Host Vehicle. * Inspect Remote Vehicle OBU Event Logs,	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		and not in its lane of travel in common roadway geometries.	determine location, speed, and heading path of Remote Vehicle. * Verify vehicles are not in the same travel lane. * Inspect Host Vehicle OBU Event Logs and verify that alert was not issued. * Inspect Host Vehicle HMI Logs and verify that alert was not issued. * Absence of alert verifies the Vehicle System identifies when no imminent danger of a rear-end crash is present with a remote vehicle that is stopped and not in its lane of travel in common roadway geometries, thereby verifying the requirement is satisfied. (Note: As a system integrator, WYDOT Team tests to verify basic functionalities are present in vendor supplied systems, but does not have the resources to verify all conditions defined by "common roadway geometries".)	
WFCWT-2 -- FCW Passing Stopped Vehicle	FCWP-REQ-3 -- Passing a Stopped Vehicle Performance	The Vehicle System shall not issue an FCW advisory or alert when passing a stopped vehicle in an adjacent lane.	* Perform Test Case WFCWT-2 * Inspect Host Vehicle OBU Event Logs, determine location, speed, and heading path of Host Vehicle. * Inspect Remote Vehicle OBU Event Logs, determine location, speed, and heading path of Remote Vehicle. * Verify vehicles are not in the same travel lane. * Inspect Host Vehicle OBU Event Logs and verify that alert was not issued. * Inspect Host Vehicle HMI Logs and verify that alert was not issued. * Absence of alert verifies the Vehicle System does not issue an FCW advisory or alert when passing a stopped vehicle in an adjacent lane, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

2.18 Table WFCWT-3-LL-Description FCW Steady State Test Case Description (Lear Remote/Lear Host)

Table 2-18. WFCWT-3-LL-Description FCW Steady State Test Case Description (Lear Remote/Lear Host)

Test Case ID	WFCWT-3-LL	Test Engineer Verification and Remarks
Test Case Name	FCW Steady State	
Test Case Completion Date	January 8, 2018	
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WFCWT-3-Requirements	
Objective	FCW does NOT issue a warning when host vehicle follows closely. This test case is used to tune FCW to deliver timely warnings, while avoiding nuisance warnings.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Prepare each system and test component in accordance with Initialization for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Host Vehicle OBU/ Firmware/ Vehicle	Lear Roadstar Locomate 300 OBU. Lear firmware version PR10	
Remote Vehicle OBU/ Vehicle	Lear Roadstar Locomate 300 OBU. Lear firmware version PR10	

Test Case ID	WFCWT-3-LL	Test Engineer Verification and Remarks
Roadway Geometry	Straight Two sequential test track segments defined to execute the FCW test. Each test track segment was about 1.2 km long each providing the necessary 600 meter approach segment.	
Remote Vehicle Scenario (Test Case Input 1)	Enters track from outside communication range and circles track at 35 mph.	
Host Vehicle Scenario (Test Case Input 2)	Enters track following Remote vehicle. Follows remote vehicle closely at fixed distance for 60 seconds.	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	None	
Log File Analysis and Verification Method (Test Case Output 2)	FCW does NOT issue a warning.	
Expected Result (Pass/Fail Criteria)		
Detailed Execution Steps	**Verify Readiness** 1. Host and remote vehicle have Lear LocoMate 300 OBU's installed with antenna and HMI, configured according to the WYDOT CV Pilot OBU configuration. A lap top computer must be connected via an Ethernet cable to the OBU to verify log file offload. 2. Confirm that the test Lear LocoMate 300 RSU is installed and configured according to the WYDOT CV Pilot RSU configuration. 3. Identify offload location where vehicles can drive to, to be within the offload range of the test RSU. 4. Identify specific test segment for host and remote vehicle to maintain a steady state 35 mph speed for at least 70 seconds.	*Performed and Confirmed by:*

Test Case ID	WFCWT-3-LL	Test Engineer Verification and Remarks
	Test Start Up 5. Drive both the host and remote vehicles to the offload location, power up each OBU in the host and remote vehicle. 6. Confirm that each OBU powers up correctly and is linked to its corresponding HMI. Confirm this by driving a short distance and validating that the vehicle speed and location are updated on the HMI to reflect the short drive. 7. While parked at the offload location execute the following steps to confirm log file generation and offload. a. Log into each OBU and from the system shell issue a ping6 command to the backend host server for the WYDOT CV Pilot environment. This will confirm the full IPv6 connectivity from the OBU through the RSU to the WYDOT backend server. The ping command to issue is: #ping6 <backend server IPv6 address> b. For each OBU confirm that log files are being generated. Confirm this by reviewing the event log directory on the OBU and checking that various log files are increasing in size. The specific log files to see increasing are: /var/eventlog/bsmLogDuringEvent.csv /var/eventlog/rxMsg.csv /var/eventlog/driverAlert.csv c. For each OBU confirm that log files are being offloaded, when vehicle is at the designated offload location. Confirm this by reviewing the offload subdirectories on the OBU and ensuring that they do not continuously accumulate log files. A few log files may accumulate (2-3), but within 30 seconds they should all offload and be removed from the log directory. The specific offload subdirectories to check are: /var/storage/bsmLogDuringEvent /var/storage/rxMsg	

Test Case ID	WFCWT-3-LL	Test Engineer Verification and Remarks
	/var/storage/driverAlert Once the log file generation and offload are confirmed the test repetitions can begin. **Driving the Test** 8. Begin by driving both the host and remote vehicles to the starting end of the test track segment identified for steady state run. 9. The remote vehicle departs first, accelerates up to 35 mph and maintains this speed. 10. About 4 seconds after the remote vehicle departs the host vehicle departs and follows the remote vehicle accelerating up to 35 mph. Accelerating slowly the host vehicle moves up on the remote vehicle until it is trailing the remote vehicle by about a 2 second trailing time gap (roughly measured by the host vehicle driver). 11. The two vehicles maintain their steady state speed with the same 2 second trailing time gap for a measured time of at least 60 seconds. Both drivers should focus on maintaining the 35 mph test speed as closely as possible. 12. During the measured steady state driving portion, the host vehicle driver monitors the HMI to identify any advisory or warning messages issued to the driver. 13. After the measured steady state driving duration, the host vehicle driver should come to a complete stop and manually record any types of driver alerts (or lack of alerts) received during the prior steady state driving duration. 14. The host and remote vehicles then return to the previously defined start location to repeat the test again. After final test repetition, both the remote and host vehicles drive to offload location and confirm that generated log files are offloaded (see test startup step 7). **Analysis Procedure** 15. Execute a set of queries on the DW to extract bsm and driver alert log records for the period of time around each FCW test run. These queries are implemented in a script that generates a KML file for display in Google Earth. This allows each bsm and driver alert record from each test vehicle to be plotted in the Google Earth application. The follow example command line runs the query script to generate	

Test Case ID	WFCWT-3-LL	Test Engineer Verification and Remarks
	the KML file for a test executed at the Archer test track that started 08 Jan 2018 03:15:00 pm MST and ended at 03:16:35 pm MST. Note that the time boundaries in the query are in Coordinated Universal Time (UTC). python create_kml.py circle --lat 41.150576 --long -104.654964 --distance 1000 --beginTime '2018-01-08 22:15:00' --endTime '2018-01-08 22:16:35' 16. Open the resulting KML file in Google Earth. The bsm records and driver alert records for each vehicle will be visible along the paths they traveled at the test site location. Bsm records from each vehicle will be in a different color. Driver alert records (if any) will be shown as white arrows at each point in the vehicle trajectory that the driver alert was issued. Adjust the time slider so that appropriate bsm and driver alerts around the FCW test are visible. 17. Confirm that no driver alerts were issued to the host vehicle during the steady state close following duration.	

2.19 Table WFCWT-3-LL-Results FCW Steady State Test Case Results (Lear Remote/Lear Host)

Table 2-19. WFCWT-3-LL-Results FCW Steady State Test Case Results (Lear Remote/Lear Host)

Test Case ID	Rep	WFCWT-3-LL	Test Engineer Verification and Remarks
Test Case Name		FCW Steady State	
Test Case Completion Date			*Performed and Confirmed by:*
Test Case Driver Visual and Log File Analysis Results	**Rep 1**		*Performed and Confirmed by:*
Test Case Driver Visual and Log File Analysis Results	**Rep 2**		*Performed and Confirmed by:*
Test Case Driver Visual and Log File Analysis Results	**Rep 3**		*Performed and Confirmed by:*
Test Case Driver Visual and Log File Analysis Results	**Rep 4**		*Performed and Confirmed by:*
Test Case Driver Visual and Log File Analysis Results	**Rep 5**		*Performed and Confirmed by:*
Test Case Analysis Tables			*Performed and Confirmed by:*
Pass/Fail Assessment			*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.20 Table WFCWT-3-LS-Description FCW Steady State Test Case Description

Table 2-20. WFCWT-3-LS-Description FCW Steady State Test Case Description

Test Case ID	**WFCWT-3-LS**	**Test Engineer Verification and Remarks**
Test Case Name	FCW Steady State	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WFCWT-3-Requirements	
Objective	FCW does NOT issue a warning when host vehicle follows closely. This test case is used to tune FCW to deliver timely warnings, while avoiding nuisance warnings.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Prepare each system and test component in accordance with Initialization for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Host Vehicle OBU/ Firmware/ Vehicle	SiriusXM	
Remote Vehicle OBU/ Vehicle	Lear Roadstar OBU	

Test Case ID	WFCWT-3-LS	Test Engineer Verification and Remarks
Roadway Geometry	Straight	
Remote Vehicle Scenario (Test Case Input 1)	Enters track from outside communication range and circles track at 35 mph.	
Host Vehicle Scenario (Test Case Input 2)	Enters track following Remote vehicle. Follows remote vehicle closely at fixed distance for 60 seconds.	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	None	
Log File Analysis and Verification Method (Test Case Output 2)	FCW does NOT issue a warning.	
Expected Result (Pass/Fail Criteria)		
Detailed Execution Steps	**Verify Readiness** 1. Host and remote vehicle have Lear LocoMate 300 OBU's installed with antenna and HMI, configured according to the WYDOT CV Pilot OBU configuration. A lap top computer must be connected via an Ethernet cable to the OBU to verify log file offload. 2. Confirm that the test Lear LocoMate 300 RSU is installed and configured according to the WYDOT CV Pilot RSU configuration. 3. Identify offload location where vehicles can drive to, to be within the offload range of the test RSU. 4. Identify specific test segment for host and remote vehicle to maintain a steady state 35 mph speed for at least 70 seconds.	*Performed and Confirmed by:*

Test Case ID	WFCWT-3-LS	Test Engineer Verification and Remarks
	Test Start Up 5. Drive both the host and remote vehicles to the offload location, power up each OBU in the host and remote vehicle. 6. Confirm that each OBU powers up correctly and is linked to its corresponding HMI. Confirm this by driving a short distance and validating that the vehicle speed and location are updated on the HMI to reflect the short drive. 7. While parked at the offload location execute the following steps to confirm log file generation and offload. a. Log into each OBU and from the system shell issue a ping6 command to the backend host server for the WYDOT CV Pilot environment. This will confirm the full IPv6 connectivity from the OBU through the RSU to the WYDOT backend server. The ping command to issue is: #ping6 <backend server IPv6 address> b. For each OBU confirm that log files are being generated. Confirm this by reviewing the event log directory on the OBU and checking that various log files are increasing in size. The specific log files to see increasing are: /var/eventlog/bsmLogDuringEvent.csv /var/eventlog/rxMsg.csv /var/eventlog/driverAlert.csv a. For each OBU confirm that log files are being offloaded, when vehicle is at the designated offload location. Confirm this by reviewing the offload subdirectories on the OBU and ensuring that they do not continuously accumulate log files. A few log files may accumulate (2-3), but within 30 seconds they should all offload and be removed from the log directory. The specific offload subdirectories to check are: /var/storage/bsmLogDuringEvent	

Test Case ID	WFCWT-3-LS	Test Engineer Verification and Remarks
	/var/storage/rxMsg /var/storage/driverAlert Once the log file generation and offload are confirmed the test repetitions can begin. **Driving the Test** 8. Begin by driving both the host and remote vehicles to the starting end of the test track segment identified for steady state run. 9. The remote vehicle departs first, accelerates up to 35 mph and maintains this speed. 10. About 4 seconds after the remote vehicle departs the host vehicle departs and follows the remote vehicle accelerating up to 35 mph. Accelerating slowly the host vehicle moves up on the remote vehicle until it is trailing the remote vehicle by about a 2 second trailing time gap (roughly measured by the host vehicle driver). 11. The two vehicles maintain their steady state speed with the same 2 second trailing time gap for a measured time of at least 60 seconds. Both drivers should focus on maintaining the 35 mph test speed as closely as possible. 12. During the measured steady state driving portion, the host vehicle driver monitors the HMI to identify any advisory or warning messages issued to the driver. 13. After the measured steady state driving duration, the host vehicle driver should come to a complete stop and manually record any types of driver alerts (or lack of alerts) received during the prior steady state driving duration. 14. The host and remote vehicles then return to the previously defined start location to repeat the test again. After final test repetition, both the remote and host vehicles drive to offload location and confirm that generated log files are offloaded (see test startup step 7). **Analysis Procedure** 15. Execute a set of queries on the DW to extract bsm and driver alert log records for the period of time around each FCW test run. These queries are	

Test Case ID	WFCWT-3-LS	Test Engineer Verification and Remarks
	implemented in a script that generates a KML file for display in Google Earth. This allows each bsm and driver alert record from each test vehicle to be plotted in the Google Earth application. The follow example command line runs the query script to generate the KML file for a test executed at the Archer test track that started 08 Jan 2018 03:15:00 pm MST and ended at 03:16:35 pm MST. Note that the time boundaries in the query are in Coordinated Universal Time (UTC). python create_kml.py circle --lat 41.150576 --long -104.654964 --distance 1000 --beginTime '2018-01-08 22:15:00' --endTime '2018-01-08 22:16:35' 16. Open the resulting KML file in Google Earth. The bsm records and driver alert records for each vehicle will be visible along the paths they traveled at the test site location. Bsm records from each vehicle will be in a different color. Driver alert records (if any) will be shown as white arrows at each point in the vehicle trajectory that the driver alert was issued. Adjust the time slider so that appropriate bsm and driver alerts around the FCW test are visible. 17. Confirm that no driver alerts were issued to the host vehicle during the steady state close following duration.	

2.21 Table WFCWT-3-LS-Results FCW Steady State Test Case Results

Table 2-21. WFCWT-3-LS-Results FCW Steady State Test Case Results

Test Case ID	WFCWT-3-LS	Test Engineer Verification and Remarks
Test Case Name	FCW Steady State	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*

Test Case ID	WFCWT-3-LS	Test Engineer Verification and Remarks
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.22 Table WFCWT-3-Requirements FCW Steady State Requirements Verification Analysis

Table 2-22 WFCWT-3-Requirements FCW Steady State Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WFCWT-3 -- FCW Steady State	VS-REQ-10.1 -- Safely Following a Vehicle	The Vehicle System shall identify when no imminent danger of a rear-end crash is present with a remote vehicle in its lane of travel in common roadway geometries.	* Perform Test Case WFCWT-3 * Inspect Host Vehicle OBU Event Logs, determine location, speed, and heading path of Host Vehicle. * Determine travel lane of Host Vehicle * Inspect Remote Vehicle OBU Event Logs, determine location, speed, and heading path of Remote Vehicle.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			* Determine travel lane of Remote Vehicle. * Inspect Host and Remote Vehicle Event Logs and identify time period when Host follows Remote at 35 mph at a distance of 5 to 8 meters for 60 seconds or more. * Inspect Host Vehicle OBU Event Logs and verify that alert was not issued during this time. * Inspect Host Vehicle HMI Logs and verify that alert was not issued during this time. * Absence of alert verifies the Vehicle System identifies when no imminent danger of a rear-end crash is present with a remote vehicle in its lane of travel in common roadway geometries, thereby verifying the requirement is satisfied. (Note: As a system integrator, WYDOT Team tests to verify basic functionalities are present in vendor supplied systems, but does not have the resources to verify all conditions defined by "common roadway geometries".)	
WFCWT-3 -- FCW Steady State	FCWP-REQ-4 -- Following a Vehicle Performance	The Vehicle System shall not issue an imminent FCW alert when following a remote vehicle traveling at a constant speed above 30 mph.	* Perform Test Case WFCWT-3 * Inspect Host Vehicle OBU Event Logs, determine location, speed, and heading path of Host Vehicle. * Determine travel lane of Host Vehicle * Inspect Remote Vehicle OBU Event Logs, determine location, speed, and heading path of Remote Vehicle. * Determine travel lane of Host Vehicle. * Inspect Host and Remote Vehicle Event Logs and identify time period when Host follows Remote at 35 mph at a distance of 5 to 8 meters for 60 seconds or more. * Inspect Host Vehicle OBU Event Logs and verify that alert was not issued during this time. * Inspect Host Vehicle HMI Logs and verify that alert was not issued during this time. * Absence of alert verifies the Vehicle System does not issue an imminent FCW alert when following a remote vehicle traveling at a constant speed above	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			30 mph, thereby verifying the requirement is satisfied.	

2.23 Table WFCWT-4-LL-Description FCW Braking Vehicle Ahead Test Case Description (Lear Remote/Lear Host)

Table 2-23. WFCWT-4-LL-Description FCW Braking Vehicle Ahead Test Case Description (Lear Remote/Lear Host)

Test Case ID	WFCWT-4-LL	Test Engineer Verification and Remarks
Test Case Name	FCW Braking Vehicle Ahead	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WFCWT-4-Requirements	
Objective	When remote vehicle brakes heavily FCW application issues a warning in time for driver to avoid forward collision.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Prepare each system and test component in accordance with Initialization for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Host Vehicle OBU/ Firmware/ Vehicle		

Test Case ID	WFCWT-4-LL	Test Engineer Verification and Remarks
Remote Vehicle OBU/ Vehicle		
Roadway Geometry	Straight Two sequential test track segments defined to execute the FCW test. Each test track segment was about 1.2 km long each providing the necessary 600 meter approach segment.	
Remote Vehicle Scenario (Test Case Input 1)	Enters track from outside communication range and circles track at 35 mph. At a pre-specified location Remote vehicle decelerates rapidly from 35 mph to stop.	
Host Vehicle Scenario (Test Case Input 2)	Enters track following Remote vehicle. Follows remote vehicle closely at fixed distance. After receiving FCW warning, Host vehicle brakes and comes to a stop before impacting the remote vehicle.	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	FCW Advisory (Level 1) FCW Imminent Alert (Level 2)	
Log File Analysis and Verification Method (Test Case Output 2)	*Time-to-collision when FCW Advisory is issued *Time-to-collision when FCW Imminent Alert is issued.	
Expected Result (Pass/Fail Criteria)	FCW alert after the remote vehicle brakes heavily in time for driver to take action to avoid collision.	
Detailed Execution Steps	**Verify Readiness** 1. Host and remote vehicle have Lear LocoMate 300 OBU's installed with antenna and HMI, configured according to the WYDOT CV Pilot OBU configuration. A lap top computer must be connected via an Ethernet cable to the OBU to implement initial log file offload verification. 2. Confirm that the test Lear LocoMate 300 RSU is installed and configured according to the WYDOT CV Pilot RSU configuration. 3. Identify offload location where vehicles can drive to, to be within the offload range of the test RSU. 4. Identify specific test segment where remote vehicle can drive at steady state 35 mph for at least 30 seconds. This implies a segment about 500 meters long. Identify	*Performed and Confirmed by:*

Test Case ID	WFCWT-4-LL	Test Engineer Verification and Remarks
	the braking start point at 100 meters before the end of this segment. Mark this braking start point with a roadside cone to ensure drivers of both the remote and host vehicles know where the remote vehicle will start its slowdown to a stop. **Test Start Up** 5. Drive both the host and remote vehicles to the offload location, power up each OBU in the host and remote vehicle. 6. Confirm that each OBU powers up correctly and is linked to its corresponding HMI. Confirm this by driving a short distance and validating that the vehicle speed and location are updated on the HMI to reflect the short drive. 7. While parked at the offload location execute the following steps to confirm log file generation and offload. a. Log into each OBU and from the system shell issue a ping6 command to the backend host server for the WYDOT CV Pilot environment. This will confirm the full IPv6 connectivity from the OBU through the RSU to the WYDOT backend server. The ping command to issue is: #ping6 <backend server IPv6 address> b. For each OBU confirm that log files are being generated. Confirm this by reviewing the event log directory on the OBU and checking that various log files are increasing in size. The specific log files to see increasing are: /var/eventlog/bsmLogDuringEvent.csv /var/eventlog/rxMsg.csv /var/eventlog/driverAlert.csv c. For each OBU confirm that log files are being offloaded, when vehicle is at the designated offload location. Confirm this by reviewing the offload subdirectories on the OBU and ensuring that they do not continuously accumulate log files. A few log files may accumulate (2-3), but within 30	

Test Case ID	WFCWT-4-LL	Test Engineer Verification and Remarks
	seconds they should all offload and be removed from the log directory. The specific offload subdirectories to check are: /var/storage/bsmLogDuringEvent /var/storage/rxMsg /var/storage/driverAlert Once the log file generation and offload are confirmed the test repetitions can begin. **Driving the Test** 8. Begin by driving the both the host and remote vehicles to the beginning of the test segment identified for the test. 9. The remote vehicle departs first and accelerates up to 35 mph and maintains this speed. 10. About 4 seconds after the remote vehicle departs the host vehicle departs and follows the remote vehicle accelerating up to 35 mph. Accelerating slowly the host vehicle moves up on the remote vehicle until it is trailing the remote vehicle by about a 5 second trailing time gap (roughly measured by the host vehicle driver). 11. The two vehicles maintain their steady state speed (35 mph) with the same 5 second trailing time gap until the remote vehicle reaches the defined brake point. 12. Upon reaching the brake point the remote vehicle brakes and quickly slows to a stop. 13. As the host vehicle approaches the slowing/stopped remote vehicle the host driver brakes as necessary to ensure the host vehicle stops or avoids the remote vehicle before any collision. 14. During the host vehicle slow down and stop the host vehicle driver identifies any forward collision advisory and/or imminent forward collision warnings issued to the driver. 15. After safely stopping behind the remote vehicle or avoiding the remote vehicle, the host vehicle driver should come to a complete stop and manually record the types of driver alerts received during the prior approach sequence.	

Test Case ID	WFCWT-4-LL	Test Engineer Verification and Remarks
	16. Both the host and remote vehicles return to the previously defined start location to repeat the test again. After final test repetition, both the remote and host vehicles drive to offload location and confirm that generated log files are offloaded (see test startup step 7). **Analysis Procedure** 17. Execute a set of queries on the DW to extract bsm and driver alert log records for the period of time around each FCW test run. These queries are implemented in a script that generates a KML file for display in Google Earth. This allows each bsm and driver alert record from each test vehicle to be plotted in the Google Earth application. The follow example command line runs the query script to generate the KML file for a test executed at the Archer test track that started 08 Jan 2018 03:12:20 pm MST and ended at 03:14:00 pm MST. python create_kml.py circle --lat 41.150576 --long -104.654964 --distance 1000 --beginTime '2018-01-08 22:12:20' --endTime '2018-01-08 22:14:00' 18. Open the resulting KML file in Google Earth. The bsm records and driver alert records for each vehicle will be visible along the paths they traveled at the test site location. Bsm records from each vehicle will be in a different color. Driver alert records will be shown as white arrows at each point in the vehicle trajectory that the driver alert was issued. Adjust the time slider so that appropriate bsm and driver alerts around the FCW test are visible. 19. Identify the time of the first FCW alert for the host vehicle. Record the time and velocity of the host vehicle at this alert time. 20. Identify the bsm from the remote vehicle that corresponds with the time of the first FCW alert identified in the previous step. Record the time and velocity of the remote vehicle at this alert time. 21. Using the Google Earth ruler tool, measure the distance in meters from the host vehicle FCW alert to the location of the remote vehicle bsm at the corresponding time instant.	

Test Case ID	WFCWT-4-LL	Test Engineer Verification and Remarks
	22. Calculate the time to collision (ttc) at the point where the advisory FCW is issued. The constant 0.44704 converts speed from mph to m/s. Time to collision (sec) ttc = distance /((host vehicle speed – remote vehicle speed) * 0.44704) 23. Confirm that this ttc is within the configured collision alert time.	

2.24 Table WFCWT-4-LL-Results FCW Braking Vehicle Ahead Test Case Results (Lear Remote/Lear Host)

Table 2-24. WFCWT-4-LL-Results FCW Braking Vehicle Ahead Test Case Results (Lear Remote/Lear Host)

Test Case ID	Rep	WFCWT-4-LL	Test Engineer Verification and Remarks
Test Case Name		FCW Braking Vehicle Ahead	
Test Case Completion Date			*Performed and Confirmed by:*
Test Case Driver Visual and Log File Analysis Results	**Rep 1**		*Performed and Confirmed by:*
Test Case Driver Visual and Log File Analysis Results	**Rep 2**		*Performed and Confirmed by:*
Test Case Driver Visual and Log File Analysis Results	**Rep 3**		*Performed and Confirmed by:*

Test Case ID	Rep	WFCWT-4-LL	Test Engineer Verification and Remarks
Test Case Driver Visual and Log File Analysis Results	**Rep 4**		*Performed and Confirmed by:*
Test Case Driver Visual and Log File Analysis Results	**Rep 5**		*Performed and Confirmed by:*
Test Case Analysis Tables			*Performed and Confirmed by:*
Pass/Fail Assessment			*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.25 Table WFCWT-4-LS-Description FCW Braking Vehicle Ahead Test Case Description

Table 2-25. WFCWT-4-LS-Description FCW Braking Vehicle Ahead Test Case Description

Test Case ID	WFCWT-4-LS	Test Engineer Verification and Remarks
Test Case Name	FCW Braking Vehicle Ahead	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WFCWT-4-Requirements	
Objective	When remote vehicle brakes heavily FCW application issues a warning in time for driver to avoid forward collision.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Prepare each system and test component in accordance with Initialization for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Host Vehicle OBU/ Firmware/ Vehicle	Sirius XM OBU	
Remote Vehicle OBU/ Vehicle	Lear Roadstar OBU	
Roadway Geometry	Straight	
Remote Vehicle Scenario (Test Case Input 1)	Enters track from outside communication range and circles track at 35 mph. At a pre-specified location Remote vehicle decelerates rapidly from 35 mph to stop.	

Test Case ID	**WFCWT-4-LS**	**Test Engineer Verification and Remarks**
Host Vehicle Scenario (Test Case Input 2)	Enters track following Remote vehicle. Follows remote vehicle closely at fixed distance. After receiving FCW warning, Host vehicle brakes and comes to a stop before impacting the remote vehicle.	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	FCW Advisory (Level 1) FCW Imminent Alert (Level 2)	
Log File Analysis and Verification Method (Test Case Output 2)	*Time-to-collision when FCW Advisory is issued *Time-to-collision when FCW Imminent Alert is issued.	
Expected Result (Pass/Fail Criteria)	FCW alert after the remote vehicle brakes heavily in time for driver to take action to avoid collision.	
Detailed Execution Steps	*The following is an example description of Detailed Execution Steps for conducting this test case.* **Verify Readiness** 1. Host and remote vehicle have Lear LocoMate 300 OBU's installed with antenna and HMI, configured according to the WYDOT CV Pilot OBU configuration. A lap top computer must be connected via an Ethernet cable to the OBU to implement initial log file offload verification. 2. Confirm that the test Lear LocoMate 300 RSU is installed and configured according to the WYDOT CV Pilot RSU configuration. 3. Identify offload location where vehicles can drive to, to be within the offload range of the test RSU. 4. Identify specific test segment where remote vehicle can drive at steady state 35 mph for at least 30 seconds. This implies a segment about 500 meters long. Identify the braking start point at 100 meters before the end of this segment. Mark this braking start point with a roadside cone to ensure drivers of both the remote and host vehicles know where the remote vehicle will start its slowdown to a stop.	*Performed and Confirmed by:*

Test Case ID	WFCWT-4-LS	Test Engineer Verification and Remarks
	Test Start Up 5. Drive both the host and remote vehicles to the offload location, power up each OBU in the host and remote vehicle. 6. Confirm that each OBU powers up correctly and is linked to its corresponding HMI. Confirm this by driving a short distance and validating that the vehicle speed and location are updated on the HMI to reflect the short drive. 7. While parked at the offload location execute the following steps to confirm log file generation and offload. a. Log into each OBU and from the system shell issue a ping6 command to the backend host server for the WYDOT CV Pilot environment. This will confirm the full IPv6 connectivity from the OBU through the RSU to the WYDOT backend server. The ping command to issue is: #ping6 <backend server IPv6 address> b. For each OBU confirm that log files are being generated. Confirm this by reviewing the event log directory on the OBU and checking that various log files are increasing in size. The specific log files to see increasing are: /var/eventlog/bsmLogDuringEvent.csv /var/eventlog/rxMsg.csv /var/eventlog/driverAlert.csv c. For each OBU confirm that log files are being offloaded, when vehicle is at the designated offload location. Confirm this by reviewing the offload subdirectories on the OBU and ensuring that they do not continuously accumulate log files. A few log files may accumulate (2-3), but within 30 seconds they should all offload and be removed from the log directory. The specific offload subdirectories to check are: /var/storage/bsmLogDuringEvent /var/storage/rxMsg	

Test Case ID	WFCWT-4-LS	Test Engineer Verification and Remarks
	/var/storage/driverAlert Once the log file generation and offload are confirmed the test repetitions can begin. **Driving the Test** 8. Begin by driving the both the host and remote vehicles to the beginning of the test track segment identified for the test. 9. The remote vehicle departs first and accelerates up to 35 mph and maintains this speed. 10. About 4 seconds after the remote vehicle departs the host vehicle departs and follows the remote vehicle accelerating up to 35 mph. Accelerating slowly the host vehicle moves up on the remote vehicle until it is trailing the remote vehicle by about a 5 second trailing time gap (roughly measured by the host vehicle driver). 11. The two vehicles maintain their steady state speed (35 mph) with the same 5 second trailing time gap until the remote vehicle reaches the defined brake point. 12. Upon reaching the brake point the remote vehicle brakes and quickly slows to a stop. 13. As the host vehicle approaches the slowing/stopped remote vehicle the host driver brakes as necessary to ensure the host vehicle stops or avoids the remote vehicle before any collision. 14. During the host vehicle slow down and stop the host vehicle driver identifies any forward collision advisory and/or imminent forward collision warnings issued to the driver. 15. After safely stopping behind the remote vehicle or avoiding the remote vehicle, the host vehicle driver should come to a complete stop and manually record the types of driver alerts received during the prior approach sequence. 16. Both the host and remote vehicles return to the previously defined start location to repeat the test again. 17. After final test repetition, both the remote and host vehicles drive to offload location and confirm that generated log files are offloaded (see test startup step 7).	

Test Case ID	WFCWT-4-LS	Test Engineer Verification and Remarks
	Analysis Procedure 18. Execute a set of queries on the DW to extract bsm and driver alert log records for the period of time around each FCW test run. These queries are implemented in a script that generates a KML file for display in Google Earth. This allows each bsm and driver alert record from each test vehicle to be plotted in the Google Earth application. The follow example command line runs the query script to generate the KML file for a test executed at the Archer test track that started 08 Jan 2018 03:12:20 pm MST and ended at 03:14:00 pm MST. python create_kml.py circle --lat 41.150576 --long -104.654964 --distance 1000 --beginTime '2018-01-08 22:12:20' --endTime '2018-01-08 22:14:00' 19. Open the resulting KML file in Google Earth. The bsm records and driver alert records for each vehicle will be visible along the paths they traveled at the test site location. Bsm records from each vehicle will be in a different color. Driver alert records will be shown as white arrows at each point in the vehicle trajectory that the driver alert was issued. Adjust the time slider so that appropriate bsm and driver alerts around the FCW test are visible. 20. Identify the time of the first FCW alert for the host vehicle. Record the time and velocity of the host vehicle at this alert time. 21. Identify the bsm from the remote vehicle that corresponds with the time of the first FCW alert identified in the previous step. Record the time and velocity of the remote vehicle at this alert time. 22. Using the Google Earth ruler tool, measure the distance in meters from the host vehicle FCW alert to the location of the remote vehicle bsm at the corresponding time instant. 23. Calculate the time to collision (ttc) at the point where the advisory FCW is issued. The constant 0.44704 converts speed from mph to m/s. Time to collision (sec) ttc = distance /((host vehicle speed – remote vehicle speed) * 0.44704) 24. Confirm that this ttc is within the configured collision alert time.	

2.26 Table WFCWT-4-LS-Results FCW Braking Vehicle Ahead Test Case Results

Table 2-26. WFCWT-4-LS-Results FCW Braking Vehicle Ahead Test Case Results

Test Case ID	**WFCWT-4-LS**	**Test Engineer Verification and Remarks**
Test Case Name	FCW Braking Vehicle Ahead	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.27 Table WFCWT-4-Requirements FCW Braking Vehicle Ahead Requirements Verification Analysis

Table 2-27. WFCWT-4-Requirements FCW Braking Vehicle Ahead Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WFCWT-4 -- FCW Braking Vehicle Ahead	FCWP-REQ-5 -- Decelerating Vehicle Performance	The Vehicle System shall issue an imminent FCW alert when the Time-to-Collision is below a configurable threshold for alerting the driver that there is an imminent threat of forward collision with a decelerating vehicle ahead in the same lane of travel and immediate action is required from the driver to avoid the collision. Guidance for FCW Time-to Collision, Advisories and Alerts is provided in SyRS Section 6.1.1.	* Perform Test Case WFCWT-4 * Inspect Host Vehicle OBU Logs * Confirm detection of decelerating remote vehicle ahead * Confirm issuance of imminent FCW alert * Issuance of imminent FCW alert verifies Vehicle System issues an imminent FCW alert when the Time-to-Collision is below a configurable threshold for alerting the driver that there is an imminent threat of forward collision with a decelerating vehicle ahead in the same lane of travel and immediate action is required from the driver to avoid the collision, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

2.28 Table WFCWT-5 -LL-Description FCW Stopped Vehicle in a Curve Test Case Description (Lear Remote/Lear Host)

Table 2-28. WFCWT-5 -LL-Description FCW Stopped Vehicle in a Curve Test Case Description (Lear Remote/Lear Host)

Test Case ID	**WFCWT-5-LL**	**Test Engineer Verification and Remarks**
Test Case Name	FCW Stopped Vehicle in a Curve	
Test Case Completion Date		

Test Case ID	WFCWT-5-LL	Test Engineer Verification and Remarks
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WFCWT-5-Requirements	
Objective	When there is a stopped vehicle in the same lane of travel in a curve, FCW application issues a warning in time for driver to avoid forward collision.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Prepare each system and test component in accordance with Initialization for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Host Vehicle OBU/ Firmware/ Vehicle	Lear Roadstar Locomate 300 OBU. Lear firmware version PR10	
Remote Vehicle OBU/ Vehicle	Lear Roadstar Locomate 300 OBU. Lear firmware version PR10	
Roadway Geometry	Curve	
Remote Vehicle Scenario (Test Case Input 1)	Remote vehicle enters track, approaches and stops in a curve at designated test location in a curve.	
Host Vehicle Scenario (Test Case Input 2)	Host vehicle enters track from outside communication range. Host Vehicle approaches stopped remote vehicle at 35 mph. After receiving FCW warning, driver stops or veers to clear adjacent lane and proceeds past stopped vehicle.	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	FCW Advisory (Level 1) FCW Imminent Alert (Level 2)	

Test Case ID	WFCWT-5-LL	Test Engineer Verification and Remarks
Log File Analysis and Verification Method (Test Case Output 2)	*Time-to-collision when FCW Advisory is issued *Time-to-collision when FCW Imminent Alert is issued.	
Expected Result (Pass/Fail Criteria)	FCW issues a warning when there is a stopped vehicle in the same lane of travel in a curve in time for driver to take action to avoid collision.	
Detailed Execution Steps	**Verify Readiness** 1. Host and remote vehicle have Lear LocoMate 300 OBU's installed with antenna and HMI, configured according to the WYDOT CV Pilot OBU configuration. A lap top computer must be connected via an Ethernet cable to the OBU to implement initial log file offload verification. 2. Confirm that the test Lear LocoMate 300 RSU is installed and configured according to the WYDOT CV Pilot RSU configuration. 3. Identify offload location where vehicles can drive to, to be within the offload range of the test RSU. 4. Identify specific test location for remote vehicle to stop and be stationary. This stationary position should be at approximately 100 meters into a continuously curved portion of the test track. Identify path that host vehicle will use to approach stationary remote vehicle. The approach path must start at least 300 meters from stationary vehicle location. **Test Start Up** 5. Drive both the host and remote vehicles to the offload location, power up each OBU in the host and remote vehicle. 6. Confirm that each OBU powers up correctly and is linked to its corresponding HMI. Confirm this by driving a short distance and validating that the vehicle speed and location are updated on the HMI to reflect the short drive. 7. While parked at the offload location execute the following steps to confirm log file generation and offload. a. Log into each OBU and from the system shell issue a ping6 command to the backend host server for the WYDOT CV Pilot environment. This will	*Performed and Confirmed by:*

Test Case ID	WFCWT-5-LL	Test Engineer Verification and Remarks
	confirm the full IPv6 connectivity from the OBU through the RSU to the WYDOT backend server. The ping command to issue is: #ping6 <backend server IPv6 address> b. For each OBU confirm that log files are being generated. Confirm this by reviewing the event log directory on the OBU and checking that various log files are increasing in size. The specific log files to see increasing are: /var/eventlog/bsmLogDuringEvent.csv /var/eventlog/rxMsg.csv /var/eventlog/driverAlert.csv c. For each OBU confirm that log files are being offloaded, when vehicle is at the designated offload location. Confirm this by reviewing the offload subdirectories on the OBU and ensuring that they do not continuously accumulate log files. A few log files may accumulate (2-3), but within 30 seconds they should all offload and be removed from the log directory. The specific offload subdirectories to check are: /var/storage/bsmLogDuringEvent /var/storage/rxMsg /var/storage/driverAlert Once the log file generation and offload are confirmed the test repetitions can begin. **Driving the Test** 8. Begin by driving the remote vehicle to the designated stationary position on the test track. 9. Once the remote vehicle is stationary, the host vehicle enters the test track, this entry onto the track must be at least 300 meters driving distance from the stationary remote vehicle. The host vehicle should follow the same path that the remote vehicle did when driving to the stationary position on the test track.	

Test Case ID	WFCWT-5-LL	Test Engineer Verification and Remarks
	10. Accelerate the host vehicle up to 35 miles per hour driving on the test track towards the stationary remote vehicle. The host driver should initially focus on achieving and maintaining the test speed of 35 mph. 11. As the host vehicle approaches the stationary remote vehicle the driver maintains the vehicle speed and monitors the approach to the remote vehicle to ensure the host vehicle stops or avoids the remote vehicle before any collision. 12. During the approach to the remote vehicle, the host vehicle driver identifies any forward collision advisory and/or imminent forward collision warnings issued to the driver. 13. After safely stopping behind the remote vehicle or avoiding the remote vehicle, the host vehicle driver should come to a complete stop and manually record the types of driver alerts received during the prior approach sequence. 14. The host vehicle then returns to the previously defined start location to repeat the test again. 15. The remote vehicle may remain stationary between multiple repetitions of the test and the host vehicle begins each new repetition at step two of this driving sequence. If the remote vehicle moves after a test repetition completes, then the next repetition of the test driving sequence must start at the drive test first step. 16. After final test repetition, both the remote and host vehicles drive to offload location and confirm that generated log files are offloaded (see test startup step 7). **Analysis Procedure** 17. Execute a set of queries on the DW to extract bsm and driver alert log records for the period of time around each FCW test run. These queries are implemented in a script that generates a KML file for display in Google Earth. This allows each bsm and driver alert record from each test vehicle to be plotted in the Google Earth application. The follow example command line runs the query script to generate the KML file for a test executed at the Archer test track that started 10 Jan 2018 02:09:45 pm MST and ended at 02:12:00 pm MST. python create_kml.py circle --lat 41.150576 --long -104.654964 --distance 1500 --beginTime '2018-01-10 21:09:45' --endTime '2018-01-10 21:12:00'	

Test Case ID	WFCWT-5-LL	Test Engineer Verification and Remarks
	18. Open the resulting KML file in Google Earth. The bsm records and driver alert records for each vehicle will be visible along the paths they traveled at the test site location. Bsm records from each vehicle will be in a different color. Driver alert records will be shown as white arrows at each point in the vehicle trajectory that the driver alert was issued. Adjust the time slider so that appropriate bsm and driver alerts around the FCW test are visible. 19. Using the Google Earth ruler tool, measure the distance in meters from the first advisory FCW (stationary vehicle alert) to the location of the stationary remote vehicle. Record the host vehicle speed in mph that is associated with this first advisory FCW. 20. Calculate the time to collision (ttc) at the point where the advisory FCW is issued. The constant 0.44704 converts speed from mph to m/s. Time to collision (sec) ttc = distance /(speed * 0.44704) 21. Confirm that this ttc is close to the configured collision advisory time. 22. Use the same measurement process to calculate a time to collision from the first driver alert that is an imminent FCW (forward collision warning). Identify the first imminent FCW driver alert based on the alert type defined in each alert record data. Using the Google Earth ruler tool, measure the distance in meters from the first imminent FCW to the location of the stationary remote vehicle. 23. Confirm that this ttc is close to the configured collision imminent time.	

2.29 Table WFCWT-5 -LL-Results FCW Stopped Vehicle in a Curve Test Case Results (Lear Remote/Lear Host)

Table 2-29. WFCWT-5 -LL-Results FCW Stopped Vehicle in a Curve Test Case Results (Lear Remote/Lear Host)

Test Case ID	Rep	WFCWT-5-LL	Test Engineer Verification and Remarks
Test Case Name		FCW Stopped Vehicle in a Curve	
Test Case Completion Date			*Performed and Confirmed by:*
Test Case Driver Visual and Log File Analysis Results	Rep 1		*Performed and Confirmed by:*
Test Case Driver Visual and Log File Analysis Results	Rep 2		*Performed and Confirmed by:*
Test Case Driver Visual and Log File Analysis Results	Rep 3		*Performed and Confirmed by:*
Test Case Driver Visual and Log File Analysis Results	Rep 4		*Performed and Confirmed by:*
Test Case Driver Visual and Log File Analysis Results	Rep 5		*Performed and Confirmed by:*
Test Case Analysis Tables			*Performed and Confirmed by:*
Pass/Fail Assessment			*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.30 Table WFCWT-5-LS-Description FCW Stopped Vehicle in a Curve Test Case Description

Table 2-30. WFCWT-5-LS-Description FCW Stopped Vehicle in a Curve Test Case Description

Test Case ID	WFCWT-5-LS	Test Engineer Verification and Remarks
Test Case Name	FCW Stopped Vehicle in a Curve	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WFCWT-5-Requirements	
Objective	When there is a stopped vehicle in the same lane of travel in a curve, FCW application issues a warning in time for driver to avoid forward collision.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Prepare each system and test component in accordance with Initialization for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Host Vehicle OBU/ Firmware/ Vehicle	SiriusXM OBU	
Remote Vehicle OBU/ Vehicle	Lear Roadstar OBU	
Roadway Geometry	Curve	
Remote Vehicle Scenario (Test Case Input 1)	Remote vehicle enters track, approaches and stops in a curve at designated test location in a curve.	

Test Case ID	**WFCWT-5-LS**	**Test Engineer Verification and Remarks**
Host Vehicle Scenario (Test Case Input 2)	Host vehicle enters track from outside communication range. Host Vehicle approaches stopped remote vehicle at 35 mph. After receiving FCW warning, driver stops or veers to clear adjacent lane and proceeds past stopped vehicle.	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	FCW Advisory (Level 1) FCW Imminent Alert (Level 2)	
Log File Analysis and Verification Method (Test Case Output 2)	*Time-to-collision when FCW Advisory is issued *Time-to-collision when FCW Imminent Alert is issued.	
Expected Result (Pass/Fail Criteria)	FCW issues a warning when there is a stopped vehicle in the same lane of travel in a curve in time for driver to take action to avoid collision.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* **Verify Readiness** 1. Host and remote vehicle have Lear LocoMate 300 OBU's installed with antenna and HMI, configured according to the WYDOT CV Pilot OBU configuration. A lap top computer must be connected via an Ethernet cable to the OBU to implement initial log file offload verification. 2. Confirm that the test Lear LocoMate 300 RSU is installed and configured according to the WYDOT CV Pilot RSU configuration. 3. Identify offload location where vehicles can drive to, to be within the offload range of the test RSU. 4. Identify specific test location for remote vehicle to stop and be stationary. This stationary position should be at approximately 100 meters into a continuously curved portion of the test track. Identify path that host vehicle will use to approach stationary remote vehicle. The approach path must start at least 300 meters from stationary vehicle location.	*Performed and Confirmed by:*

Test Case ID	WFCWT-5-LS	Test Engineer Verification and Remarks
	Test Start Up 5. Drive both the host and remote vehicles to the offload location, power up each OBU in the host and remote vehicle. 6. Confirm that each OBU powers up correctly and is linked to its corresponding HMI. Confirm this by driving a short distance and validating that the vehicle speed and location are updated on the HMI to reflect the short drive. 7. While parked at the offload location execute the following steps to confirm log file generation and offload. a. Log into each OBU and from the system shell issue a ping6 command to the backend host server for the WYDOT CV Pilot environment. This will confirm the full IPv6 connectivity from the OBU through the RSU to the WYDOT backend server. The ping command to issue is: #ping6 <backend server IPv6 address> b. For each OBU confirm that log files are being generated. Confirm this by reviewing the event log directory on the OBU and checking that various log files are increasing in size. The specific log files to see increasing are: /var/eventlog/bsmLogDuringEvent.csv /var/eventlog/rxMsg.csv /var/eventlog/driverAlert.csv c. For each OBU confirm that log files are being offloaded, when vehicle is at the designated offload location. Confirm this by reviewing the offload subdirectories on the OBU and ensuring that they do not continuously accumulate log files. A few log files may accumulate (2-3), but within 30 seconds they should all offload and be removed from the log directory. The specific offload subdirectories to check are: /var/storage/bsmLogDuringEvent /var/storage/rxMsg	

Test Case ID	WFCWT-5-LS	Test Engineer Verification and Remarks
	/var/storage/driverAlert Once the log file generation and offload are confirmed the test repetitions can begin. **Driving the Test** 8. Begin by driving the remote vehicle to the designated stationary position on the test track. 9. Once the remote vehicle is stationary, the host vehicle enters the test track, this entry onto the track must be at least 300 meters driving distance from the stationary remote vehicle. The host vehicle should follow the same path that the remote vehicle did when driving to the stationary position on the test track. 10. Accelerate the host vehicle up to 35 miles per hour driving on the test track towards the stationary remote vehicle. The host driver should initially focus on achieving and maintaining the test speed of 35 mph. 11. As the host vehicle approaches the stationary remote vehicle the driver maintains the vehicle speed and monitors the approach to the remote vehicle to ensure the host vehicle stops or avoids the remote vehicle before any collision. 12. During the approach to the remote vehicle, the host vehicle driver identifies any forward collision advisory and/or imminent forward collision warnings issued to the driver. 13. After safely stopping behind the remote vehicle or avoiding the remote vehicle, the host vehicle driver should come to a complete stop and manually record the types of driver alerts received during the prior approach sequence. 14. The host vehicle then returns to the previously defined start location to repeat the test again. 15. The remote vehicle may remain stationary between multiple repetitions of the test and the host vehicle begins each new repetition at step two of this driving sequence. If the remote vehicle moves after a test repetition completes, then the next repetition of the test driving sequence must start at the driving test first step. 16. After final test repetition, both the remote and host vehicles drive to offload location and confirm that generated log files are offloaded (see test startup step 7).	

Test Case ID	WFCWT-5-LS	Test Engineer Verification and Remarks
	Analysis Procedure 17. Execute a set of queries on the DW to extract bsm and driver alert log records for the period of time around each FCW test run. These queries are implemented in a script that generates a KML file for display in Google Earth. This allows each bsm and driver alert record from each test vehicle to be plotted in the Google Earth application. The follow example command line runs the query script to generate the KML file for a test executed at the Archer test track that started 10 Jan 2018 02:09:45 pm MST and ended at 02:12:00 pm MST. python create_kml.py circle --lat 41.150576 --long -104.654964 --distance 1500 --beginTime '2018-01-10 21:09:45' --endTime '2018-01-10 21:12:00' 18. Open the resulting KML file in Google Earth. The bsm records and driver alert records for each vehicle will be visible along the paths they traveled at the test site location. Bsm records from each vehicle will be in a different color. Driver alert records will be shown as white arrows at each point in the vehicle trajectory that the driver alert was issued. Adjust the time slider so that appropriate bsm and driver alerts around the FCW test are visible. 19. Using the Google Earth ruler tool, measure the distance in meters from the first advisory FCW (stationary vehicle alert) to the location of the stationary remote vehicle. Record the host vehicle speed in mph that is associated with this first advisory FCW. 20. Calculate the time to collision (ttc) at the point where the advisory FCW is issued. The constant 0.44704 converts speed from mph to m/s. Time to collision (sec) ttc = distance /(speed * 0.44704) 21. Confirm that this ttc is close to the configured collision advisory time. 22. Use the same measurement process to calculate a time to collision from the first driver alert that is an imminent FCW (forward collision warning). Identify the first imminent FCW driver alert based on the alert type defined in each alert record data. Using the Google Earth ruler tool, measure the distance in meters from the first imminent FCW to the location of the stationary remote vehicle.	

Test Case ID	WFCWT-5-LS	Test Engineer Verification and Remarks
	23. Confirm that this ttc is close to the configured collision imminent time.	

2.31 Table WFCWT-5-LS-Results FCW Stopped Vehicle in a Curve Test Case Results

Table 2-31. WFCWT-5-LS-Results FCW Stopped Vehicle in a Curve Test Case Results

Test Case ID	WFCWT-5-LS	Test Engineer Verification and Remarks
Test Case Name	FCW Stopped Vehicle in a Curve	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.32 Table WFCWT-5-Requirements FCW Stopped Vehicle in a Curve Requirements Verification Analysis

Table 2-32. WFCWT-5-Requirements FCW Stopped Vehicle in a Curve Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WFCWT-5 -- FCW Stopped Vehicle in a Curve	VS-REQ-9.2 -- Rear-End Crash in Curved Road	The Vehicle System shall identify imminent danger of a rear-end crash with a remote vehicle lead vehicle in its lane of travel in a curved roadway geometry.	* Perform Test Case WFCWT-5 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped remote vehicle ahead * Confirm issuance of imminent danger alert * Issuance of imminent danger alert verifies Vehicle System identifies imminent danger of a rear-end crash with a remote vehicle lead vehicle in its lane of travel in a curved roadway geometry, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WFCWT-5 -- FCW Stopped Vehicle in a Curve	FCWP-REQ-6 -- FCW Advisory Alert in a Curve Performance	The Vehicle System shall issue an advisory FCW alert when the Time-to-Collision is below a configurable threshold for advising the driver of potential for collision with a stopped vehicle ahead in the same lane of travel in a curve. Guidance for FCW Time-to Collision, Advisories and Alerts is provided in SyRS Section 6.1.1.	* Perform Test Case WFCWT-5 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped remote vehicle ahead * Confirm issuance of advisory FCW alert * Issuance of advisory FCW alert verifies Vehicle System issues an advisory FCW alert when the Time-to-Collision is below a configurable threshold for advising the driver of potential for collision with a stopped vehicle ahead in the same lane of travel in a curve, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WFCWT-5 -- FCW Stopped Vehicle in a Curve	FCWP-REQ-7 -- FCW Imminent Alert in a Curve Performance	The Vehicle System shall issue an imminent FCW alert when the Time-to-Collision is below a configurable threshold for alerting the driver that there is an imminent threat of forward collision with a stopped vehicle ahead in the same lane of travel in a curve and immediate action is required from the driver to avoid the collision. Guidance for	* Perform Test Case WFCWT-5 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped remote vehicle ahead * Confirm issuance of FCW Imminent danger alert * Issuance of FCW Imminent danger alert verifies Vehicle System issues an imminent FCW alert when the Time-to-Collision is below a configurable threshold for alerting the driver that there is an imminent threat of forward collision with a stopped vehicle ahead in the same lane of travel in a curve and immediate action is required from the driver to	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		FCW Time-to Collision, Advisories and Alerts is provided in SyRS Section 6.1.1.	avoid the collision, thereby verifying the requirement is satisfied.	

2.33 Table WFCWT-6 -LL-Description FCW Passing Stopped Vehicle in a Curve Test Case Description (Lear Remote/Lear Host)

Table 2-33. WFCWT-6 -LL-Description FCW Passing Stopped Vehicle in a Curve Test Case Description (Lear Remote/Lear Host)

Test Case ID	**WFCWT-6-LL**	**Test Engineer Verification and Remarks**
Test Case Name	FCW Passing Stopped Vehicle in a Curve	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WFCWT-6-Requirements	

Objective	• FCW does NOT issue a warning when there are no FCW threats in the host vehicle path in curve.
	• WV2IMCT-2 - V2I & End-to-end Communication of BSMs
	  o Verify End-to-end Communication of BSMs and V2I BSM communication range
	• WV2IMCT-4 - V2I & End-to-end Communication of log files
	  o Verify End-to-end Communication of log files and V2I log files communication range	

Preconditions	• Verify configuration of each system and test component complies with Configuration for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Prepare each system and test component in accordance with Initialization for Forward	

Test Case ID	WFCWT-6-LL	Test Engineer Verification and Remarks
	Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Host Vehicle OBU/ Firmware/ Vehicle	Lear Roadstar Locomate 300 OBU	
Remote Vehicle OBU/ Vehicle	Lear Roadstar Locomate 300 OBU	
Roadway Geometry	Curve	
Remote Vehicle Scenario (Test Case Input 1)	Remote vehicle enters track, approaches and stops in a curve at designated test location.	
Host Vehicle Scenario (Test Case Input 2)	Host vehicle enters track from outside communication range. Host Vehicle passes stopped remote vehicle in adjacent lane.	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	None	
Log File Analysis and Verification Method (Test Case Output 2)	FCW does NOT issue a warning when there are no FCW threats in the host vehicle path in curve.	
Log File Analysis and Verification Method (Test Case Output 3)	• Test engineer analyzes logs to confirm a configurable threshold percentage of BSMs sent are received and logged by host and remote vehicle OBUs, when vehicles are at least 300 meters apart.	
WV2IMCT-2-L Log File Analysis and Verification Method (Test Case Output 2)	• Test engineer analyzes logs to confirm a configurable threshold percentage of BSMs are received and processed by RSU when vehicle is at least 300 meters away.	

Test Case ID	WFCWT-6-LL	Test Engineer Verification and Remarks
WV2IMCT-4-L Log File Analysis and Verification Method (Test Case Output 2)	• Test engineer analyzes logs to confirm a Log files are received by ODE. • Test engineer analyzes logs to confirm a Log files are stored by Data Warehouse.	
Expected Result (Pass/Fail Criteria)	• FCW does NOT issue a warning when there are no FCW threats in the Host vehicle path. • Log files are received by ODE.	
WV2IMCT-2-L Expected Result (Pass/Fail Criteria)	• A configurable threshold percentage of BSMs are received and processed by RSU when vehicle is at least 300 meters away.	
WV2IMCT-4-L Expected Result (Pass/Fail Criteria)	• Log files are received by ODE. • Log files are stored by Data Warehouse.	
Detailed Execution Steps	**Verify Readiness** 1. Host and remote vehicle have Lear LocoMate 300 OBU's installed with antenna and HMI, configured according to the WYDOT CV Pilot OBU configuration. A laptop computer must be connected via an Ethernet cable to the OBU to implement initial log file offload verification. 2. Confirm that the test track Lear LocoMate 300 RSU is installed and configured according to the WYDOT CV Pilot RSU configuration. 3. Identify offload location where vehicles can drive to, to be within the offload range of the test track RSU. 4. Identify specific test track location on a curved road segment for remote vehicle to stop and be stationary and have an adjacent lane for the host vehicle to pass. 5. Identify path that host vehicle will use to approach stationary remote vehicle. The approach path must start at least 300 meters from stationary vehicle location. **Test Start Up** 6. Drive both the host and remote vehicles to the offload location, power up each OBU in the host and remote vehicle.	*Performed and Confirmed by:*

Test Case ID	WFCWT-6-LL	Test Engineer Verification and Remarks
	7. Confirm that each OBU powers up correctly and is linked to its corresponding HMI. Confirm this by driving a short distance and validating that the vehicle speed and location are updated on the HMI to reflect the short drive. 8. While parked at the offload location execute the following steps to confirm log file generation and offload. a. Log into each OBU and from the system shell issue a ping6 command to the backend host server for the WYDOT CV Pilot environment. This will confirm the full IPv6 connectivity from the OBU through the RSU to the WYDOT backend server. The ping command to issue is: i. #ping6 <backend server IPv6 address> b. For each OBU confirm that log files are being generated. Confirm this by reviewing the event log directory on the OBU and checking that various log files are increasing in size. The specific log files to see increasing are: i. /var/eventlog/bsmLogDuringEvent.csv ii. /var/eventlog/rxMsg.csv iii. /var/eventlog/driverAlert.csv c. For each OBU confirm that log files are being offloaded, when vehicle is at the designated offload location. Confirm this by reviewing the offload subdirectories on the OBU and ensuring that they do not continuously accumulate log files. A few log files may accumulate (2-3), but within 30 seconds they should all offload and be removed from the log directory. The specific offload subdirectories to check are: i. /var/storage/bsmLogDuringEvent ii. /var/storage/rxMsg iii. /var/storage/driverAlert Once the log file generation and offload are confirmed the test repetitions can begin.	

Test Case ID	WFCWT-6-LL	Test Engineer Verification and Remarks
	Driving the Test 9. Begin by driving the remote vehicle to the designated stationary position on the test track. 10. Once the remote vehicle is stationary, the host vehicle enters the test track, this entry onto the track must be at least 300 meters driving distance from the stationary remote vehicle. The host vehicle should follow the same path that the remote vehicle did, but in the adjacent lane to the remote vehicle. As it approaches the stationary remote vehicle, the host vehicle should always remain in the lane adjacent to the remote vehicle. 11. Accelerate the host vehicle up to 35 miles per hour driving on the test track in the lane adjacent to the stationary remote vehicle. The host driver should initially focus on achieving and maintaining the test speed of 35 mph. 12. As the host vehicle approaches the stationary remote vehicle the driver maintains the vehicle speed and monitors the approach to the remote vehicle to ensure the host vehicle remains in the adjacent lane and there is no chance of collision with the stationary remote vehicle. 13. During the approach to the remote vehicle, the host vehicle driver monitors the HMI to identify any advisory or warning messages issued to the driver. 14. After safely passing the stationary remote vehicle, the host vehicle driver should come to a complete stop and manually record any types of driver alerts (or lack of alerts) received during the prior approach and passing sequence. 15. The host vehicle then returns to the previously defined start location to repeat the test again. 16. The remote vehicle may remain stationary between multiple repetitions of the test and the host vehicle begins each new repetition at step two of this driving sequence. If the remote vehicle moves after a test repetition completes, then the next repetition of the test driving sequence must start at the first driving test step. 17. After final test repetition, both the remote and host vehicles drive to offload location and confirm that generated log files are offloaded (see test startup third step).	

Test Case ID	WFCWT-6-LL	Test Engineer Verification and Remarks
	Analysis Procedure 18. Execute a set of queries on the connected vehicle database to extract bsm and driver alert log records for the period of time around each FCW test run. These queries are implemented in a script that generates a KML file for display in Google Earth. This allows each bsm and driver alert record from each test vehicle to be plotted in the Google Earth application. The follow example command line runs the query script to generate the KML file for a test executed at the Archer test track that started 08 Jan 2018 02:15:10 pm MST and ended at 02:16:00 pm MST. Note that the time boundaries in the query are in Coordinated Universal Time (UTC). python create_kml.py circle --lat 41.150576 --long -104.654964 --distance 2000 --beginTime '2018-01-08 21:15:10' --endTime '2018-01-08 21:16:00' 19. Open the resulting KML file in Google Earth. The bsm records and driver alert records for each vehicle will be visible along the paths they traveled at the test site location. Bsm records from each vehicle will be in a different color. Driver alert records (if any) will be shown as white triangles at each point in the vehicle trajectory that the driver alert was issued. Adjust the time slider so that appropriate bsm and driver alerts around the FCW test are visible. 20. Confirm that no forward collision alerts were issued to the host vehicle during its approach and passing of the remote vehicle. **Analysis Procedure V2I BSM** 21. Execute a set of queries on the connected vehicle database to extract bsm received by the RSU from the test vehicles These queries are implemented in a script that generates a KML file for display in Google Earth. This allows each bsm received by the RSU from each test vehicle to be plotted in the Google Earth application. The follow example command line runs the query script to generate the KML file for a test executed at the Archer test track that started 08 Jan 2018 02:15:10 pm MST and ended at 02:16:00 pm MST. Note that the time boundaries in the query are in Coordinated Universal Time (UTC).	

Test Case ID	WFCWT-6-LL	Test Engineer Verification and Remarks
	python create_kml_rsu.py circle --lat 41.150576 --long -104.654964 --distance 2000 --beginTime '2018-01-08 21:15:10' --endTime '2018-01-08 21:16:00' 22. Open the resulting KML file in Google Earth. The bsm records received by the RSU for each vehicle will be visible along the paths they traveled at the test site location. Bsm records from each vehicle will be in a different color. Adjust the time slider so that bsm along the test run are visible. 23. Use the google earth ruler to measure the distance from the RSU location to the closest recorded bsm. Confirm this distance is at least 300 meters per test requirements. 24. Identify bsm log files generated during the test repetitions based on time and vehicle log file name. 25. Use the log file names to query the connected vehicle database to extract the bsm records for these log files, confirm that the records contain the BSM part I and II data. **Analysis Procedure V2I Log Files** 26. Identify bsm log files and driver alert log files generated during the test repetitions based on time and vehicle log file name. 27. Check the offload times of those files as they appear on the ODE server. 28. Execute a set of queries on the connected vehicle database to extract bsm and driver alert log records for the period of time around each FCW test run. These queries are implemented in a script that generates a KML file for display in Google Earth. This allows each bsm and driver alert record from each test vehicle to be plotted in the Google Earth application. The follow example command line runs the query script to generate the KML file for a test executed at the Archer test track that started 08 Jan 2018 02:15:10 pm MST and ended at 02:16:00 pm MST. Note that the time boundaries in the query are in Coordinated Universal Time (UTC). python create_kml.py circle --lat 41.150576 --long -104.654964 --distance 2000 --beginTime '2018-01-08 21:15:10' --endTime '2018-01-08 21:16:00'	

Test Case ID	WFCWT-6-LL	Test Engineer Verification and Remarks
	29. Identify a bsm for a vehicle close to the identified offload time of the files from that vehicle. Use the google earth ruler to measure the distance from the RSU location to the closest recorded bsm. Confirm this distance is greater than 150 meters per test requirements.	

2.34 Table WFCWT-6-LL-Results FCW Passing Stopped Vehicle in a Curve Test Case Results (Lear Remote/Lear Host)

Table 2-34. WFCWT-6-LL-Results FCW Passing Stopped Vehicle in a Curve Test Case Results (Lear Remote/Lear Host)

Test Case ID	Rep	WFCWT-6-LL	Test Engineer Verification and Remarks
Test Case Name		FCW Passing Stopped Vehicle in a Curve	*Performed and Confirmed by:*
Test Case Completion Date			*Performed and Confirmed by:*
Test Case Driver Visual and Log File Analysis Results	**Rep 1**		*Performed and Confirmed by:*
WV2IMCT-2 Log Analysis Test Case Results	**Rep 1**		*Performed and Confirmed by:*
WV2IMCT-4-L Log Analysis Test Case Results			*Performed and Confirmed by:*
Test Case Driver Visual and Log File Analysis Results	**Rep 2**		*Performed and Confirmed by:*
WV2IMCT-2 Log Analysis Test Case Results	**Rep 2**		*Performed and Confirmed by:*

Test Case ID	Rep	WFCWT-6-LL	Test Engineer Verification and Remarks
WV2IMCT-4-L Log Analysis Test Case Results	**Rep 2**		*Performed and Confirmed by:*
Test Case Driver Visual and Log File Analysis Results	**Rep 3**		*Performed and Confirmed by:*
WV2IMCT-2 Log Analysis Test Case Repetition 3 Results	**Rep 3**		*Performed and Confirmed by:*
WV2IMCT-4-L Log Analysis Test Case Results	**Rep 3**		*Performed and Confirmed by:*
Test Case Driver Visual and Log File Analysis Results	**Rep 4**		*Performed and Confirmed by:*
WV2IMCT-2 Log Analysis Test Case Repetition 4 Results	**Rep 4**		*Performed and Confirmed by:*
WV2IMCT-4-L Log Analysis Test Case Results	**Rep 4**		*Performed and Confirmed by:*
Test Case Driver Visual and Log File Analysis Results	**Rep 5**		*Performed and Confirmed by:*
WV2IMCT-2 Log Analysis Test Case Repetition 5 Results	**Rep 5**		*Performed and Confirmed by:*
WV2IMCT-4-L Log Analysis Test Case Results	**Rep 5**		*Performed and Confirmed by:*
Test Case Analysis Tables			*Performed and Confirmed by:*
Pass/Fail Assessment			*Performed and Confirmed by:*
WV2IMCT-2-L Pass/Fail Assessment			*Performed and Confirmed by:*

Test Case ID	Rep	WFCWT-6-LL	Test Engineer Verification and Remarks
WV2IMCT-4-L Pass/Fail Assessment			*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.35 Table WFCWT-6-LS-Description FCW Passing Stopped Vehicle in a Curve Test Case Description

Table 2-35. WFCWT-6-LS-Description Passing FCW Passing Stopped Vehicle in a Curve Test Case Description

Test Case ID	WFCWT-6-LS	Test Engineer Verification and Remarks
Test Case Name	FCW Passing Stopped Vehicle in a Curve	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WFCWT-6-Requirements	
Objective	FCW does NOT issue a warning when there are no FCW threats in the host vehicle path in curve.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Prepare each system and test component in accordance with Initialization for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	

Test Case ID	WFCWT-6-LS	Test Engineer Verification and Remarks
Host Vehicle OBU/ Firmware/ Vehicle	Sirius XM OBU	
Remote Vehicle OBU/ Vehicle	Lear Roadstar OBU	
Roadway Geometry	Curve	
Remote Vehicle Scenario (Test Case Input 1)	Remote vehicle enters track, approaches and stops in a curve at designated test location.	
Host Vehicle Scenario (Test Case Input 2)	Host vehicle enters track from outside communication range. Host Vehicle passes stopped remote vehicle in adjacent lane.	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	None	
Log File Analysis and Verification Method (Test Case Output 2)	FCW does NOT issue a warning when there are no FCW threats in the host vehicle path in curve.	
Expected Result (Pass/Fail Criteria)	FCW does NOT issue a warning when there are no FCW threats in the Host vehicle path.	
Detailed Execution Steps	**Verify Readiness** 1. Host and remote vehicle have Lear LocoMate 300 OBU's installed with antenna and HMI, configured according to the WYDOT CV Pilot OBU configuration. A lap top computer must be connected via an Ethernet cable to the OBU to implement initial log file offload verification. 2. Confirm that the test track Lear LocoMate 300 RSU is installed and configured according to the WYDOT CV Pilot RSU configuration. 3. Identify offload location where vehicles can drive to, to be within the offload range of the test track RSU.	*Performed and Confirmed by:*

Test Case ID	WFCWT-6-LS	Test Engineer Verification and Remarks
	4. Identify specific test track location on a curved road segment for remote vehicle to stop and be stationary and have an adjacent lane for the host vehicle to pass. Identify path that host vehicle will use to approach stationary remote vehicle. The approach path must start at least 300 meters from stationary vehicle location. **Test Start Up** 5. Drive both the host and remote vehicles to the offload location, power up each OBU in the host and remote vehicle. 6. Confirm that each OBU powers up correctly and is linked to it's corresponding HMI. Confirm this by driving a short distance and validating that the vehicle speed and location are updated on the HMI to reflect the short drive. 7. While parked at the offload location execute the following steps to confirm log file generation and offload. a. Log into each OBU and from the system shell issue a ping6 command to the backend host server for the WYDOT CV Pilot environment. This will confirm the full IPv6 connectivity from the OBU through the RSU to the WYDOT backend server. The ping command to issue is: i. #ping6 <backend server IPv6 address> b. For each OBU confirm that log file are being generated. Confirm this by reviewing the event log directory on the OBU and checking that various log files are increasing in size. The specific log files to see increasing are: i. /var/eventlog/bsmLogDuringEvent.csv ii. /var/eventlog/rxMsg.csv iii. /var/eventlog/driverAlert.csv c. For each OBU confirm that log files are being offloaded, when vehicle is at the designated offload location. Confirm this by reviewing the offload subdirectories on the OBU and ensuring that they do not continuously accumulate log files. A few log files may accumulate (2-3), but within 30 seconds they should all offload and be removed from the log directory. The specific offload subdirectories to check are:	

Test Case ID	WFCWT-6-LS	Test Engineer Verification and Remarks
	i. /var/storage/bsmLogDuringEvent ii. /var/storage/rxMsg iii. /var/storage/driverAlert Once the log file generation and offload are confirmed the test repetitions can begin. **Driving the Test** 8. Begin by driving the remote vehicle to the designated stationary position on the test track. 9. Once the remote vehicle is stationary, the host vehicle enters the test track, this entry onto the track must be at least 300 meters driving distance from the stationary remote vehicle. The host vehicle should follow the same path that the remote vehicle did, but in the adjacent lane to the remote vehicle. As it approaches the stationary remote vehicle, the host vehicle should always remain in the lane adjacent to the remote vehicle. 10. Accelerate the host vehicle up to 35 miles per hour driving on the test track in the lane adjacent to the stationary remote vehicle. The host driver should initially focus on achieving and maintaining the test speed of 35 mph. 11. As the host vehicle approaches the stationary remote vehicle the driver maintains the vehicle speed and monitors the approach to the remote vehicle to ensure the host vehicle remains in the adjacent lane and there is no chance of collision with the stationary remote vehicle. 12. During the approach to the remote vehicle, the host vehicle driver monitors the HMI to identify any advisory or warning messages issued to the driver. 13. After safely passing the stationary remote vehicle, the host vehicle driver comes to a complete stop and manually records any driver alerts (or lack of alerts) received during the prior approach and passing sequence. 14. The host vehicle then returns to the previously defined start location to repeat the test again. 15. The remote vehicle may remain stationary between multiple repetitions of the test and the host vehicle begins each new repetition at step two of this driving sequence. If the remote vehicle moves after a test repetition completes, then the next repetition of the test driving sequence must start at the first driving step.	

Test Case ID	WFCWT-6-LS	Test Engineer Verification and Remarks
	16. After final test repetition, both the remote and host vehicles drive to offload location and confirm that generated log files are offloaded (see test startup step 3). **Analysis Procedure** 17. Execute a set of queries on the connected vehicle database to extract bsm and driver alert log records for the period of time around each FCW test run. These queries are implemented in a script that generates a KML file for display in Google Earth. This allows each bsm and driver alert record from each test vehicle to be plotted in the Google Earth application. The follow example command line runs the query script to generate the KML file for a test executed at the Archer test track that started 08 Jan 2018 02:15:10 pm MST and ended at 02:16:00 pm MST. Note that the time boundaries in the query are in Coordinated Universal Time (UTC). python create_kml.py circle --lat 41.150576 --long -104.654964 --distance 2000 --beginTime '2018-01-08 21:15:10' --endTime '2018-01-08 21:16:00' 18. Open the resulting KML file in Google Earth. The bsm records and driver alert records for each vehicle will be visible along the paths they traveled at the test site location. Bsm records from each vehicle will be in a different color. Driver alert records (if any) will be shown as white triangles at each point in the vehicle trajectory that the driver alert was issued. Adjust the time slider so that appropriate bsm and driver alerts around the FCW test are visible. 19. Confirm that no forward collision alerts were issued to the host vehicle during its approach and passing of the remote vehicle.	

2.36 Table WFCWT-6-LS-Results FCW Passing Stopped Vehicle in a Curve Test Case Results

Table 2-36. WFCWT-6-LS-Results FCW Passing Stopped Vehicle in a Curve Test Case Results

Test Case ID	**WFCWT-6-LS**	**Test Engineer Verification and Remarks**
Test Case Name	FCW Passing Stopped Vehicle in a Curve	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.37 Table WFCWT-6-Requirements FCW Passing Stopped Vehicle in a Curve Requirements Verification Analysis

Table 2-37/ WFCWT-6-Requirements FCW Passing Stopped Vehicle in a Curve Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WFCWT-6 -- FCW Passing Stopped Vehicle in a Curve	FCWP-REQ-8 -- Passing a Stopped Vehicle in a Curve Performance	The Vehicle System shall not issue an FCW advisory or alert when passing a stopped vehicle in an adjacent lane in a curve.	* Perform Test Case WFCWT-6 * Inspect Host Vehicle OBU Event Logs, determine location, speed, and heading path of Host Vehicle. * Inspect Remote Vehicle OBU Event Logs, determine location, speed, and heading path of Remote Vehicle. * Verify vehicles are not in the same travel lane. * Inspect Host Vehicle OBU Event Logs and verify that alert was not issued. * Inspect Host Vehicle HMI Logs and verify that alert was not issued. * Absence of alert verifies the Vehicle System does not issue an FCW advisory or alert when passing a stopped vehicle in an adjacent lane in a curve.	Requirement Verification Confirmed by:
WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-6)	SCMS-REQ-2.1 -- SCMS Vehicle System Certificates	The Vehicle System shall download certificates from the USDOT SCMS.	* Conduct Test WV2IMCT-2(WFCWT-6) * Inspect Vehicle System SCMS logs * Confirm Vehicle System downloads certificates from the USDOT SCMS, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-6)	WCVS-REQ-1.1 -- Collect BSM Data	The Wyoming CV System shall collect Basic Safety Message Parts I and II (as defined in J2945/1) from the Vehicle System consistent with Section 6.3.8 (BSM Scheduling and Congestion Control) of J2945/1	* Perform Test Case WV2IMCT-2(WFCWT-6) * Inspect OBU Logs and identify 1 or more instances of BSMs sent to RSUs * Inspect RSU logs and identify corresponding 1 or more instances of BSMs received * Inspect ODE Logs and identify corresponding 1 or more instances of BSMs received * Inspect Pikalert logs and identify corresponding 1 or more instances BSMs received Confirmation shows Wyoming CV System collects Basic Safety Message Parts I and II (as defined in J2945/1) from the Vehicle System consistent with	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			Section 6.3.8 (BSM Scheduling and Congestion Control) of J2945/1, thereby verifying the requirement is satisfied. (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	
WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-6)	WCVS-REQ-11.1 -- Store BSM	The Wyoming CV System shall store processed BSM Parts I and II data received from the Vehicle System. As the BSM will be previously validated, only core data elements will be stored (defined in sections 6.8, 6.147, 6.128, and 6.133 of J2735).	* Perform Test Case WV2IMCT-2(WFCWT-6) * Inspect ODE logs and confirm receipt of BSM Part 1 and 2 from OBU. * Inspect DW logs and confirm receipt of BSM Part 1 and 2 from OBU for storage. * Receipt of BSM by DW confirms the Wyoming CV System stores processed BSM Parts I and II data received from the Vehicle System, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-6)	VS-REQ-4.1 -- Collect Vehicle Status Data	The Vehicle System shall have the capability to collect vehicle status information from the host vehicle, as stated in Section 5.4.2 of the ICD.	* Perform Test Case WV2IMCT-2(WFCWT-6) * Inspect OBU Logs and identify 1 or more instances of BSMs sent to RSUs * Inspect BSMs and identify CAN data elements, identified as "yes/CAN" in WYDOT ICD Table 7 1: BSM Message Fields * Confirmation shows the Vehicle System has the capability to collect vehicle status information from the host vehicle, as stated in Section 542 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-1-IT)	VS-REQ-4.2.1 -- Vehicle Dimension Data	The Vehicle System shall have the capability to collect vehicle dimension from the host vehicle driver through the Human Machine Interface.	* Perform Test Case WV2IMCT-2(WFCWT-1) * Inspect OBU Logs and identify 1 or more instances of BSMs sent to RSUs * Inspect BSMs and identify vehicle dimension data elements, identified in WYDOT ICD Table 7 1: BSM Message Fields * Confirmation shows the Vehicle System has the capability to collect vehicle dimension from the host vehicle driver through the Human Machine Interface, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WV2IMCT-4 -- V2I & End-to-end communication of log files (Integrated with WFCWT-6)	VS-REQ-36.2 -- TVI Data Management-Log	The Vehicle System shall transmit log files via secure copy (SCP) to the Wyoming CV System over DSRC that contain event logs data defined in VS-REQ-41.	* Perform Test Case WV2IMCT-4(WFCWT-1) * Confirm secure copy to the Wyoming CV System of Event Logs. * Confirmation shows the Vehicle System transmits log files via secure copy (SCP) to the Wyoming CV System over DSRC that contain event logs data, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

2.38 Table WFCWT-7 -LL-Description FCW Stopped and Obstructed Remote Vehicle Ahead Test Case Description (Lear Remote/Lear Host)

Table 2-38. WFCWT-7 -LL-Description FCW Stopped and Obstructed Remote Vehicle Ahead Test Case Description (Lear Remote/Lear Host)

Test Case ID	WFCWT-7-LL	Test Engineer Verification and Remarks
Test Case Name	FCW Stopped and Obstructed Remote Vehicle Ahead	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WFCWT-7-Requirements	
Objective	• FCW application issues a warning, in time for driver to avoid forward collision, when following an obstructing vehicle that changes lanes to reveal a stopped vehicle ahead in the same lane of travel. • WV2VMCT-1 V2V exchange of BSMs - Verify V2V BSM Communication Range and Antenna Performance.	

Test Case ID	WFCWT-7-LL	Test Engineer Verification and Remarks
Preconditions		
Host Vehicle OBU/ Firmware/ Vehicle	Lear Roadstar OBU	
Remote Vehicle OBU/ Vehicle	Lear Roadstar OBU	
Roadway Geometry	Straight	
Remote Vehicle Scenario (Test Case Input 1)	Remote vehicle enters track, approaches and stops at designated test location.	
Obstructing Vehicle	Obstructing vehicle without active OBU enters track from outside communication range. Obstructing Vehicle approaches stopped remote at 35 mph. When nearing the stopped remote vehicle, the Obstructing vehicle veers to clear adjacent lane and proceeds past stopped vehicle.	
Host Vehicle Scenario (Test Case Input 2)	Host vehicle enters track from outside communication range and follows Obstructing vehicle at 35 mph. After Obstructing vehicle veers out of the lane, Host vehicle continues until receiving FCW warning when driver stops or veers to clear adjacent lane and proceeds past stopped vehicle.	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	FCW Imminent Alert (Level 2)	
Log File Analysis and Verification Method (Test Case Output 2)	*Time-to-collision when FCW Imminent Alert is issued.	
Expected Result (Pass/Fail Criteria)	FCW issues a warning in time for driver to take action to avoid collision, when obstructing vehicle veers out of lane and there is a stopped vehicle ahead in the same lane of travel.	

Test Case ID	WFCWT-7-LL	Test Engineer Verification and Remarks
WV2VMCT-1-LL Expected Result (Pass/Fail Criteria)	A configurable threshold percentage of BSMs sent are received and logged by host and remote vehicle OBUs, when vehicles are at least 300 meters apart.	
Detailed Execution Steps	*Dry runs of test procedure and test cases are to be conducted and detailed execution steps for each system component are to be prepared to support consistent implementation by test staff.*	*Performed and Confirmed by:*

2.39 Table WFCWT-7 -LL-Results FCW Stopped and Obstructed Remote Vehicle Ahead Test Case Results (Lear Remote/Lear Host)

Table 2-39. WFCWT-7 -LL-Results FCW Stopped and Obstructed Remote Vehicle Ahead Test Case Results (Lear Remote/Lear Host)

Test Case ID	Rep	WFCWT-7-LL	Test Engineer Verification and Remarks
Test Case Name		FCW Stopped and Obstructed Remote Vehicle Ahead	*Performed and Confirmed by:*
Test Case Completion Date			*Performed and Confirmed by:*
Test Case Repetition 1 Results	Rep 1		*Performed and Confirmed by:*
WV2VMCT-1-L Log Analysis Test Case Results	Rep 1		*Performed and Confirmed by:*
Test Case Repetition 2 Results	Rep2		*Performed and Confirmed by:*
WV2VMCT-1-L Log Analysis Test Case Results	Rep 2		*Performed and Confirmed by:*
Test Case Repetition 3 Results	Rep 3		*Performed and Confirmed by:*

Test Case ID	Rep	WFCWT-7-LL	Test Engineer Verification and Remarks
WV2VMCT-1-L Log Analysis Test Case Results	**Rep 3**		
Test Case Repetition 4 Results	**Rep 4**		*Performed and Confirmed by:*
WV2VMCT-1-L Log Analysis Test Case Results	**Rep 4**		
Test Case Repetition 5 Results	**Rep 5**		*Performed and Confirmed by:*
WV2VMCT-1-L Log Analysis Test Case Results	**Rep 5**		
Test Case Analysis Tables			*Performed and Confirmed by:*
Pass/Fail Assessment			*Performed and Confirmed by:*
WV2VMCT-1-L Pass/Fail Assessment			

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.40 Table WFCWT-7-LS-Description FCW Stopped and Obstructed Remote Vehicle Ahead Test Case Description

Table 2-40. WFCWT-7-LS-Description FCW Stopped and Obstructed Remote Vehicle Ahead Test Case Description

Test Case ID	**WFCWT-7-LS**	**Test Engineer Verification and Remarks**
Test Case Name	FCW Stopped and Obstructed Remote Vehicle Ahead	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WFCWT-7-Requirements	
Objective	FCW application issues a warning, in time for driver to avoid forward collision, when following an obstructing vehicle that changes lanes to reveal a stopped vehicle ahead in the same lane of travel.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Prepare each system and test component in accordance with Initialization for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Host Vehicle OBU/ Firmware/ Vehicle	SiriusXM OBU	
Remote Vehicle OBU/ Vehicle	Lear Roadstar OBU	
Roadway Geometry	Straight	

Test Case ID	WFCWT-7-LS	Test Engineer Verification and Remarks
Remote Vehicle Scenario (Test Case Input 1)	Remote vehicle enters track, approaches and stops at designated test location.	
Obstructing Vehicle	Obstructing vehicle without active OBU enters track from outside communication range. Obstructing Vehicle approaches stopped remote at 35 mph. When nearing the stopped remote vehicle, the Obstructing vehicle veers to clear adjacent lane and proceeds past stopped vehicle.	
Host Vehicle Scenario (Test Case Input 2)	Host vehicle enters track from outside communication range and follows Obstructing vehicle at 35 mph. After Obstructing vehicle veers out of the lane, Host vehicle continues until receiving FCW warning when driver stops or veers to clear adjacent lane and proceeds past stopped vehicle.	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	FCW Imminent Alert (Level 2)	
Log File Analysis and Verification Method (Test Case Output 2)	*Time-to-collision when FCW Imminent Alert is issued.	
Expected Result (Pass/Fail Criteria)	FCW issues a warning in time for driver to take action to avoid collision, when obstructing vehicle veers out of lane and there is a stopped vehicle ahead in the same lane of travel.	
Detailed Execution Steps	*Dry runs of test procedure and test cases are to be conducted and detailed execution steps for each system component are to be prepared to support consistent implementation by test staff.*	*Performed and Confirmed by:*

2.41 Table WFCWT-7-LS-Results FCW Stopped and Obstructed Remote Vehicle Ahead Test Case Results

Table 2-41. WFCWT-7-LS-Results FCW Stopped and Obstructed Remote Vehicle Ahead Test Case Results

Test Case ID	**WFCWT-7-LS**	**Test Engineer Verification and Remarks**
Test Case Name	FCW Stopped and Obstructed Remote Vehicle Ahead	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.42 Table WFCWT-7-Requirements FCW Stopped and Obstructed Remote Vehicle Ahead Requirements Verification Analysis

Table 2-42. WFCWT-7-Requirements FCW Stopped and Obstructed Remote Vehicle Ahead Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WFCWT-7 -- FCW Stopped and Obstructed Remote Vehicle Ahead	VS-REQ-8 -- FCW Stopped and Obstructed Vehicles	The Vehicle System shall ingest BSM Parts I and II data received from remote vehicles to identify stopped and obstructed remote vehicles directly ahead in the same lane and direction of travel (defined in J2945/1 section 4.2.4.2 (d)). Data ingest is defined as obtaining and importing data for use or storage	* Perform Test Case WFCWT-7 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped and obstructed remote vehicle ahead * Confirm issuance of advisory alert * Issuance of advisory alert confirms Vehicle System ingests BSM data received from remote vehicles to identify stopped and obstructed remote vehicles directly ahead in the same lane and direction of travel, thereby verifying requirement. (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	Requirement Verification Confirmed by:
WV2VMCT-1 -- V2V exchange of BSMs (Integrated with WFCWT-7)	VS-REQ-1 -- Receive BSM	The Vehicle System shall receive Basic Safety Message (as defined in SAE J2945/1) over DSRC from other connected vehicles consistent with Section 6.3.8 of SAE J2945/1 (BSM Scheduling and Congestion Control).	* Perform Test Case WFCWT-1 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped remote vehicle ahead * Confirm issuance of imminent danger alert * Issuance of imminent danger alert verifies Vehicle System receives Basic Safety Message (as defined in SAE J2945/1) over DSRC from other connected vehicles consistent with Section 6.3.8 of SAE J2945/1 (BSM Scheduling and Congestion Control), thereby verifying requirement. (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			developers verifies consistent implementation of standards formats and specifications.)	
WV2VMCT-1 -- V2V exchange of BSMs (Integrated with WFCWT-7)	VS-REQ-33 -- BCVI Messages	The Vehicle System shall wirelessly broadcast over DSRC a basic safety message (BSM) to other connected devices.	* Perform Test Case WV2VMCT-1(WFCWT-1) * Inspect Host Vehicle OBU Logs and identify 1 or more instances of BSMs sent from Host Vehicle to Remote Vehicle * Inspect Remote Vehicle OBU logs and identify corresponding receipt of BSMs * Confirmation shows the Vehicle System wirelessly broadcasts over DSRC a basic safety message (BSM) to other connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-1-IT)	VS-REQ-4.2.2 -- Vehicle Trailer Data	The Vehicle System shall have the capability to collect information from the host vehicle driver regarding the dimensions of attached trailers, including capability to indicate that no trailer is present, through the Human Machine Interface.	* Perform Test Case WV2IMCT-2(WFCWT-1) * Inspect OBU Logs and identify 1 or more instances of BSMs sent to RSUs * Inspect BSMs and identify vehicle trailer data elements, identified in WYDOT ICD Table 7 1: BSM Message Fields * Confirmation shows the Vehicle System has the capability to collect information from the host vehicle driver regarding the dimensions of attached trailers, including capability to indicate that no trailer is present, through the Human Machine Interface, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-7)	RSU-REQ-11 -- Distribute to ODE	The Roadside Units shall share all collected information with the Operational Data Environment, as described in Section 5.18.1 of the ICD.	* Perform Test Case WV2IMCT-2(WFCWT-1) * Inspect RSU logs and identify 1 or more instances of BSMs received from Vehicles * Inspect ODE logs and identify receipt of corresponding BSMs. * Confirmation shows the Roadside Units share all collected information with the Operational Data Environment, as described in Section 5.18.1 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-2 -- V2I & End-to-end Communication of	ODE-REQ-3.4.1 -- Distribute to Data Warehouse-BSM	The Operational Data Environment shall distribute all collected and processed BSM	* Perform test case WV2IMCT-2(WFCWT-1) * Inspect DW logs * Confirm receipt of BSMs	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
BSMs (Integrated with WFCWT-1)		information to the Data Warehouse, as described in Section 5.20 of the ICD.	* Confirmation shows the Operational Data Environment distributes all collected and processed BSM information to the Data Warehouse, as described in Section 5.20 of the ICD, thereby verifying the requirement is satisfied. * Confirmation shows the Operational Data Environment distribute all collected and processed BSM information to the Data Warehouse, as described in Section 520 of the ICD , thereby verifying the requirement is satisfied.	
WV2IMCT-2 -- V2I & End-to-end Communication of BSMs (Integrated with WFCWT-1)	MV-REQ-3 -- Static Identifier	WYDOT Maintenance Vehicles' DSRC communications shall have a static identifier.	* Perform Test Case WV2IMCT-2(WFCWT-1) * Inspect OBU Logs and identify 1 or more instances of BSMs sent to RSUs * Inspect BSMs and identify static identifier * Confirmation shows the WYDOT Fleet vehicles' DSRC communications have a static identifier, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

2.43 Table WFCWT-8 -LL-Description FCW Slow Moving Vehicle Ahead Test Case Description (Lear Remote/Lear Host)

Table 2-43. WFCWT-8 -LL-Description FCW Slow Moving Vehicle Ahead Test Case Description (Lear Remote/Lear Host)

Test Case ID	WFCWT-8-LL	Test Engineer Verification and Remarks
Test Case Name	FCW Slow Moving Vehicle	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WFCWT-8-Requirements	
Objective	FCW application issues a warning when approaching a slow moving remote vehicle in time for driver to avoid forward collision.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Prepare each system and test component in accordance with Initialization for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Host Vehicle OBU/ Firmware/ Vehicle	Lear Roadstar OBU	
Remote Vehicle OBU/ Vehicle	Lear Roadstar OBU	
Roadway Geometry	Straight	
Remote Vehicle Scenario (Test Case Input 1)	Enters track from outside communication range and circles track at 15 mph.	

Test Case ID	WFCWT-8-LL	Test Engineer Verification and Remarks
Host Vehicle Scenario (Test Case Input 2)	Host vehicle enters track from outside communication range. Host Vehicle approaches slow moving remote vehicle at 35 mph. After receiving FCW warning, host vehicle driver either stops or veers to adjacent lane and proceeds past slow moving vehicle.	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	FCW Advisory (Level 1) FCW Imminent Alert (Level 2)	
Log File Analysis and Verification Method (Test Case Output 2)	*Time-to-collision when FCW Advisory is issued *Time-to-collision when FCW Imminent Alert is issued.	
Expected Result (Pass/Fail Criteria)	FCW issues a warning when there is a slow-moving vehicle in the same lane of travel in a curve in time for driver to take action to avoid collision.	
Detailed Execution Steps	**Verify Readiness** 1. Host and remote vehicle have Lear LocoMate 300 OBU's installed with antenna and HMI, configured according to the WYDOT CV Pilot OBU configuration. A lap top computer must be connected via an Ethernet cable to the OBU to implement initial log file offload verification. 2. Confirm that the test track Lear LocoMate 300 RSU is installed and configured according to the WYDOT CV Pilot RSU configuration. 3. Identify offload location where vehicles can drive to, to be within the offload range of the test track RSU. 4. Identify specific test track segment for remote vehicle to travel at a reduced speed and have a minimum of 600 meters trailing distance for the host vehicle to approach and catch up to the remote vehicle. **Test Start Up** 5. Drive both the host and remote vehicles to the offload location, power up each OBU in the host and remote vehicle. 6. Confirm that each OBU powers up correctly and is linked to it's corresponding HMI. Confirm this by driving a short distance and validating that the vehicle speed and location are updated on the HMI to reflect the short drive.	*Performed and Confirmed by:*

Test Case ID	WFCWT-8-LL	Test Engineer Verification and Remarks
	7. While parked at the offload location execute the following steps to confirm log file generation and offload. a. Log into each OBU and from the system shell issue a ping6 command to the backend host server for the WYDOT CV Pilot environment. This will confirm the full IPv6 connectivity from the OBU through the RSU to the WYDOT backend server. The ping command to issue is: i. #ping6 <backend server IPv6 address> b. For each OBU confirm that log files are being generated. Confirm this by reviewing the event log directory on the OBU and checking that various log files are increasing in size. The specific log files to see increasing are: i. /var/eventlog/bsmLogDuringEvent.csv ii. /var/eventlog/rxMsg.csv iii. /var/eventlog/driverAlert.csv c. For each OBU confirm that log files are being offloaded, when vehicle is at the designated offload location. Confirm this by reviewing the offload subdirectories on the OBU and ensuring that they do not continuously accumulate log files. A few log files may accumulate (2-3), but within 30 seconds they should all offload and be removed from the log directory. The specific offload subdirectories to check are: i. /var/storage/bsmLogDuringEvent ii. /var/storage/rxMsg iii. /var/storage/driverAlert Once the log file generation and offload are confirmed the test repetitions can begin. **Driving the Test** 8. Begin by driving both the host and remote vehicle to the beginning of the designated test track segment on which the test will be executed. 9. First the remote vehicle starts driving down the test segment. The remote vehicle drives at least 300 meters down the test track segment and then slows to the intercept speed of 15 mph. The remote vehicle then maintains the 15 mph speed until the test sequence completes.	

Test Case ID	WFCWT-8-LL	Test Engineer Verification and Remarks
	10. Once the remote vehicle is more than 300 meters down the test track segment and has slowed to the intercept speed, then the host vehicle starts down the test track segment in pursuit of the remote vehicle. The host vehicle follows the same path that the remote vehicle did when driving down the test segment. 11. Accelerate the host vehicle up to 35 miles per hour driving on the test track segment in pursuit of the slow moving remote vehicle. The host driver should initially focus on achieving and maintaining the test speed of 35 mph. 12. As the host vehicle approaches the slow moving remote vehicle the host vehicle driver maintains the vehicle speed and monitors the approach to the remote vehicle to ensure the host vehicle slows to match speed or avoids the remote vehicle before any collision. 13. During the approach to the remote vehicle, the host vehicle driver identifies any forward collision advisory and/or imminent forward collision warnings issued to the driver. 14. Once the host vehicle has caught up to the remote vehicle and has slowed to match speed with the remote vehicle, this signals the end of this test sequence. The host vehicle driver should come to a complete stop and record the types of driver alerts received during the prior approach sequence. 15. Both the host vehicle and remote vehicle return to the previously defined starting position to repeat the test again. Multiple sequential test track segments may be defined on the test track so at the end of one test sequence both vehicles are positioned at the beginning of the next test track segment. This allows the next test repetition to start immediately after the first completes. 16. After final test repetition, both the remote and host vehicles drive to offload location and confirm that generated log files are offloaded (see test startup third step). **Analysis Procedure** 17. Execute a set of queries on the DW to extract bsm and driver alert log records for the period of time around each FCW test run. These queries are implemented in a script that generates a KML file for display in Google Earth. This allows each bsm and driver alert record from each test vehicle to be plotted in the Google Earth	

Test Case ID	WFCWT-8-LL	Test Engineer Verification and Remarks
	application. The follow example command line runs the query script to generate the KML file for a test executed at the Archer test track that started 07 Dec 2017 03:15:10 pm MST and ended at 03:16:00 pm MST. python create_kml.py circle --lat 41.150576 --long -104.654964 --distance 1000 --beginTime '2017-12-07 22:15:10' --endTime '2017-12-07 22:16:00' 18. Open the resulting KML file in Google Earth. The bsm records and driver alert records for each vehicle will be visible along the paths they traveled at the test site location. Bsm records from each vehicle will be in a different color. Driver alert records will be shown as white arrows at each point in the vehicle trajectory that the driver alert was issued. Adjust the time slider so that appropriate bsm and driver alerts around the FCW test are visible. 19. Identify the first driver alert along the host vehicle path. This indicates the first FCW advisory issued to the host driver. Record the host vehicle speed (mph) and time associated with this first FCW driver alert. 20. Use the first driver alert time and find a bsm record from the remote vehicle that most closely matches the alert time. A remote vehicle bsm record within 0.05 seconds is close enough. Record the remote vehicle speed in mph associated with this bsm record. 21. Using the Google Earth ruler tool, measure the distance in meters from the first advisory FCW alert to the location of the time matched remote vehicle bsm. This distance is how far apart the host vehicle and remote vehicle were at the time the host vehicle received the FCW alert. 22. Calculate the time to collision (ttc) at the point where the advisory FCW is issued. The constant 0.44704 converts speed from mph to m/s. Time to collision (sec) ttc = distance /((host speed – remote speed) * 0.44704) 23. Confirm that this ttc is close to the configured collision advisory time.	

2.44 Table WFCWT-8 -LL-Results FCW Slow Moving Vehicle Ahead Test Case Results (Lear Remote/Lear Host)

Table 2-44. WFCWT-8 -LL-Results FCW Slow Moving Vehicle Ahead Test Case Results (Lear Remote/Lear Host)

Test Case ID	Rep	WFCWT-8-LL	Test Engineer Verification and Remarks
Test Case Name		FCW Slow Moving Vehicle Ahead	*Performed and Confirmed by:*
Test Case Completion Date			*Performed and Confirmed by:*
Test Case Driver Visual and Log File Analysis Results	Rep 1		*Performed and Confirmed by:*
Test Case Driver Visual and Log File Analysis Results	Rep 2		*Performed and Confirmed by:*
Test Case Driver Visual and Log File Analysis Results	Rep 3		*Performed and Confirmed by:*
Test Case Driver Visual and Log File Analysis Results	Rep 4		*Performed and Confirmed by:*
Test Case Driver Visual and Log File Analysis Results	Rep 5		*Performed and Confirmed by:*
Test Case Analysis Tables			*Performed and Confirmed by:*

Test Case ID	Rep	WFCWT-8-LL	Test Engineer Verification and Remarks
Pass/Fail Assessment			*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.45 Table WFCWT-8-LS-Description FCW Slow Moving Vehicle Ahead Test Case Description

Table 2-45. WFCWT-8-LS-Description FCW Slow Moving Vehicle Ahead Description

Test Case ID	WFCWT-8-LS	Test Engineer Verification and Remarks
Test Case Name	FCW Slow Moving Vehicle Ahead	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WFCWT-8-Requirements	
Objective	FCW application issues a warning when approaching a slow moving remote vehicle in time for driver to avoid forward collision.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Prepare each system and test component in accordance with Initialization for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	

Test Case ID	**WFCWT-8-LS**	**Test Engineer Verification and Remarks**
Host Vehicle OBU/ Firmware/ Vehicle	SiriusXM OBU	
Remote Vehicle OBU/ Vehicle	Lear Roadstar OBU	
Roadway Geometry	Straight	
Remote Vehicle Scenario (Test Case Input 1)	Enters track from outside communication range and circles track at 15 mph.	
Host Vehicle Scenario (Test Case Input 2)	Host vehicle enters track from outside communication range. Host Vehicle approaches slow moving remote vehicle at 35 mph. After receiving FCW warning, driver stops or veers to clear adjacent lane and proceeds past stopped vehicle.	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	FCW Advisory (Level 1) FCW Imminent Alert (Level 2)	
Log File Analysis and Verification Method (Test Case Output 2)	*Time-to-collision when FCW Advisory is issued *Time-to-collision when FCW Imminent Alert is issued.	
Expected Result (Pass/Fail Criteria)	FCW issues a warning when there is a slow-moving vehicle in the same lane of travel in a curve in time for driver to take action to avoid collision.	
Detailed Execution Steps	*Dry runs of test procedure and test cases are to be conducted and detailed execution steps for each system component are to be prepared to support consistent implementation by test staff.*	*Performed and Confirmed by:*

2.46 Table WFCWT-8-LS-Results FCW Slow Moving Vehicle Ahead Test Case Results

Table 2-46. WFCWT-8-LS-Results FCW Slow Moving Vehicle Ahead Test Case Results

Test Case ID	**WFCWT-8-LS**	**Test Engineer Verification and Remarks**
Test Case Name	FCW Slow Moving Vehicle Ahead	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.47 Table WFCWT-8-Requirements FCW Slow Moving Vehicle Ahead Requirements Verification Analysis

Table 2-47. WFCWT-8-Requirements FCW Slow Moving Vehicle Ahead Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WFCWT-8 -- FCW Slow Moving Vehicle	FCWP-REQ-9 -- Slow Moving Vehicle Advisory Alert in a Curve Performance	The Vehicle System shall issue an advisory FCW alert when the Time-to-Collision is below a configurable threshold for advising the driver of potential for collision with a moving vehicle ahead in the same lane of travel in a curve. Guidance for FCW Time-to Collision, Advisories and Alerts is provided in SyRS Section 6.1.1.	* Perform Test Case WFCWT-8 * Inspect Host Vehicle OBU Logs * Confirm detection of slow moving remote vehicle ahead * Confirm issuance of advisory FCW alert * Issuance of advisory FCW alert verifies Vehicle System issues an advisory FCW alert when the Time-to-Collision is below a configurable threshold for advising the driver of potential for collision with a moving vehicle ahead in the same lane of travel in a curve, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WFCWT-8 -- FCW Slow Moving Vehicle	FCWP-REQ-10 -- Slow Moving Vehicle Imminent Alert in a Curve Performance	The Vehicle System shall issue an imminent FCW alert when the Time-to-Collision is below a configurable threshold for alerting the driver that there is an imminent threat of forward collision with a moving vehicle ahead in the same lane of travel in a curve and immediate action is required from the driver to avoid the collision. Guidance for FCW Time-to Collision, Advisories and Alerts is provided in SyRS Section 6.1.1.	* Perform Test Case WFCWT-8 * Inspect Host Vehicle OBU Logs * Confirm detection of slow moving remote vehicle ahead * Confirm issuance of FCW Imminent danger alert * Issuance of FCW Imminent danger alert verifies Vehicle System issues an imminent FCW alert when the Time-to-Collision is below a configurable threshold for alerting the driver that there is an imminent threat of forward collision with a moving vehicle ahead in the same lane of travel in a curve and immediate action is required from the driver to avoid the collision, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

2.48 Table WFCWT-9-LL-Description Simultaneous Message Prioritization Test Case Description (Lear Remote/Lear Host)

Table 2-48. WFCWT-9-LL-Description Simultaneous Message Prioritization Test Case Description (Lear Remote/Lear Host)

Test Case ID	WFCWT-9-LL	Test Engineer Verification and Remarks
Test Case Name	Simultaneous Message Prioritization	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WFCWT-9-Requirements	
Objective	Verify prioritization of simultaneous FCW, Distress Notification, and I2V SA messages.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Prepare each system and test component in accordance with Initialization for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Backoffice Component	Representative TIM Source	
Host Vehicle OBU/ Firmware/ Vehicle	Lear Roadstar OBU	
Remote Vehicle OBU/ Vehicle	Lear Roadstar OBU	
Roadway Geometry	Straight	

Test Case ID	WFCWT-9-LL	Test Engineer Verification and Remarks
Back Office to RSU to Host Vehicle Message	Representative TIM	
Remote Vehicle to Host Vehicle Message 1	DNM	
Remote Vehicle to Host Vehicle Message 2	BSM	
Back Office Scenario (TC Input 1)	Back Office System Operator issues inputs to trigger DB to issue TIM (TC Input 1).	
Remote Vehicle Scenario (Input 2)	Enters track from outside communication range stops in travel lane in the middle of geofence and issues Manual Distress Notification, along with broadcasting BSMs.	
Host Vehicle Scenario (Input 3)	Host vehicle passes RSU and downloads I2V SA TIM and enters I2V SA TIM geofence. Host vehicle then approaches distressed vehicle, downloads DNM. Finally Host vehicle continues approaching stopped distressed remote vehicle at 35 mph. (all while still in I2V SA and DNM geofence)	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Representative TIM, followed by Distressed Vehicle notification, followed by FCW Advisory Alert, Followed by FCW Imminent Alert.	*Performed and Confirmed by:*
Log File Analysis and Verification Method (Test Case Output 2)	*Time and distance from beginning of geofence when I2V SA message is displayed *Time and distance from remote vehicle when Distress notification is delivered *Time-to-collision when FCW Advisory is issued *Time-to-collision when FCW Imminent Alert is issued.	
Expected Result (Pass/Fail Criteria)	I2V SA Message displays within 8 meters of beginning of specified geofence. DNM message displays at specified distance from distressed vehicle, prioritized over I2V SA message. As host vehicle approaches remote vehicle, FCW advisory alert is issued,	

Test Case ID	WFCWT-9-LL	Test Engineer Verification and Remarks
	followed by FCW imminent alert, prioritized over I2V SA and DNM, in time for driver to avoid collision.	
Detailed Execution Steps	*Dry runs of test procedure and test cases are to be conducted and detailed execution steps for each system component are to be prepared to support consistent implementation by test staff.*	

2.49 Table WFCWT-9-LL-Results Simultaneous Message Prioritization Test Case Results (Lear Remote/Lear Host)

Table 2-49. WFCWT-9-LL-Results Simultaneous Message Prioritization Test Case Results (Lear Remote/Lear Host)

Test Case ID	WFCWT-9-LL	Test Engineer Verification and Remarks
Test Case Name	Simultaneous Message Prioritization	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*

Test Case ID	WFCWT-9-LL	Test Engineer Verification and Remarks
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.50 Table WFCWT-9-LS-Description Simultaneous Message Prioritization Test Case Description

Table 2-50. WFCWT-9-LS-Description Simultaneous Message Prioritization Test Case Description

Test Case ID	WFCWT-9-LS	Test Engineer Verification and Remarks
Test Case Name	Simultaneous Message Prioritization	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WFCWT-9-Requirements	
Objective	Verify prioritization of simultaneous FCW, Distress Notification, and I2V SA messages.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Prepare each system and test component in accordance with Initialization for Forward Collision Warning Test Procedure and Test Cases described in Table WFCWT-CI. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	

Test Case ID	WFCWT-9-LS	Test Engineer Verification and Remarks
Backoffice Component	Representative TIM Source	
Host Vehicle OBU/ Firmware/ Vehicle	SiriusXM OBU	
Remote Vehicle OBU/ Vehicle	Lear Roadstar OBU	
Roadway Geometry	Straight	
Back Office to RSU to Host Vehicle Message	Representative TIM	
Remote Vehicle to Host Vehicle Message 1	NA. (*Note: SiriusXM does not support Distress Notification)*	
Remote Vehicle to Host Vehicle Message 2	BSM	
Back Office Scenario (TC Input 1)	Back Office System Operator issues inputs to trigger DB to issue TIM (TC Input 1).	
Remote Vehicle Scenario (Input 2)	Enters track from outside communication range stops in travel lane in the middle of geofence and issues Manual Distress Notification, along with broadcasting BSMs.	
Host Vehicle Scenario (Input 3)	Host vehicle passes RSU and downloads I2V SA TIM and enters I2V SA TIM geofence. Finally Host vehicle continues approaching stopped distressed remote vehicle at 35 mph. (all while still in I2V SA and DNM geofence)	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Representative TIM, followed by FCW Advisory Alert, Followed by FCW Imminent Alert. (*Note: SiriusXM does not support Distress Notification)*	*Performed and Confirmed by:*
Log File Analysis and Verification	*Time and distance from beginning of geofence when I2V SA message is displayed	

Test Case ID	WFCWT-9-LS	Test Engineer Verification and Remarks
Method (Test Case Output 2)	*Time-to-collision when FCW Advisory is issued *Time-to-collision when FCW Imminent Alert is issued. *(Note: SiriusXM does not support Distress Notification)*	
Expected Result (Pass/Fail Criteria)	I2V SA Message displays within 8 meters of beginning of specified geofence. As host vehicle approaches remote vehicle, FCW advisory alert is issued, followed by FCW imminent alert, prioritized over I2V SA and DNM, in time for driver to avoid collision.	
Detailed Execution Steps	*Dry runs of test procedure and test cases are to be conducted and detailed execution steps for each system component are to be prepared to support consistent implementation by test staff.*	

2.51 Table WFCWT-9-LS-Results Simultaneous Message Prioritization Test Case Results

Table 2-51. WFCWT-9-LS-Results Simultaneous Message Prioritization Test Case Results

Test Case ID	WFCWT-9-LL	Test Engineer Verification and Remarks
Test Case Name	Simultaneous Message Prioritization	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*

Test Case ID	WFCWT-9-LL	Test Engineer Verification and Remarks
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.52 Table WFCWT-9-Requirements Simultaneous Message Prioritization Requirements Verification Analysis

Table 2-52. WFCWT-9-Requirements Simultaneous Message Prioritization Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WFCWT-9 -- Simultaneous Message Prioritization	VS-REQ-23 -- IVAA Rank	The Vehicle System shall provide prioritized in-vehicle alerts based on the rank order presented in Table 4-1 of the SyRS, with the highest rank on top.	* Perform Test Case WFCWT-9 * Verify I2V SA Message displays within 8 meters of beginning of specified geofence. * Verify DN TIM message displays at specified distance from distressed vehicle, prioritized over I2V SA message. * Verify that, as host vehicle approaches remote vehicle, FCW imminent danger warning is issued, prioritized over I2V SA and DN TIM, in time for driver to avoid collision. * Prioritized delivery of I2V SA Message, DN TIM, and FCW imminent danger alert verifies the Vehicle System provides prioritized in-vehicle alerts based on the rank order presented in Table 4-1 of	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			the SyRS, with the highest rank on top, thereby verifying the requirement is satisfied.	
WFCWT-9 -- Simultaneous Message Prioritization	VS-REQ-24 -- IVAA Level	The Vehicle System shall have three levels of alert, as described in Table 4-2 of the SyRS.	* Perform Test Case WFCWT-9 * Verify I2V SA Message displays within 8 meters of beginning of specified geofence. * Verify DN TIM message displays at specified distance from distressed vehicle, prioritized over I2V SA message. * Verify that, as host vehicle approaches remote vehicle, FCW imminent danger warning is issued, prioritized over I2V SA and DN TIM, in time for driver to avoid collision. * Prioritized delivery of I2V SA Message, DN TIM, and FCW imminent danger alert verifies the Vehicle System has three levels of alert, as described in Table 4-2 of the SyRS, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WFCWT-9 -- Simultaneous Message Prioritization	VS-REQ-25 -- IVAA Priority Alert	The Vehicle System shall provide only the highest priority alert to the vehicle operator when more than one alert is currently active	* Perform Test Case WFCWT-9 * Verify I2V SA Message displays within 8 meters of beginning of specified geofence. * Verify DN TIM message displays at specified distance from distressed vehicle, prioritized over I2V SA message. * Verify that, as host vehicle approaches remote vehicle, FCW imminent danger warning is issued, prioritized over I2V SA and DN TIM, in time for driver to avoid collision. * Prioritized delivery of I2V SA Message, DN TIM, and FCW imminent danger alert verifies the Vehicle System provides only the highest priority alert to the vehicle operator when more than one alert is currently active, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

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www.its.dot.gov

FHWA-JPO-17-472B.4

U.S. Department of Transportation

Connected Vehicle Pilot Deployment Program Phase 2

WYDOT CV Pilot – I2V Situational Awareness Test Procedure and Test Cases

www.its.dot.gov/index.htm
Final Report — July 30, 2018
FHWA-JPO-17-472B.5

U.S. Department of Transportation

Produced by DTFH6116H00027
U.S. Department of Transportation

Notice

Technical Report Documentation Page

<table>
<tr><td>1. Report No.
FHWA-JPO-17-472B.5</td><td>2. Government Accession No.</td><td colspan="2">3. Recipient’s Catalog No.</td></tr>
<tr><td colspan="2" rowspan="2">4. Title and Subtitle
WYDOT CV Pilot - I2V Situational Awareness Test Procedure and Test Cases</td><td colspan="2">5. Report Date
7/30/2018</td></tr>
<tr><td colspan="2">6. Performing Organization Code</td></tr>
<tr><td colspan="2">7. Author(s)
Denny Stephens (Vital Assurance), Tony English (Trihydro), Nayel Ureña Serulle (ICF), Deepak Gopalakrishna (ICF), Vince Garcia (Wyoming DOT)</td><td colspan="2">8. Performing Organization Report No.
Task 2G: Operational Readiness Test and Demonstration Planning</td></tr>
<tr><td colspan="2" rowspan="2">9. Performing Organization Name and Address
Wyoming DOT, 5300 Bishop Boulevard, Cheyenne, WY 82009
ICF International, 1725 Eye St NW, Washington DC, 20006
Trihydro Corporation, 1252 Commerce Drive, Laramie, WY 82070
Vital Assurance, 175 S. Third St., Suite 200, Columbus, OH 43215</td><td colspan="2">10. Work Unit No. (TRAIS)</td></tr>
<tr><td colspan="2">11. Contract or Grant No.
DTFH6116H00027</td></tr>
<tr><td colspan="2" rowspan="2">12. Sponsoring Agency Name and Address
U.S Department of Transportation 1200 New Jersey Ave, SE
Washington, DC 20590</td><td colspan="2">13. Type of Report and Period Covered
Operational Readiness Plan, 09/01/2016 to 7/30/2018</td></tr>
<tr><td colspan="2">14. Sponsoring Agency Code</td></tr>
<tr><td colspan="4">15. Supplementary Notes
Kate Hartman (COR), Sarah Tarpgaard (CO)</td></tr>
<tr><td colspan="4">16. Abstract
The Wyoming Department of Transportation’s (WYDOT) Connected Vehicle (CV) Pilot Deployment Program is intended to develop a suite of applications that utilize vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communication technology to reduce the impact of adverse weather on truck travel in the I-80 corridor. These applications support a flexible range of services from advisories, roadside alerts, parking notifications and dynamic travel guidance. Information from these applications are made available directly to the equipped fleets or through data connections to fleet management centers (who will then communicate it to their trucks using their own systems). The pilot will be conducted in three Phases. Phase 1 includes the planning for the CV pilot including the concept of operations development. Phase 2 is the design, development, and testing phase. Phase 3 includes a real-world demonstration of the applications developed as part of this pilot.

This document presents the template for the I2V Situational Awareness Test Procedure and Test Cases of the Wyoming Department of Transportation (WYDOT) Connected Vehicle (CV) Pilot project as part of the United States Department of Transportation’s (USDOT) CV program. These tests are part of the WYDOT CV Pilot Operational Test Plan - Attachment B.</td></tr>
<tr><td colspan="2">17. Key Words
Connected Vehicle Technology, I-80 Corridor, Road Weather, Truck Safety, System Architecture</td><td colspan="2">18. Distribution Statement
This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161</td></tr>
<tr><td>19. Security Classif. (of this report)
None</td><td>20. Security Classif. (of this page)
None</td><td>21. No. of Pages
178</td><td>22. Price
NA</td></tr>
</table>

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

Acknowledgements

The Operational Readiness Plan development team would like to thank USDOT and Noblis for their technical assistance throughout the development of this document.

Table of Contents

1 Introduction 1

1.1 Project Scope 1

1.2 Purpose of this Test 2

2 I2V Situational Awareness Test Procedure and Test Cases 3

2.1 Table WI2VSAT-SUM I2V Situational Awareness Test Case Summary 4

2.2 Table WI2VSAT-TP I2V Situational Awareness Test Procedure 9

2.3 Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization ... 11

2.4 Table WI2VSAT-1-REP-L Description - Message Display in Travel Lanes Test Case Description 24

2.5 Table WI2VSAT-1-REP-L Results - Message Display in Travel Lanes 30

2.6 Table WI2VSAT-1-REP-S Description - Message Display in Travel Lanes Test Case Description 32

2.7 Table WI2VSAT-1-REP-S Results - Message Display in Travel Lanes 35

2.8 Table WI2VSAT-1-REP Requirements Verification Analysis 37

2.9 Table WI2VSAT-1-Pikalert-L Description - Message Display in Travel Lanes – Pikalert Test Case Description 45

2.10 Table WI2VSAT-1-Pikalert-L Results - Message Display in Travel Lanes 50

2.11 Table WI2VSAT-1-Pikalert Requirements Verification Analysis 52

2.12 Table WI2VSAT-1-511-L Description - Message Display in Travel Lanes – 511 Test Case Description 61

2.13 Table WI2VSAT-1-511-L Results - Message Display in Travel Lanes - 511 63

2.14 Table WI2VSAT-1-511 Requirements Verification Analysis 64

2.15 Table WI2VSAT-1-RCRS-L Description - Message Display in Travel Lanes – RCRS Test Case Description 66

2.16 Table WI2VSAT-1-RCRS-L Results - Message Display in Travel Lanes - RCRS 68

2.17 Table WI2VSAT-1-RCRS Requirements Verification Analysis 69

2.18 Table WI2VSAT-1-IC-L Description - Message Display in Travel Lanes – IC Test Case Description 71

2.19 Table WI2VSAT-1-IC-L Results - Message Display in Travel Lanes - IC 76

2.20 Table WI2VSAT-1-IC Requirements Verification Analysis 77

2.21 Table WI2VSAT-1-CA-L Description - Message Display in Travel Lanes – CA Test Case Description 80

2.22 Table WI2VSAT-1-CA-L Results - Message Display in Travel Lanes - CA 82
2.23 Table WI2VSAT-1-CA Requirements Verification Analysis... 83
2.24 Table WI2VSAT-1- WTI-Speed-L Description - Message Display in Travel Lanes- WTI-Speed Test Case Description 86
2.25 Table WI2VSAT-1- WTI-Speed-L Results - Message Display in Travel Lanes- WTI-Speed 88
2.26 Table WI2VSAT-1-WTI-Speed Requirements Verification Analysis 89
2.27 Table WI2VSAT-1- WTI-Restriction Description - Message Display in Travel Lanes - WTI-Restriction Test Case Description... 93
2.28 Table WI2VSAT-1- WTI-Restriction Results - Message Display in Travel Lanes - WTI-Restriction 95
2.29 Table WI2VSAT-1- WTI-Restriction Requirements Verification Analysis...................... 96
2.30 Table WI2VSAT-1- WTI-DMS-L Description - Message Display in Travel Lanes - WTI-DMS Test Case Description... 97
2.31 Table WI2VSAT-1- WTI-DMS-L Results - Message Display in Travel Lanes - WTI-DMS 99
2.32 Table WI2VSAT-1-WTI-DMS Requirements Verification Analysis............................. 100
2.33 Table WI2VSAT-1- WTI-Closure-L Description - Message Display in Travel Lanes - WTI-Closure Test Case Description 101
2.34 Table WI2VSAT-1- WTI-Closure-L Results - Message Display in Travel Lanes - WTI-Closure 103
2.35 Table WI2VSAT-1-WTI-Closure Requirements Verification Analysis 104
2.36 Table WI2VSAT-2-L Description - Message Display in Shoulder Lanes Test Case Description 105
2.37 Table WI2VSAT-2-L Results - Message Display in Shoulder Lanes 108
2.38 Table WI2VSAT-2-S Description - Message Display in Shoulder Lanes Test Case Description 109
2.39 Table WI2VSAT-2-S Description - Message Display in Shoulder Lanes.................... 112
2.40 Table WI2VSAT-2 Requirements Verification Analysis... 113
2.41 Table WI2VSAT-3-L Description - Message Display on Adjacent Service Road Test Case Description... 114
2.42 Table WI2VSAT-3-L Results - Message Display on Adjacent Service Road.............. 116
2.43 Table WI2VSAT-3-S Description - Message Display on Adjacent Service Road Test Case Description... 117
2.44 Table WI2VSAT-3-S Results - Message Display on Adjacent Service Road 119
2.45 Table WI2VSAT-3 Requirements Verification Analysis... 120
2.46 Table WI2VSAT-4-L Description - Message Display Perpendicular to Travel Lanes Test Case Description... 121

2.47 Table WI2VSAT-4-L Results - Message Display Perpendicular to Travel Lanes 123

2.48 Table WI2VSAT-4-S Description - Message Display Perpendicular to Travel Lanes Test Case Description 124

2.49 Table WI2VSAT-4-S Results - Message Display Perpendicular to Travel Lanes 127

2.50 Table WI2VSAT-4 Requirements Verification Analysis 128

2.51 Table WI2VSAT-5-L Description - Message Display in Travel Lanes sent via Satellite Test Case Description 128

2.52 Table WI2VSAT-5-L Results - Message Display in Travel Lanes sent via Satellite ... 131

2.53 Table WI2VSAT-5-S Description - Message Display in Travel Lanes sent via Satellite Test Case Description 132

2.54 Table WI2VSAT-5-S Results - Message Display in Travel Lanes sent via Satellite ... 135

2.55 Table WI2VSAT-5 Requirements Verification Analysis 136

2.56 Table WI2VSAT-6-L Description - Message Display in Opposing Travel Lanes Test Case Description 137

2.57 Table WI2VSAT-6-L Results - Message Display in Opposing Travel Lanes 139

2.58 Table WI2VSAT-6-S Description - Message Display in Opposing Travel Lanes Test Case Description 140

2.59 Table WI2VSAT-6-S Results - Message Display in Opposing Travel Lanes 143

2.60 Table WI2VSAT-6 Requirements Verification Analysis 144

2.61 Table WI2VSAT-7-L Description - Simultaneous DSRC and Satellite TIM Processing Test Case Description 144

2.62 Table WI2VSAT-7-L Results - Simultaneous DSRC and Satellite TIM Processing 147

2.63 Table WI2VSAT-7-S Description - Simultaneous DSRC and Satellite TIM Processing Test Case Description 148

2.64 Table WI2VSAT-7-S Results - Simultaneous DSRC and Satellite TIM Processing ... 150

2.65 Table WI2VSAT-7 Requirements Verification Analysis 151

2.66 Table WI2VSAT-8-L Description - Message Display Start Time Test Case Description 152

2.67 Table WI2VSAT-8-L Results - Message Display Start Time 154

2.68 Table WI2VSAT-8-S Description - Message Display Start Time Test Case Description 155

2.69 able WI2VSAT-8-S Results - Message Display Start Time 158

2.70 Table WI2VSAT-8 Requirements Verification Analysis 159

2.71 Table WI2VSAT-9-L Description - Message Display Stop Time Test Case Description 159

2.72 Table WI2VSAT-9-L Results - Message Display Stop Time 162

2.73 Table WI2VSAT-9-S Description - Message Display Stop Time Test Case Description 163
2.74 Table WI2VSAT-9-S Results - Message Display Stop Time 166
2.75 Table WI2VSAT-9 Requirements Verification Analysis 167

List of Tables

Table 2-1. WI2VSAT-SUM I2V Situational Awareness Test Case Summary 4
Table 2-2. WI2VSAT-TP I2V Situational Awareness Test Procedure 9
Table 2-3. WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization 11
Table 2-4. WI2VSAT-1-REP-L Description - Message Display in Travel Lanes Test Case Description 24
Table 2-5. WI2VSAT-1-REP-L Results - Message Display in Travel Lanes 30
Table 2-6. WI2VSAT-1-REP-S Description - Message Display in Travel Lanes Test Case Description 32
Table 2-7. WI2VSAT-1-REP-S Results - Message Display in Travel Lanes................................ 35
Table 2-8. WI2VSAT-1-REP Requirements Verification Analysis 37
Table 2-9. WI2VSAT-1-Pikalert-L Description - Message Display in Travel Lanes – Pikalert Test Case Description 45
Table 2-10. WI2VSAT-1-Pikalert-L Results - Message Display in Travel Lanes 50
Table 2-11. WI2VSAT-1-Pikalert Requirements Verification Analysis 52
Table 2-12. WI2VSAT-1-511-L Description - Message Display in Travel Lanes – 511 Test Case Description 61
Table 2-13. WI2VSAT-1-511-L Results - Message Display in Travel Lanes - 511 63
Table 2-14. WI2VSAT-1-511 Requirements Verification Analysis 64
Table 2-15. WI2VSAT-1-RCRS-L Description - Message Display in Travel Lanes – RCRS Test Case Description 66
Table 2-16. WI2VSAT-1-RCRS-L Results - Message Display in Travel Lanes - RCRS............... 68
Table 2-17. WI2VSAT-1-RCRS Requirements Verification Analysis 69
Table 2-18. WI2VSAT-1-IC-L Description - Message Display in Travel Lanes – IC Test Case Description 71
Table 2-19. WI2VSAT-1-IC-L Results - Message Display in Travel Lanes - IC 76
Table 2-20. WI2VSAT-1-IC Requirements Verification Analysis.. 77
Table 2-21. WI2VSAT-1-CA-L Description - Message Display in Travel Lanes - CA Test Case Description 80
Table 2-22. WI2VSAT-1-CA-L Results - Message Display in Travel Lanes - CA 82
Table 2-23. WI2VSAT-1-CA Requirements Verification Analysis 83
Table 2-24. WI2VSAT-1- WTI-Speed-L Description - Message Display in Travel Lanes- WTI-Speed Test Case Description 86
Table 2-25. WI2VSAT-1- WTI-Speed-L Results - Message Display in Travel Lanes- WTI-Speed88
Table 2-26. WI2VSAT-1-WTI-Speed Requirements Verification Analysis 89

Table 2-27. WI2VSAT-1- WTI-Restriction Description - Message Display in Travel Lanes - WTI-Restriction Test Case Description 93
Table 2-28. WI2VSAT-1- WTI-Restriction Results - Message Display in Travel Lanes - WTI-Restriction 95
Table 2-29. WI2VSAT-1- WTI-Restriction Requirements Verification Analysis 96
Table 2-30. WI2VSAT-1- WTI-DMS-L Description - Message Display in Travel Lanes - WTI-DMS Test Case Description 97
Table 2-31. WI2VSAT-1- WTI-DMS-L Results - Message Display in Travel Lanes - WTI-DMS .. 99
Table 2-32. WI2VSAT-1-WTI-DMS Requirements Verification Analysis 100
Table 2-33. WI2VSAT-1- WTI-Closure-L Description - Message Display in Travel Lanes - WTI-Closure Test Case Description 101
Table 2-34. WI2VSAT-1- WTI-Closure-L Results - Message Display in Travel Lanes - WTI-Closure 103
Table 2-35. WI2VSAT-1-WTI-Closure Requirements Verification Analysis 104
Table 2-36. WI2VSAT-2-L Description - Message Display in Shoulder Lanes Test Case Description 105
Table 2-37. WI2VSAT-2-L Results - Message Display in Shoulder Lanes 108
Table 2-38. WI2VSAT-2-S Description - Message Display in Shoulder Lanes Test Case Description 109
Table 2-39. WI2VSAT-2-S Description - Message Display in Shoulder Lanes 112
Table 2-40. WI2VSAT-2 Requirements Verification Analysis 113
Table 2-41. WI2VSAT-3-L Description - Message Display on Adjacent Service Road Test Case Description 114
Table 2-42. WI2VSAT-3-L Results - Message Display on Adjacent Service Road 116
Table 2-43. WI2VSAT-3-S Description - Message Display on Adjacent Service Road Test Case Description 117
Table 2-44. WI2VSAT-3-S Results - Message Display on Adjacent Service Road 119
Table 2-45. WI2VSAT-3 Requirements Verification Analysis 120
Table 2-46. WI2VSAT-4-L Description - Message Display Perpendicular to Travel Lanes Test Case Description 121
Table 2-47. WI2VSAT-4-L Results - Message Display Perpendicular to Travel Lanes 123
Table 2-48. WI2VSAT-4-S Description - Message Display Perpendicular to Travel Lanes Test Case Description 124
Table 2-49. WI2VSAT-4-S Results - Message Display Perpendicular to Travel Lanes 127
Table 2-50. WI2VSAT-4 Requirements Verification Analysis 128
Table 2-51. WI2VSAT-5-L Description - Message Display in Travel Lanes sent via Satellite Test Case Description 128
Table 2-52. WI2VSAT-5-L Results - Message Display in Travel Lanes sent via Satellite 131
Table 2-53. WI2VSAT-5-S Description - Message Display in Travel Lanes sent via Satellite Test Case Description 132
Table 2-54. WI2VSAT-5-S Results - Message Display in Travel Lanes sent via Satellite 135

Table 2-55. WI2VSAT-5 Requirements Verification Analysis 136
Table 2-56. WI2VSAT-6-L Description - Message Display in Opposing Travel Lanes Test Case Description 137
Table 2-57. WI2VSAT-6-L Results - Message Display in Opposing Travel Lanes 139
Table 2-58. WI2VSAT-6-S Description - Message Display in Opposing Travel Lanes Test Case Description 140
Table 2-59. WI2VSAT-6-S Results - Message Display in Opposing Travel Lanes..................... 143
Table 2-60. WI2VSAT-6 Requirements Verification Analysis 144
Table 2-61. WI2VSAT-7-L Description - Simultaneous DSRC and Satellite TIM Processing Test Case Description 144
Table 2-62. WI2VSAT-7-L Results - Simultaneous DSRC and Satellite TIM Processing........... 147
Table 2-63. WI2VSAT-7-S Description - Simultaneous DSRC and Satellite TIM Processing Test Case Description 148
Table 2-64. WI2VSAT-7-S Results - Simultaneous DSRC and Satellite TIM Processing 150
Table 2-65. WI2VSAT-7 Requirements Verification Analysis 151
Table 2-66. WI2VSAT-8-L Description - Message Display Start Time Test Case Description ... 152
Table 2-67. WI2VSAT-8-L Results - Message Display Start Time.. 154
Table 2-68. WI2VSAT-8-S Description - Message Display Start Time Test Case Description... 155
Table 2-69. WI2VSAT-8-S Results - Message Display Start Time 158
Table 2-70. WI2VSAT-8 Requirements Verification Analysis 159
Table 2-71. WI2VSAT-9-L Description - Message Display Stop Time Test Case Description ... 159
Table 2-72. WI2VSAT-9-L Results - Message Display Stop Time.. 162
Table 2-73. WI2VSAT-9-S Description - Message Display Stop Time Test Case Description... 163
Table 2-74. WI2VSAT-9-S Results - Message Display Stop Time 166
Table 2-75. WI2VSAT-9 Requirements Verification Analysis 167

1 Introduction

1.1 Project Scope

Wyoming is one of the first wave of CV Pilot sites selected to showcase the value of and spur the adoption of CV technology in the United States. CV technology is a broad term to describe the applications and the systems that leverage dedicated short-range communications (DSRC) for vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I) and infrastructure-to-vehicle (I2V) communication to improve safety, mobility and productivity of the users of the nation's transportation system.

As one of the three selected pilots, WYDOT is focusing on improving safety and mobility by creating new ways to communicate road and travel information to commercial truck drivers and fleet managers along the 402 miles of Interstate 80 (I-80 henceforth) in the State. For the pilot project, WYDOT concluded Phase 1 (planning) in September 2016 and then initiated Phase 2 (deployment) which is scheduled to conclude in mid-2018. This will be followed by an 18-month demonstration period in the third phase.

Systems and applications developed in the pilot will enable drivers of connected vehicles to have improved awareness of potential hazards and of situations they cannot see. At a very high level, the pilot scope includes the following implementation elements:

- **Deploy about 75 roadside units (RSU)** that can receive and broadcast messages using DSRC along various sections on I-80.
- **Equip around 400 vehicles, a combination of fleet vehicles and commercial trucks, with on-board units (OBU).** Of the 400 vehicles, at least 150 are planned to be heavy trucks. All vehicles are expected to be regular users of I-80. Several types of OBUs are being procured as part of the pilot and differ based on their communication capabilities, ability to integrate with the in-vehicle network, and connectivity to ancillary devices and sensors. All OBUs will have the functionality to broadcast Basic Safety Messages (BSM) and will include a human-machine interface (HMI) to share alerts and advisories to drivers of these vehicles.
- **Develop several V2V, V2I, I2V applications** that will enable communication to drivers of alerts and advisories regarding various road conditions. These applications include support for in-vehicle dissemination of advisories for collision avoidance, speed management, detours, parking, and presence of work zones and maintenance and emergency vehicles downstream of their current location.
- **Enable overall improvements in WYDOT's traffic management and traveler information practices** by using data collected from connected vehicles. Targeted improvements include ingesting more location specific mobile road weather information system (RWIS) data, using Pikalert®[1] to provide for more accurate and road segment specific conditions to define better variable speed limits (VSLs), and improving road

[1] Pikalert is a trademark of the University Corporation for Atmospheric Research.

condition dissemination via 511, Dynamic Message Signs (DMS) and other WYDOT sources.

1.2 Purpose of this Test

This document presents the test results of the *I2V Situational Awareness Test Procedure and Test Cases* for the Wyoming Department of Transportation (WYDOT) Connected Vehicle (CV) Pilot project as part of the United States Department of Transportation's (USDOT) CV program. These tests are part of the WYDOT CV Pilot Operational Test Plan - Attachment B.

The purpose of this document is to describe the results of a sequence of end-to-end tests conducted to validate the successful operation of the system in terms of I2V situational awareness.

2 I2V Situational Awareness Test Procedure and Test Cases

This chapter describes *Test Procedure ID WI2VSAT -- I2V Situational Awareness Test Procedures and Test Cases*. Table *WI2VSAT*-SUM is a high-level summary of the test cases addressed in this test procedure, providing a summary and orientation for the reader. Table *WI2VSAT* -TP details the Test Procedure itself. Table *WI2VSAT*-CI describes the configuration of each of the WYDOT CV Pilot System components for the Test Procedure and the Initialization to be performed for each prior to conducting the Test Cases. Tables *WI2VSAT*-1-REP-L-Description through *WI2VSAT*-9-S-Description provide the detailed description of Test Cases to be performed under this Test Procedure. Tables *WI2VSAT*-1-REP-L-Results through *WI2VSAT*-9-S-Results capture the results of each repetition of each Test Case. Finally, Tables *WI2VSAT*-1-REP-Requirements through *WI2VSAT*-9-Requirements describe the requirement verification methodology and capture the Test Engineer’s confirmation that each requirement is verified. Appendix A of the ORTP provides a list of all system requirements, the test case in which they are verified, and their individual requirements verification methodology.

In this chapter, the following Test Cases are integrated with WI2VSAT-1-REP Message Display in Travel Lanes for efficiency in conducting the tests.

- WI2VMCT-1 End-to-end & DSRC Delivery of I2V SA TIMs

2.1 Table WI2VSAT-SUM I2V Situational Awareness Test Case Summary

Table 2-1. WI2VSAT-SUM I2V Situational Awareness Test Case Summary

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID	Requirements Verified
WI2VSAT-1-REP	Message Display in Travel Lanes - Representative	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle driving in travel lanes in "message direction". * This is performed using “representative” TIM message.	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.		Compiled in Table WI2VSAT-1-REP-Requirements
WI2VSAT-1-Pikalert	Message Display in Travel Lanes - Pikalert	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle driving in travel lanes in "message direction". * This is performed for Pikalert (Spot Weather Impact Warning).	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.		Compiled in Table WI2VSAT-1-Pikalert-Requirements
WI2VSAT-1-511	Message Display in Travel Lanes - 511	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	Host vehicle driving in travel lanes in "message direction". * This is performed for 511 (Truck Parking).	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.		Compiled in Table WI2VSAT-1-511-Requirements
WI2VSAT-1-RCRS	Message Display in	Verify I2V SA TIM is parsed correctly and message begins and	* Host vehicle driving in travel lanes in "message direction".	* Message displays within 8 meters of beginning of specified geofence and		Compiled in Table WI2VSAT-1-

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID	Requirements Verified
	Travel Lanes - RCRS	ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	* This is performed for RCRS (Road condition).	ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.		RCRS-Requirements
WI2VSAT-1-IC	Message Display in Travel Lanes - IC	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle driving in travel lanes in "message direction". * This is performed for IC (Incident caution).	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.		Compiled in Table WI2VSAT-1-IC-Requirements
WI2VSAT-1-CA	Message Display in Travel Lanes - CA	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle driving in travel lanes in "message direction". * This is performed for CA (Work Zone Warning).	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.		Compiled in Table WI2VSAT-1-CA-Requirements
WI2VSAT-1-WTI-Speed	Message Display in Travel Lanes - WTI Speed	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle driving in travel lanes in "message direction". * This is performed for WTI (Variable Speed Limit).	Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.		Compiled in Table WI2VSAT-1-WTI Speed-Requirements
WI2VSAT-1-WTI-Restriction	Message Display in Travel Lanes	Verify I2V SA TIM is parsed correctly and message begins and	* Host vehicle driving in travel lanes in "message direction".	* Message displays within 8 meters of beginning of specified geofence and		Compiled in Table WI2VSAT-1-

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID	Requirements Verified
	WTI - Restriction	ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	* This is performed for WTI (Vehicle Restriction).	ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.		WTI-Restriction-Requirements
WI2VSAT-1-WTI-DMS	Message Display in Travel Lanes - DMS	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	Host vehicle driving in travel lanes in "message direction". * This is performed for WTI (DMS Message).	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.		Compiled in Table WI2VSAT-1-WTI-DMS-Requirements
WI2VSAT-1-WTI-Closure	Message Display in Travel Lanes - Closures	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle driving in travel lanes in "message direction". * This is performed for WTI (Road Closure).	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.		Compiled in Table WI2VSAT-1-WTI-Closure-Requirements
WI2VSAT-2	Message Display in Shoulder Lanes	Verify I2V SA TIM geofence is parsed correctly and messages begins and ends display on shoulders at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle traveling in "message direction" on inside shoulder and outside shoulder. This is performed using “representative” TIM message.	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.		Compiled in Table WI2VSAT-2-Requirements

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID	Requirements Verified
WI2VSAT-3	Message Display on Adjacent Service Road	Verify I2V SA TIM geofence is parsed correctly and messages do not display on adjacent service roads. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle traveling in "message direction" on adjacent service road. This is performed using “representative” TIM message	* No message is displayed. * Verified visually and by inspection of logs.		Compiled in Table WI2VSAT-3-Requirements
WI2VSAT-4	Message Display Perpendicular to Travel Lanes	Verify I2V SA TIM geofence is parsed correctly and messages do not display when approaching on perpendicular service roads. Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle approaches "travel lanes" on intersecting road perpendicular to "message direction". * This is performed using “representative” TIM message	* No message is displayed. * Verified visually and by inspection of logs.		Compiled in Table WI2VSAT-4-Requirements
WI2VSAT-5	Message Display in Travel Lanes sent via Satellite	* Verify I2V SA TIM sent via Satellite is identical to I2V SA TIM sent via DSRC in WI2VSAT-1. * Verify messages are parsed correctly and message begins and ends display at correct geofence geofence milepost.	Similar to WI2VSAT-1, Host vehicle driving in travel lanes in "message direction". * This is performed using “representative” TIM message.	* Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.		Compiled in Table WI2VSAT-5-Requirements
WI2VSAT-6	Message Display in	Verify I2V SA TIM geofence is parsed correctly and	* Host vehicle approaches in travel lanes opposite to TIM	* No message is displayed.		Compiled in Table

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID	Requirements Verified
	Opposing Travel Lanes	messages do not display when approaching in travel lanes opposite from specified message direction. Verify GPS accuracy supports accurate display of I2V SA Messages.	"message direction". * This is performed using "representative" TIM message.	* Verified visually and by inspection of logs.		WI2VSAT-6-Requirements
WI2VSAT-7	Simultaneous DSRC and Satellite I2V SA TIMs communications	Verify correct processing of end-to-end communication (DB to OBU) of I2V SA TIMs simultaneously via satellite and via DSRC.	* I2V SA TIM is formulated by Data Broker and distributed to test RSU and to satellite service provider. * Host vehicle approaches RSU from outside of DSRC communication range, while in satellite communication range. Host vehicle driving in travel lanes in "message direction". * This is performed using "representative" TIM message.	* OBU correctly processes identical I2V SA TIMs from DSRC and satellite. * Message displays within 8 meters of beginning of specified geofence and ceases display within 8 meters of end of specified geofence. * Verified visually and by inspection of logs.		Compiled in Table WI2VSAT-7-Requirements
WI2VSAT-8	Message Display Start Time	Verify geofence implementation and I2V SA TIM start and stop time functionality and performance on I-80. * Verify GPS	* Host vehicle driving in travel lanes on I-80 in "message direction". Vehicle enters geofence 10 seconds before start time. * This is performed	* Message begins displays within 1 second of specified start date and time (while inside the geofence). * Verified visually and by inspection of logs.		Compiled in Table WI2VSAT-8-Requirements

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID	Requirements Verified
		accuracy supports accurate display of I2V SA Messages.	using "representative" TIM message.			
WI2VSAT-9	Message Display Stop Time	Verify geofence implementation and I2V SA TIM start and stop time functionality and performance on I-80. * Verify GPS accuracy supports accurate display of I2V SA Messages.	* Host vehicle driving in travel lanes on I-80 in "message direction". Vehicle enters geofence at least 10 seconds before message stop time. * This is performed using "representative" TIM message.	* Message ceases displays within 1 second of specified stop date and time (while inside the geofence). * Verified visually and by inspection of logs.		Compiled in Table WI2VSAT-9-Requirements

2.2 Table WI2VSAT-TP I2V Situational Awareness Test Procedure

Table 2-2. WI2VSAT-TP I2V Situational Awareness Test Procedure

Test Procedure ID	**WI2VSAT**	**Test Engineer Verification and Remarks**
Test Procedure Name	I2V Situational Awareness Test Procedure	
Test Procedure Completion Date		
Priority	Required	
Objectives	• Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages. • Verify requirements associated with each Test Case.	
Relationship to	• Precondition is successful development and integration of the WYDOT CV Pilot	

<table>
<tr><th>Test Procedure ID</th><th>WI2VSAT</th><th>Test Engineer Verification and Remarks</th></tr>
<tr><td>Other Procedures</td><td>System, as described in the SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.
• WI2VSAT Test cases may be combined at the discretion of the Test Engineer under the condition that that there is no interference, confusion or conflict in interpretation of test results.</td><td></td></tr>
<tr><td>Discussion, Guidance, and Rationales</td><td>• The test speed of 35 mph was selected from experience in prior tests (Bogard, 2014) as an V2V test speed that can be safely handled by test engineers. Higher test speeds require professionally trained test drivers and driver protection equipment such as that used by race car drivers.
• 300m is the design communication range for DSRC SAE J2735 messages.</td><td></td></tr>
<tr><td>Test Cases Performed under This Procedure</td><td>For this procedure conduct the following Test Cases detailed later in this section.
<table>
<tr><th>Test Case ID</th><th>Integrated with</th><th>Host Vehicle OBU</th></tr>
<tr><td>WI2VSAT-1-REP-L</td><td>*WI2VMCT-1-L</td><td>Lear Roadstar OBU</td></tr>
<tr><td>WI2VSAT-1-REP-S</td><td>*WI2VMCT-1-S</td><td>SiriusXM OBU</td></tr>
<tr><td>WI2VSAT-1-Pikalert-L</td><td></td><td>Lear Roadstar OBU</td></tr>
<tr><td>WI2VSAT-1-511-L</td><td></td><td>Lear Roadstar OBU</td></tr>
<tr><td>WI2VSAT-1-RCRS-L</td><td></td><td>Lear Roadstar OBU</td></tr>
<tr><td>WI2VSAT-1-IC-L</td><td></td><td>Lear Roadstar OBU</td></tr>
<tr><td>WI2VSAT-1-CA-L</td><td></td><td>Lear Roadstar OBU</td></tr>
<tr><td>WI2VSAT-1-WTI-Speed-L</td><td></td><td>Lear Roadstar OBU</td></tr>
<tr><td>WI2VSAT-1-WTI-Restriction-L</td><td></td><td>Lear Roadstar OBU</td></tr>
<tr><td>WI2VSAT-1-WTI-DMS-L</td><td></td><td>Lear Roadstar OBU</td></tr>
<tr><td>WI2VSAT-1-WTI-Closure-L</td><td></td><td>Lear Roadstar OBU</td></tr>
<tr><td>WI2VSAT-2-L</td><td></td><td>Lear Roadstar OBU</td></tr>
<tr><td>WI2VSAT-2-S</td><td></td><td>SiriusXM OBU</td></tr>
<tr><td>WI2VSAT-3-L</td><td></td><td>Lear Roadstar OBU</td></tr>
<tr><td>WI2VSAT-3-S</td><td></td><td>SiriusXM OBU</td></tr>
<tr><td>WI2VSAT-4-L</td><td></td><td>Lear Roadstar OBU</td></tr>
<tr><td>WI2VSAT-4-S</td><td></td><td>SiriusXM OBU</td></tr>
<tr><td>WI2VSAT-5-L</td><td></td><td>Lear Roadstar OBU</td></tr>
<tr><td>WI2VSAT-5-S</td><td></td><td>SiriusXM OBU</td></tr>
<tr><td>WI2VSAT-6-L</td><td></td><td>Lear Roadstar OBU</td></tr>
<tr><td>WI2VSAT-6-S</td><td></td><td>SiriusXM OBU</td></tr>
</table></td><td></td></tr>
</table>

2.3 Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization

Table 2-3. WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization

System Component	Applicable Test Procedures and Cases	Configuration for I2V Situational Awareness Test Procedure and Test Cases	Initialization for I2V Situational Awareness Test Procedure and Test Cases	Test Engineer Verification and Remarks
Backup Component with Representative TIM	WI2VSAT-1-REP, WI2VSAT-2 WI2VSAT-3 WI2VSAT-4 WI2VSAT-5	"Representative" TIM is defined as an example TIM whose successful test result indicates conducting this test case with other I2V SA TIMs is also likely to be successful. This TIM is selected empirically, by developers and test engineers. This TIM message is used when it is not necessary or efficient to repeat all message types from each back-office component.	• Prepare applicable back office component inputs for Representative TIM for Message Display • Formulate and document back office component inputs that will generate Representative I2V Situational Awareness TIM • Formulate and document Geofence inputs (manual and computer input file) for Representative I2V Situational Awareness TIM • Formulate and document back office component inputs (manual and computer input file) for distribution of Representative I2V Situational Awareness TIM through RSUs via DSRC and through Satellite.	*Configuration Verified:* *Initialization Verified:*
Pikalert	WI2VSAT-1-Pikalert	Pikalert fully updated to support I2V SA application, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested with development environment or production environment, as long as it is ready for production deployment.	• Prepare Pikalert inputs for Variable Speed Limit for Message Display in Travel Lanes • Formulate and document Pikalert inputs that will generate Spot Weather Impact Warning I2V Situational Awareness TIM • Formulate and document Geofence inputs (manual and	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for I2V Situational Awareness Test Procedure and Test Cases	Initialization for I2V Situational Awareness Test Procedure and Test Cases	Test Engineer Verification and Remarks
			computer input file) for Spot Weather Impact Warning I2V Situational Awareness TIM • Formulate and document Pikalert inputs (manual and computer input file) for distribution of Spot Weather Impact Warning I2V Situational Awareness TIM through RSUs via DSRC.	
WYDOT 511 App	WI2VSAT-1-511	511 back office system fully updated to support I2V SA application, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested with development environment or production environment, as long as it is ready for production deployment.	• Prepare 511 back office system inputs for Truck Parking Availability Advisory for Message Display in Travel Lanes • Formulate and document 511 back office system inputs that will generate Truck Parking Availability Advisory I2V Situational Awareness TIM • Formulate and document Geofence inputs (manual and computer input file) for Truck Parking Availability Advisory I2V Situational Awareness TIM • Formulate and document Pikalert Inputs (manual and computer input file) for distribution of Truck Parking Availability Advisory I2V Situational Awareness TIM through RSUs via DSRC	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for I2V Situational Awareness Test Procedure and Test Cases	Initialization for I2V Situational Awareness Test Procedure and Test Cases	Test Engineer Verification and Remarks
Road Condition Reporting System (RCRS)	WI2VSAT-1-RCRS	RCRS fully updated to support I2V SA application, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested with development environment or production environment, as long as it is ready for production deployment.	• Prepare RCRS inputs for Road Condition Advisory for Message Display in Travel Lanes • Formulate and document RCRS inputs that will generate Road Condition Advisory I2V Situational Awareness TIM • Formulate and document Geofence inputs (manual and computer input file) for Road Condition Advisory I2V Situational Awareness TIM • Formulate and document RCRS inputs (manual and computer input file) for distribution of Road Condition Advisory I2V Situational Awareness TIM through RSUs via DSRC	*Configuration Verified:* *Initialization Verified:*
Incident Console (IC)	WI2VSAT-1-IC	IC fully updated to support I2V SA application, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested with development environment or production environment, as long as it is ready for production deployment.	• Prepare IC inputs for Incident Information Advisory for Message Display in Travel Lanes • Formulate and document IC inputs that will generate Incident Information Advisory I2V Situational Awareness TIM • Formulate and document Geofence inputs (manual and computer input file) for Incident Information Advisory I2V Situational Awareness TIM • Formulate and document IC inputs (manual and computer input file) for distribution of	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for I2V Situational Awareness Test Procedure and Test Cases	Initialization for I2V Situational Awareness Test Procedure and Test Cases	Test Engineer Verification and Remarks
			Incident Information Advisory I2V Situational Awareness TIM through RSUs via DSRC	
WYDOT Construction Admin (CA)	WI2VSAT-1-CA	CA fully updated to support I2V SA application, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested with development environment or production environment, as long as it is ready for production deployment.	• Prepare CA inputs for Work Zone Warning for Message Display in Travel Lanes • Formulate and document CA inputs that will generate Work Zone Warning I2V Situational Awareness TIM • Formulate and document Geofence inputs (manual and computer input file) for Work Zone Warning I2V Situational Awareness TIM • Formulate and document CA inputs (manual and computer input file) for distribution of Work Zone Warning I2V Situational Awareness TIM through RSUs via DSRC	*Configuration Verified:* *Initialization Verified:*
WYDOT Third Party Interface (WTI) - Variable Speed Limit Advisory	WI2VSAT-1-WTI-Speed	WTI fully updated to support I2V SA application, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested with development environment or production environment, as long as it is ready for production deployment.	• Prepare WTI Inputs for Variable Speed Limit Advisory for Message Display in Travel Lanes • Formulate and document WTI Inputs that will generate Variable Speed Limit Advisory I2V Situational Awareness TIM • Formulate and document Geofence inputs (manual and computer input file) for Variable	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for I2V Situational Awareness Test Procedure and Test Cases	Initialization for I2V Situational Awareness Test Procedure and Test Cases	Test Engineer Verification and Remarks
			Speed Limit Advisory I2V Situational Awareness TIM • Formulate and document WTI Inputs (manual and computer input file) for distribution of Variable Speed Limit Advisory I2V Situational Awareness TIM through RSUs via DSRC • Document procedure for WTI System and Operators to initiate generation of WTI Variable Speed Limit Advisory TIM by DB	
WYDOT Third Party Interface (WTI) – Vehicle Restrictions Advisory	WI2VSAT-1-WTI-Restriction	WTI fully updated to support I2V SA application, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested with development environment or production environment, as long as it is ready for production deployment.	• Prepare WTI Inputs for Vehicle Restrictions Advisory for Message Display in Travel Lanes • Formulate and document WTI Inputs that will generate Vehicle Restrictions Advisory I2V Situational Awareness TIM • Formulate and document Geofence inputs (manual and computer input file) for Vehicle Restrictions Advisory I2V Situational Awareness TIM • Formulate and document WTI Inputs (manual and computer input file) for distribution of Vehicle Restrictions Advisory I2V Situational Awareness TIM through RSUs via DSRC • Document procedure for WTI System and Operators to initiate generation of Vehicle	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for I2V Situational Awareness Test Procedure and Test Cases	Initialization for I2V Situational Awareness Test Procedure and Test Cases	Test Engineer Verification and Remarks
			Restrictions Advisory TIM by DB	
WYDOT Third Party Interface (WTI) – Dynamic Message Sign Advisory	WI2VSAT-1-WTI-DMS	WTI fully updated to support I2V SA application, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested with development environment or production environment, as long as it is ready for production deployment.	• Prepare WTI Inputs for Dynamic Message Sign Advisory for Message Display in Travel Lanes • Formulate and document WTI Inputs that will generate Dynamic Message Sign Advisory I2V Situational Awareness TIM • Formulate and document Geofence inputs (manual and computer input file) for Dynamic Message Sign Advisory I2V Situational Awareness TIM • Formulate and document WTI Inputs (manual and computer input file) for distribution of Dynamic Message Sign Advisory I2V Situational Awareness TIM through RSUs via DSRC • Document procedure for WTI System and Operators to initiate generation of Dynamic Message Sign Advisory TIM by DB	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for I2V Situational Awareness Test Procedure and Test Cases	Initialization for I2V Situational Awareness Test Procedure and Test Cases	Test Engineer Verification and Remarks
WYDOT Third Party Interface (WTI) – Roadway Closure Advisory	WI2VSAT-1-WTI-Closure	WTI fully updated to support I2V SA application, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested with development environment or production environment, as long as it is ready for production deployment.	• Prepare WTI Inputs for Roadway Closure Advisory for Message Display in Travel Lanes • Formulate and document WTI Inputs that will generate Roadway Closure Advisory I2V Situational Awareness TIM • Formulate and document Geofence inputs (manual and computer input file) for Roadway Closure Advisory I2V Situational Awareness TIM • Formulate and document WTI Inputs (manual and computer input file) for distribution of Roadway Closure Advisory I2V Situational Awareness TIM through RSUs via DSRC • Document procedure for WTI System and Operators to initiate generation of Roadway Closure Advisory TIM by DB	*Configuration Verified:* *Initialization Verified:*
Transportation Reporting and Action Console	All WI2VSAT Test Cases	• TRAC fully integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Verify TRAC configuration files are correct for this test set • Download/Copy DB configuration files to Test Case Folder for Test Record	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for I2V Situational Awareness Test Procedure and Test Cases	Initialization for I2V Situational Awareness Test Procedure and Test Cases	Test Engineer Verification and Remarks
Track or Roadway	All WI2VSAT Test Cases	• Controlled environment “track” test facility. • Staging area outside DSRC communication range from geofence. • Test case may be performed on a highway to more easily accommodate testing multiple messages, each with a different geofence. If performed on a highway, test speed should be adjusted to be safe highway travel speeds.	• Identify geofence locations and place traffic cones on both sides of roadway clearly visible to drivers at plus and minus 8 meters from beginning of geofence and plus and minus 8 meters from beginning of geofence end • Place cautionary signage and boundary markers in advance of geofence to warn test staff and visitors • On roadway, place any additional signage required by WYDOT Safety Manager • Verify vehicle preparation and staging area is outside DSRC communication range of geofence engagement location	*Configuration Verified:* *Initialization Verified:*
Data Broker (DB)	All WI2VSAT Test Cases	DB fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Delete (all) existing TIMs messages • Remove old log files • Verify DB configuration files are correct for this test set • Download/Copy DB configuration files to Test Case Folder for Test Record • Reinitialize, if practical	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for I2V Situational Awareness Test Procedure and Test Cases	Initialization for I2V Situational Awareness Test Procedure and Test Cases	Test Engineer Verification and Remarks
Operational Data Environment (ODE)	All WI2VSAT Test Cases	ODE fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Delete (all) existing TIMs messages • Remove old log files • Verify ODE configuration files are correct for this test case • Download/Copy ODE configuration files to Test Case Folder for Test Record • Reinitialize, if practical	*Configuration Verified:* *Initialization Verified:*
Data Warehouse (DW)	All WI2VSAT Test Cases	DW fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Verify DW configuration files are correct for this test case • Download/Copy DW configuration files to Test Case Folder for Test Record	*Configuration Verified:* *Initialization Verified:*
Security Credential Management System (SCMS)	All WI2VSAT Test Cases	SCMS fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment. All test cases may be performed without SCMS support during development for verification of functionality and performance of other components. Final, “for the record” testing must be performed with SCMS fully integrated with WYDOT TMC per SDD and ICD, ready for production deployment.	• Verify SCMS configuration files are correct for this test case • Download/Copy SCMS configuration files to Test Case Folder for Test Record	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for I2V Situational Awareness Test Procedure and Test Cases	Initialization for I2V Situational Awareness Test Procedure and Test Cases	Test Engineer Verification and Remarks
RSU(s)	All WI2VSAT Test Cases	One RSU fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment. RSU is located outside DSRC communication range from WI2VSAT geofence.	• Verify RSU is located outside DSRC communication range from WI2VSAT geofence. • Delete (all) existing TIMs on RSU • Remove old log files • Verify RSU configuration files are correct for this test case • Download/Copy RSU configuration files to Test Case Folder for Test Record • Reboot RSU, if practical	*Configuration Verified:* *Initialization Verified:*
Satellite	WI2VSAT-5	Situation Data Warehouse and Satellite Service Provider (SSP) communications fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Delete (all) existing TIMs on SSP • Verify relevant configuration files are correct for this test case • Download/Copy relevant configuration files to Test Case Folder for Test Record	*Configuration Verified:* *Initialization Verified:*
Data Logging	All WI2VSAT Test Cases	Data logging for each of the following components fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment: • Back Office components • Data broker • OBU • HMI • TRAC	• Remove old log files after storage and archival • Initialize Test Log Folder with Unique Test Identifier	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for I2V Situational Awareness Test Procedure and Test Cases	Initialization for I2V Situational Awareness Test Procedure and Test Cases	Test Engineer Verification and Remarks
External Storage Location for Each Test Set	All WI2VSAT Test Cases	Storage location external to the system for backup and archiving of log files and test records.	• Initialize Test Record Folder with Unique Test Identifier	*Configuration Verified:* *Initialization Verified:*
WYDOT Maint Vehicle	Each WI2VSAT Test Case must be performed with WYDOT Maint Vehicle ***or*** Integrated Truck to verify I2V SA functionality and performance of Lear Roadstar OBU (Table WI2VSAT-4)	Lear Roadstar OBU with antenna configuration planned for deployment and HMI fully developed, integrated with vehicle and CAN interface per SDD and ICD, ready for production deployment. May be tested with development environment or production environment, as long as it is ready for production deployment.	• Remove old log files • Initialize log file folders for this Test Case with Unique Identifier • Verify OBU and HMI configuration files are correct for this test case • Download/Copy OBU and HMI configuration files to Test Case Folder for Test Record	*Configuration Verified:* *Initialization Verified:*
Highway Patrol Vehicle	Not Applicable – Lear Sharkfin OBU does not support I2V SA	Lear Sharkfin OBU with antenna configuration planned for deployment and HMI fully developed, installed in vehicle per SDD and ICD, ready for production deployment. May be tested with development environment or production environment, as long as it is ready for production deployment.	• Remove old log files • Initialize log file folders for this Test Case with Unique Identifier • Verify OBU and HMI configuration files are correct for this test case • Download/Copy OBU and HMI configuration files to Test Case Folder for Test Record	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for I2V Situational Awareness Test Procedure and Test Cases	Initialization for I2V Situational Awareness Test Procedure and Test Cases	Test Engineer Verification and Remarks
Integrated Truck	Each WI2VSAT Test Set must be performed with WYDOT Maint Vehicle ***or*** Integrated Truck to verify I2V SA functionality and performance of Lear Roadstar OBU (Table WI2VSAT-4)	Lear Roadstar OBU with antenna configuration planned for deployment and HMI fully developed, installed in vehicle per SDD and ICD, ready for production deployment. May be tested with development environment or production environment, as long as it is ready for production deployment.	• Remove old log files • Initialize log file folders for this Test Case with Unique Identifier • Verify OBU and HMI configuration files are correct for this test case • Download/Copy OBU and HMI configuration files to Test Case Folder for Test Record	*Configuration Verified:* *Initialization Verified:*
Retrofit Truck	WI2VSAT-1-REP, WI2VSAT-2 WI2VSAT-3 WI2VSAT-4 WI2VSAT-5 To verify I2V SA functionality and performance of SiriusXM OBU.	SiriusXM OBU with antenna configuration planned for deployment and HMI fully developed, installed in vehicle per SDD and ICD, ready for production deployment. May be tested with development environment or production environment, as long as it is ready for production deployment.	• Remove old log files • Initialize log file folders for this Test Case with Unique Identifier • Verify OBU and HMI configuration files are correct for this test case • Download/Copy OBU and HMI configuration files to Test Case Folder for Test Record	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for I2V Situational Awareness Test Procedure and Test Cases	Initialization for I2V Situational Awareness Test Procedure and Test Cases	Test Engineer Verification and Remarks
Back office System Operators	All WI2VSAT Test Cases	Trained and Practiced Back office System Operators trained in what to expect from WI2V Applications and practiced in supporting I2V Situational Awareness Application Advisories and Alerts.	• Train WTI System Operators to initiate TIM and distribute to RSU • WTI System Operators practice initiating TIM and distribution to RSU	*Configuration Verified:* *Initialization Verified:*
Drivers	All WI2VSAT Test Cases	Drivers qualified and experienced in driving the assigned vehicles. Drivers trained in what to expect from WI2V Applications and practiced in conducting driving scenarios safely and reliably with existing traffic.	• Conduct driver safety briefing • Review and practice test scenario, as required to ensure maneuvers can be conducted safely and reliably with existing traffic	*Configuration Verified:* *Initialization Verified:*
Test Staff	All WI2VSAT Test Cases	Test staff trained in what to expect from WI2V Applications and practiced in supporting driving scenarios safely and reliably with existing traffic.	• Conduct safety briefing and review danger zones • Verify that Test Staff wear safety vests • Review and practice test scenario, as required to ensure maneuvers can be conducted safely and reliably with existing traffic	*Configuration Verified:* *Initialization Verified:*
Visitors and Non-Test Staff	All WI2VSAT Test Cases	Visitors and Non-Test Staff instructed in what to expect from WI2V Applications and informed in observing driving scenarios safely and reliably with existing traffic.	• Review test scenario • Conduct safety briefing and review danger zones	*Configuration Verified:* *Initialization Verified:*

2.4 Table WI2VSAT-1-REP-L Description - Message Display in Travel Lanes Test Case Description

Table 2-4. WI2VSAT-1-REP-L Description - Message Display in Travel Lanes Test Case Description

Test Case ID	**WI2VSAT-1-REP-L**	**Test Engineer Verification and Remarks**
Test Case Name	Message Display in Travel Lanes	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WI2VSAT-1-REP-Requirements	
Objectives	• WI2VSAT-1-REP Message Display in Travel Lanes - Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages. • WI2VMCT-1 End-to-end & DSRC Delivery of I2V SA TIMs ○ Verify End-to-end Communication (DB to Vehicle) of I2V SA TIMs via DSRC and I2V SA TIM DSRC communication range	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	Representative TIM Back Office Component	

Test Case ID	WI2VSAT-1-REP-L	Test Engineer Verification and Remarks
TIM	Representative TIM	
Host Vehicle OBU/ Vehicle	Lear Roadstar OBU	
Vehicle direction versus message direction	Same direction	
Vehicle Lane of travel	Roadway Travel lanes	
Host Vehicle Driving Scenario (TC Input)	Host vehicle driving in travel lanes in "message direction". This is performed using “representative” TIM message.	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Driver observes beginning display of Representative TIM Advisory/Warning within 0.5 seconds of crossing the beginning of TIM specified geofence and cease of display within 0.5 seconds of crossing the end of TIM specified geofence.	
WI2VSAT-1-REP Log File Analysis and Verification Method (Test Case Output 2)	- Log files confirm beginning display of Representative TIM Advisory/Warning within 0.5 seconds of crossing the beginning of TIM specified geofence and cease of display within 0.5 seconds of crossing the end of TIM specified geofence.	
WI2VSAT-1-REP Expected Result (Pass/Fail Criteria)	- Driver Advisory/Warning begins display within 0.5 seconds of crossing the beginning of TIM specified geofence and ceases display within 0.5 seconds of crossing the end of TIM specified geofence. Verified visually and by inspection of HMI logs.	
Detailed Execution Steps	**Verify Readiness** 1. Host vehicle has Lear LocoMate 300 OBU installed with antenna and HMI, configured according to the WYDOT CV Pilot OBU configuration. A lap top computer must be connected via an Ethernet cable to the OBU to implement initial log file offload verification. 2. Confirm that the test track Lear LocoMate 300 RSU is installed and configured according to the WYDOT CV Pilot RSU configuration. 3. Identify offload location where vehicles can drive to, to be within the offload range of the test track RSU.	

Test Case ID	WI2VSAT-1-REP-L	Test Engineer Verification and Remarks
	4. Confirm that the test team includes both a driver and recorder for the host vehicle. 5. Create representative Traveler Information Message (TIM) along defined roadway section of the test track. The TIM start and endpoints on the roadway must be along a defined roadway section with specific known start and end points. The TIM should be an all direction TIM. 6. Define a track location, outside of the TIM zone, where the host vehicle can start driving to enter the TIM zone. Define a corresponding track location that is outside of the TIM zone after the vehicle would have completely traversed the TIM zone. **Test Start Up** 7. Drive the host vehicle to the offload location, power up the OBU. 8. Confirm that OBU powers up correctly and is linked to its corresponding HMI. Confirm this by driving a short distance and validating that the vehicle speed and location update on the HMI to reflect the short drive. 9. While parked at the offload location execute the following steps to confirm log file generation and offload. 10. Log into the OBU and from the system shell issue a ping6 command to the backend host server for the WYDOT CV Pilot environment. This will confirm the full IPv6 connectivity from the OBU through the RSU to the WYDOT backend server. The ping command to issue is: i. #ping6 <backend server IPv6 address> 11. For the OBU confirm that log files are being generated. Confirm this by reviewing the event log directory on the OBU and checking that various log files are increasing in size. The specific log files to see increasing are either: i. /var/eventlog/bsmLogDuringEventc.csv Or ii. /var/eventlog/bsmTx.csv 12. For the OBU confirm that log files are being offloaded, when vehicle is at the designated offload location. Confirm this by checking the OBU log file and confirming that an rsync for the various /var/storage directories is being executed	

Test Case ID	WI2VSAT-1-REP-L	Test Engineer Verification and Remarks
	on a regular schedule. The log file path is /var/log/messages. The periodic rsync messages should look like the following list: offload_asd:syncing /var/storage/dnMsg/ offload_asd:syncing /var/storage/environmentMsg/ offload_asd:syncing /var/storage/driverAlert/ offload_asd:syncing /var/storage/upgrades/ offload_asd:syncing /var/storage/systemLog/ Once the log file generation and offload are confirmed the test repetitions can begin. **Driving the Test** 13. Begin by driving the host vehicle to the designated start position on the test track. 14. Drive the host vehicle on track towards the known start of the TIM zone. The host driver should initially focus on achieving and maintaining a test speed of 35 mph. Record the test repetition starting time. 15. Once the vehicle has entered the TIM zone the onboard recorder manually records any types of driver alerts issued to the driver. 16. After driving the length of the TIM zone and upon exiting, the recorder monitors the HMI display and records the approximate time when the TIM icon disappeared from the display. 17. The host vehicle then turns around outside of the TIM zone and sets up for a pass through the TIM zone in the opposite direction. 18. On this second traverse the recorder again monitors the HIM display and records approximate times when the TIM icons appear and disappear. 19. After exiting the TIM zone the host vehicle returns to the original start location ready to repeat the test again.	

Test Case ID	WI2VSAT-1-REP-L	Test Engineer Verification and Remarks
	After final test repetition, the host vehicle drives to offload location and confirms that generated log files are offloaded (see test startup third step). **Analysis Procedure** 20. Execute a set of queries on the connected vehicle database to extract bsm and driver alert log records for the period of time around each I2V test run. These queries are implemented in a script that generates a KML file for display in Google Earth. This allows each bsm and driver alert record from each test vehicle to be plotted in the Google Earth application. The follow example command line runs the query script to generate the KML file for a test executed at the Archer test track that started 08 Jan 2018 02:15:10 pm MST and ended at 02:16:00 pm MST. Note that the time boundaries in the query are in Coordinated Universal Time (UTC). python create_kml.py circle --lat 41.150576 --long -104.654964 --distance 2000 --beginTime '2018-01-08 21:15:10' --endTime '2018-01-08 21:16:00' 21. Open the resulting KML file in Google Earth. The bsm records and driver alert records for the host vehicle will be visible along the path it traveled through the TIM zone. BSM records will appear as small arrows, driver alerts will appear as white triangles at each point in the vehicle trajectory that the driver alert was issued. Adjust the time slider so that appropriate BSM and driver alerts around the TIM zone test are visible. 22. Create two points in Google Earth map one each representing the start and end points of the TIM path. Enter the specified latitude and longitude values for both the start and end points. 23. Identify the BSM closest to each of the TIM zone start and end points. Record the time associated with the closest BSM. 24. Select the driver alert closest to the TIM starting path point, confirm this TIM driver alert represents the TIM alert. Record the time of this driver alert.	

Test Case ID	WI2VSAT-1-REP-L	Test Engineer Verification and Remarks
	25. Subtract the time of the starting point BSM record from the time of the driver alert record to get the time from crossing the TIM boundary to the alert. Time to alert = driver alert time – BSM time 26. Select the driver alert closest to the TIM ending path point, confirm this TIM driver alert represents the TIM alert. This driver alert indicates the point when the TIM alert was dismissed from the HMI display. Record the time of this driver alert. 27. Subtract the time of the ending point BSM record from the time of the driver alert record to get the time from crossing the TIM boundary to the alert. Time to dismiss alert = driver alert dismiss time – BSM time 28. To calculate the approximate distance between the alert time and the crossing of the TIM boundary, the latitude and longitude values for each point can be entered into the Haversine equation to generate an approximate distance between the points.	

2.5 Table WI2VSAT-1-REP-L Results - Message Display in Travel Lanes

Table 2-5. WI2VSAT-1-REP-L Results - Message Display in Travel Lanes

Test Case ID	Rep	WI2VSAT-1-REP-L	Test Engineer Verification and Remarks
Test Case Name		Message Display in Travel Lanes	*Performed and Confirmed by:*
Test Case Completion Date		May 9, 2018	*Performed and Confirmed by:*
WI2VSAT-1-REP-L Driver Advisory/ Warning Visual Results	**Rep 1**		*Performed and Confirmed by:*
WI2VSAT-1-REP-L Test Case Log File Analysis Results	**Rep 1**		*Performed and Confirmed by:*
WI2VSAT-1-REP-L Driver Advisory/ Warning Visual Results	**Rep 2**		*Performed and Confirmed by:*
WI2VSAT-1-REP-L Log Analysis Test Case Log File Analysis Results	**Rep 2**		*Performed and Confirmed by:*
WI2VSAT-1-REP-L Driver Advisory/ Warning Visual Results	**Rep 3**		*Performed and Confirmed by:*
WI2VSAT-1-REP-L Log Analysis Test Case Log File Analysis Results	**Rep 3**		*Performed and Confirmed by:*
WI2VSAT-1-REP-L Driver Advisory/ Warning Visual Results	**Rep 4**		*Performed and Confirmed by:*
WI2VSAT-1-REP-L Log Analysis Test Case Log File Analysis Results	**Rep 4**		*Performed and Confirmed by:*

Test Case ID	Rep	WI2VSAT-1-REP-L	Test Engineer Verification and Remarks
WI2VSAT-1-REP-L Driver Advisory/ Warning Visual Results	**Rep 5**		*Performed and Confirmed by:*
WI2VSAT-1-REP-L Log Analysis Test Case Log File Analysis Results	**Rep 5**		*Performed and Confirmed by:*
Test Case Analysis Tables			*Performed and Confirmed by:*
WI2VSAT-1-REP-L Pass/Fail Assessment			*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.6 Table WI2VSAT-1-REP-S Description - Message Display in Travel Lanes Test Case Description

Table 2-6. WI2VSAT-1-REP-S Description - Message Display in Travel Lanes Test Case Description

Test Case ID	**WI2VSAT-1-REP-S**	**Test Engineer Verification and Remarks**
Test Case Name	Message Display in Travel Lanes	
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WI2VSAT-1-REP-Requirements	
Objectives	• WI2VSAT-1-REP Message Display in Travel Lanes - Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages. • WI2VMCT-1 End-to-end & DSRC Delivery of I2V SA TIMs ○ Verify End-to-end Communication (DB to Vehicle) of I2V SA TIMs via DSRC and I2V SA TIM DSRC communication range	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	Representative TIM Back Office Component	
TIM	Representative TIM	

Test Case ID	WI2VSAT-1-REP-S	Test Engineer Verification and Remarks
Host Vehicle OBU/ Vehicle	SiriusXM OBU	
Vehicle direction versus message direction	Same direction	
Vehicle Lane of travel	Roadway Travel lanes	
Host Vehicle Driving Scenario (TC Input)	Host vehicle driving in travel lanes in "message direction". This is performed using "representative" TIM message.	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Driver observes beginning display of Representative TIM Advisory/Warning within 0.5 seconds of crossing the beginning of TIM specified geofence and cease of display within 0.5 seconds of crossing the end of TIM specified geofence. (Note: Test Case WI2VMCT-1 does not issue driver advisories or alerts.)	
WI2VSAT-1-REP Log File Analysis and Verification Method (Test Case Output 2)	- Log files confirm beginning display of Representative TIM Advisory/Warning within 0.5 seconds of crossing the beginning of TIM specified geofence and cease of display within 0.5 seconds of crossing the end of TIM specified geofence.	
WI2VMCT-1 Log File Analysis and Verification Method (Test Case Output 2)	Log files confirm a configurable threshold percentage of I2V SA TIMs are received and processed by OBU when vehicle is at least 300 meters away.	
WI2VSAT-1-REP Expected Result (Pass/Fail Criteria)	- Driver Advisory/Warning begins display within 0.5 seconds of crossing the beginning of TIM specified geofence and ceases display within 0.5 seconds of crossing the end of TIM specified geofence. Verified visually and by inspection of HMI logs.	
WI2VMCT-1 Expected Result (Pass/Fail Criteria)	A configurable threshold percentage of I2V SA TIMs sent by the Data Broker are received and processed by OBU when vehicle is at least 300 meters away. Verified by logs.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* **Verify Readiness for Test**	

Test Case ID	**WI2VSAT-1-REP-S**	**Test Engineer Verification and Remarks**
	1. Verify WYDOT CV Pilot TMC System is operational and ready for test **2.** Verify RSUs are operational and ready for test **3.** Cycle Host Vehicle power and reboot vehicle system. **4.** Verify Host vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix **5.** Conduct Safety Inspection of the test area and vehicle path and confirm ready for test a. No obstructions or interference b. All staff where they are supposed to be, no staff where they aren't supposed to be c. Weather is acceptable and will not lead to hazardous driving conditions d. Road surface is acceptable and will not lead to hazardous driving conditions **Test Start Up** **6.** Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational **7.** Host vehicle driver inspects driving area and confirm track is clear and ready for test. **8.** Host Vehicle Driver and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure **Driving the Test** **9.** I2V SA TIM is formulated by Data Broker and distributed to test RSU. Host vehicle enters track from outside communication range and performs Test Case Host Vehicle Scenario.	

2.7 Table WI2VSAT-1-REP-S Results - Message Display in Travel Lanes

Table 2-7. WI2VSAT-1-REP-S Results - Message Display in Travel Lanes

Test Case ID	Rep	WI2VSAT-1-REP-S	Test Engineer Verification and Remarks
Test Case Name		Message Display in Travel Lanes	*Performed and Confirmed by:*
Test Case Completion Date			*Performed and Confirmed by:*
WI2VSAT-1-REP-S Driver Advisory/ Warning Visual Results	**Rep 1**		*Performed and Confirmed by:*
WI2VSAT-1-REP-S Analysis Test Case Log File Analysis Results	**Rep 1**		*Performed and Confirmed by:*
WI2VMCT-1-S Log Analysis Test Case Log File Analysis Results	**Rep 1**		*Performed and Confirmed by:*
WI2VSAT-1-REP-S Driver Advisory/ Warning Visual Results	**Rep 2**		*Performed and Confirmed by:*
WI2VSAT-1-REP-S Log Analysis Test Case Log File Analysis Results	**Rep 2**		*Performed and Confirmed by:*
WV2VMCT-1-S Log Analysis Test Case Log File Analysis Results	**Rep 2**		*Performed and Confirmed by:*
WI2VSAT-1-REP-S Driver Advisory/ Warning Visual Results	**Rep 3**		*Performed and Confirmed by:*
WI2VSAT-1-REP-S Log Analysis Test Case Log File Analysis Results	**Rep 3**		*Performed and Confirmed by:*

Test Case ID	Rep	WI2VSAT-1-REP-S	Test Engineer Verification and Remarks
WI2VMCT-1-L Log Analysis Test Case Log File Analysis Results	**Rep 3**		*Performed and Confirmed by:*
WI2VSAT-1-REP-S Driver Advisory/ Warning Visual Results	**Rep 4**		*Performed and Confirmed by:*
WI2VSAT-1-REP-S Log Analysis Test Case Log File Analysis Results	**Rep 4**		*Performed and Confirmed by:*
WI2VMCT-1-S Log Analysis Test Case Log File Analysis Results	**Rep 4**		*Performed and Confirmed by:*
WI2VSAT-1-REP-S Driver Advisory/ Warning Visual Results	**Rep 5**		*Performed and Confirmed by:*
WI2VSAT-1-REP-S Log Analysis Test Case Log File Analysis Results	**Rep 5**		*Performed and Confirmed by:*
WI2VMCT-1-S Log Analysis Test Case Log File Analysis Results	**Rep 5**		*Performed and Confirmed by:*
Test Case Analysis Tables			*Performed and Confirmed by:*
WI2VSAT-1-REP-S Pass/Fail Assessment			*Performed and Confirmed by:*
WI2VMCT-1-S Pass/Fail Assessment			

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.8 Table WI2VSAT-1-REP Requirements Verification Analysis

Table 2-8. WI2VSAT-1-REP Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-REP -- Message Display in Travel Lanes	LTS-REQ-1.1 -- WCVS LTS Time	The Wyoming CV System shall acquire time from the LTS interface in accordance with Section 5.10.1 of the ICD.	* Perform Test Case WI2VSAT-1-REP * Inspect DB Logs and locate 1 or more instances of formation of TIMs * Determine time TIM was formulated * Identify located TIMs and inspect time and compare to independent time source * Confirm message contains correct time message was sent, verifying requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-REP -- Message Display in Travel Lanes	LTS-REQ-1.2 -- WCVS Time Synchronization	The Wyoming CV System shall receive time synchronization information from a Stratum 2 NTP source, as described in Section 5.12.1 of the ICD.	* Perform Test Case WI2VSAT-1-REP * Inspect DB Logs and locate 1 or more instances of formation of TIMs * Determine time TIM was formulated * Identify located TIMs and inspect time and compare to independent time source * Confirm message contains correct time message was sent, verifying requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-REP -- Message Display in Travel Lanes	LTS-REQ-2 -- WCVS LTS Time Standard	The Wyoming CV System shall use Coordinated Universal Time (UTC) time for logged data (e.g., events logs and environmental data) based on the format defined in J2735 section 6.19 and epoch of January 1st 1970.	Perform Test Case WI2VSAT-1-REP * Inspect event logs and locate 1 or more instances of events * Inspect event(s) located and determine reported time(s) * Confirm time reported is Coordinated Universal Time (UTC), verifying requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-REP -- Message Display in Travel Lanes	LTS-REQ-3 -- WCVS LTS Location	The Wyoming CV System shall acquire location from the LTS interface in accordance with J2945/1 section 6.2.1.	* Perform Test Case WI2VSAT-1-REP * Inspect RSU Logs and locate 1 or more instances of TIMs sent * Inspect TIMs and compare location to independent location source * Confirm message contains correct location, verifying requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-REP -- Message Display in Travel Lanes	TRAC-REQ-1.2.1 -- Transmission Time	The Wyoming CV System shall transmit alerts to TRAC within five minutes of its generation in the system.	* Perform Test Case WI2VSAT-1-REP * Inspect DB logs. * Verify receipt of information from System * Verify generation of TIMs for alerts and time TIM was generated * Inspect TRAC logs and verify receipt of the corresponding alerts within five minutes of its generation in the system. * TRAC log of TIM within 5 minutes verifies the Wyoming CV System transmits alerts to TRAC within five minutes of its generation in the system, thereby verifying requirement.	Requirement Verification Confirmed by:
WI2VSAT-1-REP -- Message Display in Travel Lanes	WCVS-REQ-9 -- Create TIM	The Wyoming CV System shall create a Traveler Information Message (TIM) formatted as defined in J2735 – 5.16 Message: MSG_TravelerInformation Message (TIM).	* Perform test Case WI2VSAT-1-REP * Inspect DB Logs and confirm generation of TIMs * Inspect DB Logs and confirm output and distribution of TIM * Confirmation shows Wyoming CV System creates a Traveler Information Message (TIM) formatted as defined in J2735 – 5.16 Message: MSG_TravelerInformation Message (TIM), thereby verifying the requirement is satisfied. * (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	Requirement Verification Confirmed by:
WI2VSAT-1-REP -- Message Display in Travel Lanes	WCVS-REQ-17 -- Archive Data	The Wyoming CV System shall provide the TMC administrator the ability to archive data used by the CV pilot by writing CV data to the WYDOT Data Warehouse, data written to the Data Warehouse is automatically archived per existing TMC best practices.	* Perform Test Case WI2VSAT-1-REP. * Inspect TIM in DW and confirm storage of alert by DW. * Inspect DW Logs and confirm archive of TIM * Inspect TMC archives and confirm archive of BSM, TIM, and DNM messages * Confirmation shows Wyoming CV System provides the TMC administrator the ability to archive data used by the CV pilot by writing CV data to the WYDOT Data Warehouse, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-REP -- Message Display in Travel Lanes	VS-REQ-14 -- SA TIM-Region	The Vehicle System shall ingest received TIMs to identify the applicable regions of use geographical path (Part II defined in J2735 section 6.142). Data ingest is defined as obtaining and importing data for use or storage	* Perform Test Case WI2VSAT-1-REP * Confirm issuance of advisories and alerts at the location specified in the TIM. * Confirmation shows the Vehicle System ingests received TIMs to identify the applicable regions of use geographical path (Part II defined in J2735 section 6142), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-REP -- Message Display in Travel Lanes	VS-REQ-28 -- IVAA SA-Advisory	The Vehicle System shall alert the vehicle operator for a situational awareness advisory using an inform message when the host vehicle is traveling towards the segment where the situational awareness applies.	* Perform Test Case WI2VSAT-1-REP * Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm issuance of advisories and alerts at the location specified in the TIM. * Confirmation shows the Vehicle System alerts the vehicle operator for a situational awareness advisory using an inform message when the following conditions are met: i) Host vehicle is traveling towards the segment where the situational awareness applies; ii) Host vehicle meets the criteria for the advisory, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-REP -- Message Display in Travel Lanes	DB-REQ-5 -- Distribute to ODE	The DB shall share TIM information with the ODE, as defined in Section 5.21.2 of the ICD.	* Perform Test Case WI2VSAT-1-REP * Inspect DB logs. * Confirm 1 or more instances of DB generation of representative TIMs * Inspect ODE Logs * Confirm ODE receipt of 1 or more instances of representative DB TIMs * Confirmation shows the DB shares TIM information with the ODE, as defined in Section 5.21.2 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-REP -- Message Display in Travel Lanes	DB-REQ-7 -- Distribute to Data Warehouse	The DB shall transmit information to the Data Warehouse as defined in Table 5-2 of the SyRS.	* Perform Test Case WI2VSAT-1-REP * Inspect DB logs. * Confirm 1 or more instances of DB generation of representative TIMs * Inspect DW Logs * Confirm DW receipt of 1 or more instances of representative DB TIMs	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			* Confirmation shows the DB shares TIM information with the ODE, as defined in Section 5.21.2 of the ICD, thereby verifying the requirement is satisfied.	
WI2VSAT-1-REP -- Message Display in Travel Lanes	DB-REQ-9 -- Distribute to SDC	The DB shall manually upload data to the SDC as defined in ICD Section 5.39.1.	* Perform Test Case WI2VSAT-1-REP * Inspect DB logs. * Confirm 1 or more instances of DB generation of representative TIMs * Confirm 1 or more instances of manual upload of data to the SDC * Confirmation shows DB manual upload of data to the SDC as defined in ICD Section 5.39.1, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-REP -- Message Display in Travel Lanes	DW-REQ-1.3 -- Store TIM	The Data Warehouse shall store all TIMs distributed to the Vehicle System and the Situational Data Warehouse, as defined in WCVS-REQ-13.	* Perform Test Case WI2VSAT-1-REP * Inspect DB logs and verify generation of TIMs for alerts. * Inspect DB Logs and verify output of alert. * Inspect TIM in DW and verify storage of alert by DW. * Confirmation shows Data Warehouse stores all TIMs distributed to the Vehicle System and the Situational Data Warehouse, as defined in WCVS-REQ-13, thereby verifying the requirement is satisfied. (Note: Data written to the Data Warehouse is automatically archived per existing TMC best practices.)	Requirement Verification Confirmed by:
WI2VSAT-1-REP -- Message Display in Travel Lanes	DW-REQ-2.2 -- Share Data with SDC	The Data Warehouse shall transmit information to the Secure Data Commons, as defined in Section 5.38.1 of the ICD.	* Perform Test Case WI2VMCT-1(WI2VSAT-1-REP) * Inspect DB Logs and locate 1 or more instances of formation of TIMs. * Inspect Data Warehouse logs and located corresponding 1 or more instances of TIMs received. * Inspect Data Warehouse logs and locate corresponding 1 or more instances of TIM information sent to Secure Data Commons * Confirmation shows the Data Warehouse transmit	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			information to the Secure Data Commons, as defined in Section 5.37.1 of the ICD, thereby verifying the requirement is satisfied.	
WI2VSAT-1-REP -- Message Display in Travel Lanes	DW-REQ-2.3 -- Share Data with RDE	The Data Warehouse shall transmit information to the RDE, as defined in Section 5.41.1 of the ICD.	* Perform Test Case WI2VMCT-1(WI2VSAT-1-REP) * Inspect DB Logs and locate 1 or more instances of formation of TIMs. * Inspect Data Warehouse logs and located corresponding 1 or more instances of TIMs received. * Inspect Data Warehouse logs and locate corresponding 1 or more instances of TIM information sent to RDE * Confirmation shows the Data Warehouse transmit information to the RDE, as defined in Section 5411 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-REP -- Message Display in Travel Lanes	I2VSAP-REQ-1 -- Message Display in Travel Lanes	Situational Awareness Message(s) shall display in vehicles traveling in all travel lanes of the roadway in the direction specified in the I2V SA TIM.	* Perform Test Case WI2VSAT-1-REP * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine Roadway and lane of travel of vehicle. * Confirm Situational Awareness Message displays in vehicles traveling in all lanes of the roadway specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) display in vehicles traveling in all travel lanes of the roadway in the direction specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-REP -- Message Display in Travel Lanes	I2VSAP-REQ-4 -- Message Display Geofence Beginning	Situational Awareness Message(s) shall display within 8 meters, at a speed of 35 miles per hour, of beginning of geofence specified in the I2V SA TIM.	* Perform Test Case WI2VSAT-1-REP * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine Roadway and lane of travel of vehicle.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			* Confirm Situational Awareness Message displays within 8 meters of beginning of geofence specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) display within 8 meters, at a speed of 35 miles per hour, of beginning of geofence specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	
WI2VSAT-1-REP -- Message Display in Travel Lanes	I2VSAP-REQ-5 -- Message Display Geofence Ending	Situational Awareness Message(s) shall cease display within 8 meters, at a speed of 35 miles per hour, of end of geofence specified in the I2V SA TIM.	* Perform Test Case WI2VSAT-1-REP * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine Roadway and lane of travel of vehicle. * Confirm Situational Awareness Message displays within 8 meters of end of geofence specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) cease display within 8 meters, at a speed of 35 miles per hour, of end of geofence specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated with WI2VSAT-1-REP)	HSM-REQ-1 -- Receive from ODE	The HSM shall receive unsigned TIMs from the ODE as defined in Section 3.1.4.1 of the SDD.	* Perform Test Case WI2VMCT-1(WI2VSAT-1-REP) * Inspect Wyoming CV System ODE logs * Confirm Wyoming CV System ODE receives signed TIMs from the HSM. * Confirmation shows the HSM receives unsigned TIMs from the ODE as defined in section 3.1.4.1 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated with WI2VSAT-1-REP)	HSM-REQ-2 -- Share with ODE	The HSM shall provide signed TIMs to the ODE as defined in Section 3.1.4.1 of the SDD.	* Perform Test Case WI2VMCT-1(WI2VSAT-1-REP) * Inspect Wyoming CV System ODE logs * Confirm Wyoming CV System ODE receives signed TIMs from the HSM. * Confirmation shows the HSM provides signed TIMs to the ODE as defined in section 3.1.4.1 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated with WI2VSAT-1-REP)	HSM-REQ-3 -- Receive from SCMS	The HSM shall receive updated certificates from the SCMS as defined in Section 3.1.3 of the SDD.	* Perform Test Case WI2VMCT-1(WI2VSAT-1-REP) * Inspect Wyoming CV System ODE logs * Confirm Wyoming CV System ODE receives signed TIMs with up to date certificates from the HSM. * Confirmation shows the HSM receives updated certificates from the SCMS as defined in Section 3.1.3 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated with WI2VSAT-1-REP)	HSM-REQ-4 -- Share with SCMS	The HSM shall shares authentication data with the SCMS as defined in Section 3.1.3 of the SDD.	* Perform Test Case WI2VMCT-1(WI2VSAT-1-REP) * Inspect Wyoming CV System ODE logs * Confirm Wyoming CV System ODE receives signed TIMs with up to date certificates from the HSM. * Confirmation shows the HSM shares authentication data with the SCMS as defined in Section 3.1.3 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated with WI2VSAT-1-REP)	SCMS-REQ-1.1 -- SCMS Wyoming CV System Certificates	The Wyoming CV System shall download certificates from the USDOT SCMS.	* Perform Test Case WI2VMCT-1(WI2VSAT-1-REP) * Inspect Wyoming CV System SCMS logs * Confirm Wyoming CV System downloads certificates from the USDOT SCMS. * Confirmation shows the Wyoming CV System downloads certificates from the USDOT SCMS, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated with WI2VSAT-1-REP)	SDC-REQ-1 -- Data Provided to the SDC	The Wyoming CV System shall transmit information to the Secure Data Commons.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: ODE-REQ-3.6- WV2IMCT-2(WFCWT-1) DW-REQ-2.2-WI2VMCT-1(WI2VSAT-1-REP)	Requirement Verification Confirmed by:
WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated	RDE-REQ-1 -- Data Provided to the RDE	The Wyoming CV System shall transmit information to the Research Data Exchange.	This requirement is verified by verification of the following requirements when performing the corresponding Test Cases: ODE-REQ-3.6-WV2IMCT-2(WFCWT-1) DW-REQ-2.2-WI2VMCT-1(WI2VSAT-1-REP)	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
with WI2VSAT-1-REP)				
WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated with WI2VSAT-1-REP)	WCVS-REQ-10.1 -- Distribute TIM to VS	The Wyoming CV System shall distribute signed TIM to the Vehicle System consistent with Section 3.5.8 (Traveler Information Requirements) of J3067	* Perform Test Case WI2VMCT-1(WI2VSAT-REP) * Inspect DB logs and verify generation of TIMs. * Inspect DB Logs and verify output and distribution of TIM to Vehicle Systems via DSRC. * Confirmation shows Wyoming CV System distributes TIM to the Vehicle System consistent with Section 3.5.8 (Traveler Information Requirements) of J3067, thereby verifying the requirement is satisfied. * (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	Requirement Verification Confirmed by:
WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated with WI2VSAT-1-REP)	VS-REQ-2.1 -- Receive TIM through DSRC	The Vehicle System shall wirelessly receive a packet containing traveler information from the Wyoming CV System through DSRC	* Perform Test Case WI2VMCT-1(WI2VSAT-REP) * Inspect DB Logs and locate 1 or more instances of formation of TIMs. * Inspect OBU logs and locate corresponding instances of TIMs received by OBU via DSRC. * Confirmation shows the Vehicle System wirelessly receives a packet containing traveler information from the Wyoming CV System through DSRC, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated with WI2VSAT-1-REP)	ODE-REQ-7 -- Receive from Data Broker	The Operational Data Environment shall receive information from the Data Broker, as defined in Section 5.21.2 of the ICD.	* Perform Test Case WI2VMCT-1(WI2VSAT-1-REP) * Inspect DB Logs and locate 1 or more instances of formation of TIMs. * Inspect ODE logs and locate corresponding 1 or more instances of TIMs received. * Confirmation shows the Operational Data Environment receive information from the Data Broker, as defined in Section 5212 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs (Integrated	HP-REQ-2 -- Receive TIM over DSRC	Highway Patrol vehicles shall receive traveler information from the Wyoming CV System over DSRC. Traveler	* Perform Test Case WI2VMCT-1(WI2VSAT-REP) * Inspect DB Logs and locate 1 or more instances of formation of TIMs. * Inspect OBU logs and locate corresponding	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
with WI2VSAT-1-REP)		information may contain one or more packets of traveler information as defined in Section 5.16 of SAE J2735.	instances of TIMs received by OBU via DSRC. * Confirmation shows the Vehicle System wirelessly receives a packet containing traveler information from the Wyoming CV System through DSRC, thereby verifying the requirement is satisfied.	

2.9 Table WI2VSAT-1-Pikalert-L Description - Message Display in Travel Lanes – Pikalert Test Case Description

Table 2-9. WI2VSAT-1-Pikalert-L Description - Message Display in Travel Lanes – Pikalert Test Case Description

Test Case ID	**WI2VSAT-1-Pikalert-L**	**Test Engineer Verification and Remarks**
Test Case Name	Message Display in Travel Lanes - Pikalert	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WI2VSAT-1- Pikalert-Requirements	
Objective	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	

Test Case ID	WI2VSAT-1-Pikalert-L	Test Engineer Verification and Remarks
Back Office Component	Pikalert	
TIM	Spot Weather Impact Warning TIM	
Host Vehicle OBU/ Vehicle	Lear Roadstar OBU	
Vehicle direction versus message direction	Same direction	
Vehicle Lane of travel	Roadway Travel lanes	
Host Vehicle Driving Scenario (TC Input)	Host vehicle driving in travel lanes in "message direction". This is performed for Pikalert (Spot Weather Impact Warning).	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Driver observes beginning display of Spot Weather Impact Warning TIM Advisory/Warning within 8 meters of beginning of TIM specified geofence and cease of display within 8 meters of end of TIM specified geofence.	
Log File Analysis and Verification Method (Test Case Output 2)	Log files confirm beginning display of Spot Weather Impact Warning TIM Advisory/Warning within 8 meters of beginning of TIM specified geofence and cease of display within 8 meters of end of TIM specified geofence.	
Expected Result (Pass/Fail Criteria)	*Driver Advisory/Warning begins display within 8 meters of beginning of TIM specified geofence and ceases display within 8 meters of end of TIM specified geofence. Verified visually and by inspection of HMI logs.	
Detailed Execution Steps	**Verify Readiness** 1. Host vehicle has Lear LocoMate 300 OBU installed with antenna and HMI, configured according to the WYDOT CV Pilot OBU configuration. A lap top computer must be connected via an Ethernet cable to the OBU to implement initial log file offload verification. 2. Confirm that the test track Lear LocoMate 300 RSU is installed and configured according to the WYDOT CV Pilot RSU configuration.	

Test Case ID	WI2VSAT-1-Pikalert-L	Test Engineer Verification and Remarks
	3. Identify offload location where vehicles can drive to, to be within the offload range of the test track RSU. 4. Confirm that the test team includes both a driver and recorder for the host vehicle. 5. Create a spot weather (Pikealert) Traveler Information Message (TIM) along defined roadway section of the test track. The TIM start and endpoints on the roadway must be along a defined roadway section with specific known start and end points. The TIM should be an all direction TIM. 6. Define a track location, outside of the TIM zone, where the host vehicle can start driving to enter the TIM zone. Define a corresponding track location that is outside of the TIM zone after the vehicle would have completely traversed the TIM zone. **Test Start Up** 7. Drive the host vehicle to the offload location, power up the OBU. 8. Confirm that OBU powers up correctly and is linked to it's corresponding HMI. Confirm this by driving a short distance and validating that the vehicle speed and location update on the HMI to reflect the short drive. 9. While parked at the offload location execute the following steps to confirm log file generation and offload. 10. Log into the OBU and from the system shell issue a ping6 command to the backend host server for the WYDOT CV Pilot environment. This will confirm the full IPv6 connectivity from the OBU through the RSU to the WYDOT backend server. The ping command to issue is: i. #ping6 <backend server IPv6 address> 11. For the OBU confirm that log files are being generated. Confirm this by reviewing the event log directory on the OBU and checking that various log files are increasing in size. The specific log files to see increasing are either: i. /var/eventlog/bsmLogDuringEventc.csv Or ii. /var/eventlog/bsmTx.csv	

Test Case ID	WI2VSAT-1-Pikalert-L	Test Engineer Verification and Remarks
	12. For the OBU confirm that log files are being offloaded, when vehicle is at the designated offload location. Confirm this by checking the OBU log file and confirming that an rsync for the various /var/storage directories is being executed on a regular schedule. The log file path is /var/log/messages. The periodic rsync messages should look like the following list: offload_asd:syncing /var/storage/dnMsg/ offload_asd:syncing /var/storage/environmentMsg/ offload_asd:syncing /var/storage/driverAlert/ offload_asd:syncing /var/storage/upgrades/ offload_asd:syncing /var/storage/systemLog/ Once the log file generation and offload are confirmed the test repetitions can begin. **Driving the Test** 13. Begin by driving the host vehicle to the designated start position on the test track. 14. Drive the host vehicle on track towards the known start of the TIM zone. The host driver should initially focus on achieving and maintaining a test speed of 35 mph. Record the test repetition starting time. 15. Once the vehicle has entered the TIM zone the onboard recorder manually records any types of driver alerts issued to the driver. 16. After driving the length of the TIM zone and upon exiting, the recorder monitors the HMI display and records the approximate time when the TIM icon disappeared from the display. 17. The host vehicle then turns around outside of the TIM zone and sets up for a pass through the TIM zone in the opposite direction. 18. On this second traverse the recorder again monitors the HIM display and records approximate times when the TIM icons appear and disappear. 19. After exiting the TIM zone the host vehicle returns to the original start location ready to repeat the test again.	

Test Case ID	WI2VSAT-1-Pikalert-L	Test Engineer Verification and Remarks
	After final test repetition, the host vehicle drives to offload location and confirms that generated log files are offloaded (see test startup third step). **Analysis Procedure** 20. Execute a set of queries on the connected vehicle database to extract bsm and driver alert log records for the period of time around each I2V test run. These queries are implemented in a script that generates a KML file for display in Google Earth. This allows each bsm and driver alert record from each test vehicle to be plotted in the Google Earth application. The follow example command line runs the query script to generate the KML file for a test executed at the Archer test track that started 08 Jan 2018 02:15:10 pm MST and ended at 02:16:00 pm MST. Note that the time boundaries in the query are in Coordinated Universal Time (UTC). python create_kml.py circle --lat 41.150576 --long -104.654964 --distance 2000 --beginTime '2018-01-08 21:15:10' --endTime '2018-01-08 21:16:00' 21. Open the resulting KML file in Google Earth. The bsm records and driver alert records for the host vehicle will be visible along the path it traveled through the TIM zone. BSM records will appear as small arrows, driver alerts will appear as white triangles at each point in the vehicle trajectory that the driver alert was issued. Adjust the time slider so that appropriate BSM and driver alerts around the TIM zone test are visible. 22. Create two points in Google Earth map one each representing the start and end points of the TIM path. Enter the specified latitude and longitude values for both the start and end points. 23. Identify the BSM closest to each of the TIM zone start and end points. Record the time associated with the closest BSM. 24. Select the driver alert closest to the TIM starting path point, confirm this TIM driver alert represents the TIM alert. Record the time of this driver alert. 25. Subtract the time of the starting point BSM record from the time of the driver alert record to get the time from crossing the TIM boundary to the alert.	

Test Case ID	WI2VSAT-1-Pikalert-L	Test Engineer Verification and Remarks
	Time to alert = driver alert time – BSM time 26. Select the driver alert closest to the TIM ending path point, confirm this TIM driver alert represents the TIM alert. This driver alert indicates the point when the TIM alert was dismissed from the HMI display. Record the time of this driver alert. 27. Subtract the time of the ending point BSM record from the time of the driver alert record to get the time from crossing the TIM boundary to the alert. Time to dismiss alert = driver alert dismiss time – BSM time 28. To calculate the approximate distance between the alert time and the crossing of the TIM boundary, the latitude and longitude values for each point can be entered into the Haversine equation to generate an approximate distance between the points.	

2.10 Table WI2VSAT-1-Pikalert-L Results - Message Display in Travel Lanes

Table 2-10. WI2VSAT-1-Pikalert-L Results - Message Display in Travel Lanes

Test Case ID	Rep	WI2VSAT-1-Pikealert-L	Test Engineer Verification and Remarks
Test Case Name		Message Display in Travel Lanes - Pikalert	*Performed and Confirmed by:*
Test Case Completion Date			*Performed and Confirmed by:*
WI2VSAT-1-Pikealert-L Driver Advisory/ Warning Visual Results	**Rep 1**		*Performed and Confirmed by:*

Test Case ID	Rep	WI2VSAT-1-Pikealert-L	Test Engineer Verification and Remarks
WI2VSAT-1-Pikealert-L Test Case Log File Analysis Results	**Rep 1**		*Performed and Confirmed by:*
WI2VSAT-1-Pikealert-L Driver Advisory/ Warning Visual Results	**Rep 2**		*Performed and Confirmed by:*
WI2VSAT-1-Pikealert-L Test Case Log File Analysis Results	**Rep 2**		*Performed and Confirmed by:*
WI2VSAT-1-Pikealert-L Driver Advisory/ Warning Visual Results	**Rep 3**		*Performed and Confirmed by:*
WI2VSAT-1-Pikealert-L Test Case Log File Analysis Results	**Rep 3**		*Performed and Confirmed by:*
WI2VSAT-1-Pikealert-L Driver Advisory/ Warning Visual Results	**Rep 4**		*Performed and Confirmed by:*
WI2VSAT-1-Pikealert-L Test Case Log File Analysis Results	**Rep 4**		*Performed and Confirmed by:*
WI2VSAT-1-Pikealert-L Driver Advisory/ Warning Visual Results	**Rep 5**		*Performed and Confirmed by:*

Test Case ID	Rep	WI2VSAT-1-Pikealert-L	Test Engineer Verification and Remarks
WI2VSAT-1-Pikealert-L Test Case Log File Analysis Results	**Rep 5**		*Performed and Confirmed by:*
Test Case Analysis Tables			*Performed and Confirmed by:*
Pass/Fail Assessment			*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.11 Table WI2VSAT-1-Pikalert Requirements Verification Analysis

Table 2-11. WI2VSAT-1-Pikalert Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	TRAC-REQ-1.2.2 -- Segment Alerts-Pikalert	The Wyoming CV System shall transmit Pikalert segment-level alerts, defined in WCVS-REQ-4, to TRAC	* Perform Test Case WI2VSAT-1-Pikalert * Inspect DB logs. * Verify generation of TIMs for alerts for Spot Weather Impact Warning * Inspect TRAC logs and verify receipt of each of the corresponding alerts, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WTI-REQ-1.1.1 -- Transmission Time	They Wyoming CV System shall transmit alerts within five minutes of its generation in the system to the WTI.	* Perform Test Case WI2VSAT-1-Pikalert * Inspect DB logs. * Verify receipt of information from System * Verify generation of TIMs for alerts and time TIM was generated * Inspect WTI logs and verify receipt of the corresponding alerts within five minutes of its generation in the system. * WTI log of TIM within 5 minutes verifies the Wyoming CV System transmits alerts within five	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			minutes of its generation in the system to the WTI, thereby verifying requirement.	
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WTI-REQ-1.2.1 -- Forecast Time	The Wyoming CV System shall transmit forecast reports to WTI for pre-specified forecast windows determined by WYDOT (6, 12, 24, 48, 72 hours).	* Perform Test Case WI2VSAT-1-Pikalert. * Inspect Pikalert Logs and verify output of customizable forecast windows, such as 12, 24, 48, and 72 hours. * Inspect WTI logs and verify receipt of customizable forecast windows, such as 12, 24, 48, and 72 hours. * Receipt confirms the Wyoming CV System transmits forecast reports to WTI for pre-specified forecast windows determined by WYDOT (6, 12, 24, 48, 72 hours). thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WTI-REQ-1.2.2 -- Forecast Update	The Wyoming CV System shall update its forecast reports in WTI at WYDOT-determined intervals (every 12 hours for example).	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs and verify output of forecast updates at WYDOT-determined intervals. * Inspect WTI logs and verify output of forecast updates at WYDOT-determined intervals. * Output confirms that the Wyoming CV System updates its forecast reports in WTI at WYDOT-determined intervals (every 12 hours for example), thereby verifying requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	CVOP-REQ-1.1.1 -- Transmission Time	They Wyoming CV System shall transmit alerts within five minutes of its generation in the system to the CVOP.	* Perform Test Case WI2VSAT-1-Pikalert * Inspect DB logs. * Verify receipt of information from System * Verify generation of TIMs for alerts and time TIM was generated * Inspect CVOP logs and verify receipt of the corresponding alerts within five minutes of its generation in the system. * CVOP log of TIM within 5 minutes verifies the Wyoming CV System transmits alerts within five minutes of its generation in the system to the CVOP, thereby verifying requirement.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in	CVOP-REQ-1.2.1 -- Forecast Time	The Wyoming CV System shall transmit forecast reports to the CVOP for pre-specified forecast	Verified by WI2VSAT-1-Pikalert, inspection of Logs. * Perform Test Case WI2VSAT-1-Pikalert.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
Travel Lanes - Pikalert		windows determined by WYDOT (6, 12, 24, 48, 72 hours).	* Inspect Pikalert Logs and verify output of customizable forecast windows, such as 12, 24, 48, and 72 hours. * Inspect CVOP logs and verify receipt of customizable forecast windows, such as 12, 24, 48, and 72 hours. * Receipt confirms the Wyoming CV System transmits forecast reports to CVOP for pre-specified forecast windows determined by WYDOT (6, 12, 24, 48, 72 hours). thereby verifying the requirement is satisfied.	
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	CVOP-REQ-1.2.2 -- Forecast Update	The Wyoming CV System shall update its forecast reports in CVOP at WYDOT-determined intervals (every 12 hours for example).	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs and verify output of forecast updates at WYDOT-determined intervals. * Inspect CVOP logs and verify output of forecast updates at WYDOT-determined intervals. * Output confirms that the Wyoming CV System updates its forecast reports in CVOP at WYDOT-determined intervals (every 12 hours for example), thereby verifying requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WI-REQ-1 -- External Data Acquisition	The Wyoming CV System shall collect weather information from external sources, as defined in the Section 4.1 - Data Ingest Module Requirements of the Motorist Alert and Warning Application (NCAR, 2014)	* Perform Test Case WI2VSAT-1-Pikalert with Spot Weather Impact Warning alert from Pikalert. * Inspect Pikalert Logs * Confirm receipt of weather information from external sources, as defined in SyRS Section 4.1 * Receipt confirms the Wyoming CV System collects weather information from external sources, as defined in the Section 4.1 * Data Ingest Module Requirements of the Motorist Alert and Warning Application (NCAR, 2014), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WI-REQ-2 -- Fixed Data Acquisition	The Wyoming CV System shall receive road weather information system (RWIS) data from the WYDOT RWIS Server as defined in Section 4.1 – Data Ingest Module Requirements of the	* Perform Test Case WI2VSAT-1-Pikalert with Spot Weather Impact Warning alert from Pikalert. * Inspect Pikalert Logs * Confirm receipt of road weather information system (RWIS) data from the WYDOT RWIS Server	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		Motorist Alert and Warning Application (NCAR 2014).	* Receipt confirms the Wyoming CV System receives road weather information system (RWIS) data from the WYDOT RWIS Server as defined in Section 4.1 – Data Ingest Module Requirements of the Motorist Alert and Warning Application (NCAR 2014), thereby verifying the requirement is satisfied.	
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WCVS-REQ-4.1 -- Precipitation Hazard	The Wyoming CV System shall generate a precipitation type and intensity report every 5 minutes, as specified in Section 3.1.4.2 of the SDD.	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs and verify output of precipitation type and intensity every 5 minutes * Inspect DB logs and verify generation of TIMs for alerts from Pikalert (Spot Weather Impact Warning) * Inspect TIM and verify output of precipitation type and intensity * Confirmation shows Wyoming CV System generates a precipitation type and intensity report every 5 minutes, as specified in Section 3.1.4.2 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WCVS-REQ-4.2 -- Road Condition Hazard	The Wyoming CV System shall generate a pavement state and slickness flag report every 5 minutes, depending on input data, as specified in Section 3.1.4.2 of the SDD.	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs and verify output of a pavement state and slickness flag report every 5 minutes * Inspect DB logs and verify generation of TIMs for alerts from Pikalert (Spot Weather Impact Warning) * Inspect TIM and verify output of a pavement state and slickness flag * Confirmation shows Wyoming CV System generates a pavement state and slickness flag report every 5 minutes, as specified in Section 3.1.4.2 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WCVS-REQ-4.3 -- Visibility Hazard	The Wyoming CV System shall generate a visibility report, along with the condition causing it, every 5 minutes, as specified in Section 3.1.4.2 of the SDD.	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs and verify output of a visibility report, along with the condition causing it, every 5 minutes * Inspect DB logs and verify generation of TIMs for	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			alerts from Pikalert (Spot Weather Impact Warning) * Inspect TIM and verify output of a visibility report, along with the condition causing it * Confirmation shows Wyoming CV System generates a visibility report, along with the condition causing it, report every 5 minutes, as specified in Section 3.1.4.2 of the SDD, thereby verifying the requirement is satisfied.	
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WCVS-REQ-5.1 -- Atmospheric Forecasts	The Wyoming CV System shall produce atmospheric weather forecasts, at a minimum, for (a) atmospheric temperature, (b) probability of precipitation, (c) wind speed, and (d) wind direction	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs and confirm output of atmospheric weather forecasts. * Inspect DB logs and confirm generation of TIMs for alerts from Pikalert (Spot Weather Impact Warning) * Inspect TIM and confirm output of atmospheric weather forecasts for (a) atmospheric temperature, (b) probability of precipitation, (c) wind speed, and (d) wind direction * Confirmation shows Wyoming CV System produces atmospheric weather forecasts, at a minimum, for (a) atmospheric temperature, (b) probability of precipitation, (c) wind speed, and (d) wind direction, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WCVS-REQ-5.2 -- Road Weather Forecasts	The Wyoming CV System shall produce road weather forecasts, at a minimum, for (a) pavement temperature, and (b) subsurface temperature	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs and confirm output of atmospheric weather forecasts. * Inspect DB logs and confirm generation of TIMs for alerts from Pikalert (Spot Weather Impact Warning) * Inspect TIM and confirm output of road weather forecasts for (a) pavement temperature, and (b) subsurface temperature * Confirmation shows Wyoming CV System produces road weather forecasts, at a minimum, for (a) pavement temperature, and (b) subsurface temperature, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WCVS-REQ-5.3 -- Forecast Time	The Wyoming CV System shall generate forecast reports for customizable forecast windows. The windows of interest will be determined by WYDOT (6, 12, 24, 48 hours for example).	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs and confirm output of atmospheric weather forecasts. * Inspect DB logs and confirm generation of TIMs for alerts from Pikalert (Spot Weather Impact Warning) * Inspect TIM and confirm output of generates forecast reports for customizable forecast windows * Confirmation shows Wyoming CV System generates forecast reports for customizable forecast windows, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WCVS-REQ-5.4 -- Forecast Update	The Wyoming CV System shall generate forecast updates for customizable intervals. The update frequency will be determined by WYDOT and may vary based on time of year (every 3 hours for example in winter to 12 hours during summer).	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs and confirm output of atmospheric weather forecasts. * Inspect DB logs and confirm generation of TIMs for alerts from Pikalert (Spot Weather Impact Warning) * Inspect TIM and confirm output of forecast updates for customizable intervals * Confirmation shows Wyoming CV System generates forecast updates for customizable intervals, thereby verifying the requirement is satisfied	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WCVS-REQ-6 -- Associate Alerts and Forecast to Segments	The Wyoming CV System shall associate each alert and forecast to one or more road segments on I-80. Roadway segments are defined by WYDOT as sections of roadway between variable mileposts.	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert Logs and verify each alert and forecast is associated with one or more road segments on I-80. * Inspect DB logs and verify generation of TIMs for alerts from Pikalert (Spot Weather Impact Warning) * Inspect TIMs and verify each alert and forecast is associated with one or more road segments on I-80. * Confirmation shows Wyoming CV System associate each alert and forecast to one or more road segments on I-80, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	VS-REQ-21 -- SWIW TIM	The Vehicle System shall ingest received TIMs to identify advisories for wind and weather conditions (Part III content choice advisories defined in J2735 section 6.142 for ITIS - data elements 6.54 Weather Conditions and 6.55 Winds defined in J2540_2). Data ingest is defined as obtaining and importing data for use or storage.	* Perform test Case WI2VSAT-1-Pikalert with Spot Weather Impact Warning alert from Pikalert. * Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm receipt of TIMs identifying Spot Weather Impact Warning alert from Pikalert * Confirmation shows the Vehicle System ingests received TIMs to identify advisories for wind and weather conditions (Part III content choice advisories defined in J2735 section 6.142 for ITIS * data elements 6.54 Weather Conditions and 6.55 Winds defined in J2540_2), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	VS-REQ-22 -- SWIW TIM-Region	The Vehicle System shall ingest received TIMs to identify the applicable regions of use geographical path (Part II defined in J2735 section 6.142). Data ingest is defined as obtaining and importing data for use or storage.	* Perform test Case WI2VSAT-1-Pikalert with Spot Weather Impact Warning alert from Pikalert. * Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm receipt of TIMs identifying Spot Weather Impact Warning alert from Pikalert * Confirm message begins and ends display at correct geofence milepost * Confirmation shows the Vehicle System ingests received TIMs to identify advisories for wind and weather conditions (Part III content choice advisories defined in J2735 section 6.142 for ITIS * data elements 6.54 Weather Conditions and 6.55 Winds defined in J2540_2), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	VS-REQ-30 -- IVAA SWIW	The Vehicle System shall alert the vehicle operator of a spot weather incident when the host vehicle is traveling toward and within five miles of the incident's location using an inform message as defined in Section 2.6.5 of the SyRS.	* Perform test Case WI2VSAT-1-Pikalert * Inspect OBU logs. * Confirm receipt of TIMs by OBU. -Confirm receipt of TIMs identifying Spot Weather Impact Warning alert from Pikalert. * Confirm issuance of advisories and alerts at the location specified in the TIM. * Confirmation shows the Vehicle System alerts the vehicle operator of a spot weather incident when the host vehicle is traveling toward and within five	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			miles of the incident's location using an inform message as defined in Section 2.6.5 of the SyRS, thereby verifying the requirement is satisfied.	
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	PA-REQ-4.1 -- Distribute to DB	The Pikalert System shall transmit generated information to the Data Broker, as described in Section 5.27 of the ICD.	* Perform Test Case WI2VSAT-1-Pikalert * Inspect Pikalert logs * Identify 1 or more instances of alerts or advisories generated * Inspect DB logs * Confirm receipt 1 or more instances of alerts or advisories generated by DW * Confirmation shows the Pikalert System transmits generated information to the Data Broker, as described in Section 5.27 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
~~WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert~~	~~PA-REQ-4.2 -- Distribute to DW~~	~~The Pikalert System shall share generated information with the Data Warehouse within five minutes of generation of the alert, as described in Sections 5.27.1.3.1 and 5.27.2.3.1 of the ICD.~~	~~* Perform Test Case WI2VSAT-1-Pikalert~~ ~~* Inspect Pikalert logs~~ ~~* Identify 1 or more instances of alerts or advisories generated~~ ~~* Determine time Pikert generated instances of alerts or advisories~~ ~~* Inspect DW logs~~ ~~* Confirm receipt 1 or more instances of alerts or advisories generated by DW~~ ~~* Determine time Pikalert alerts and advisories were received by DW~~ ~~* Compute latency is less than 5 minutes~~ ~~* Confirmation shows the Pikalert System shares generated information with the Data Warehouse within five minutes of generation of the alert, as described in Sections 5.27.1.3.1 and 5.27.2.3.1 of the ICD, thereby verifying the requirement is satisfied.~~	Requirement Verification Confirmed by: *This requirement no longer applies to the system.*
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	DB-REQ-4.1 -- Receive Alerts and Advisories	The DB shall receive all generated segment-level alerts and advisories from Pikalert, as described in Section 5.27.1 of the ICD	* Perform Test Case WI2VSAT-1-Pikalert * Inspect DB logs. * Confirm DB receipt of generated segment-level alerts and advisories from Pikalert, as described in Section 5.26.2 of the ICD * Confirmation shows the DB receives all	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			generated segment-level alerts and advisories from Pikalert, as described in Section 5.27.1 of the ICD, thereby verifying the requirement is satisfied. * (Note: For system integration testing, WYDOT Team assumes demonstration of functionality in a single instance verifies functionality for "all" instances.)	
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	DB-REQ-4.2 -- Receive Forecast	The DB shall receive all generated segment-level forecast information from Pikalert, as described in Section 5.27.2 of the ICD	* Perform Test Case WI2VSAT-1-Pikalert * Inspect DB logs. * Confirm DB receipt of generated segment-level forecast information from Pikalert, as described in Section 5.26.3 of the ICD * Confirmation shows the DB receives all generated segment-level forecast information from Pikalert, as described in Section 5.26.3 of the ICD, thereby verifying the requirement is satisfied. * (Note: For system integration testing, WYDOT Team assumes demonstration of functionality in a single instance verifies functionality for "all" instances.)	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	DW-REQ-1.1.1 -- Store Alerts/Advisories-Precipitation Hazard	The Data Warehouse shall store all generated precipitation hazard alerts, advisories and forecasts, as defined in WCVS-REQ-12.	* Perform Test Case WI2VSAT-1-Pikalert * Inspect DW and verify storage of TIM containing precipitation type and intensity * Confirmation shows Wyoming CV System generates a precipitation type and intensity report every 5 minutes, as specified in Section 3.1.4.2 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	DW-REQ-1.1.2 -- Store Alerts/Advisories-Road Condition Hazard	The Data Warehouse shall store all generated road condition hazard alerts, advisories and forecasts, as defined in WCVS-REQ-12.	* Perform Test Case WI2VSAT-1-Pikalert * Inspect DW and verify storage of TIM containing a pavement state and slickness flag * Confirmation shows Wyoming CV System generates a pavement state and slickness flag report every 5 minutes, as specified in Section 3.1.4.2 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	DW-REQ-1.1.3 -- Store Alerts/Advisories-Visibility Hazard	The Data Warehouse shall store all generated visibility hazard alerts, advisories and forecasts, as defined in WCVS-REQ-12.	* Perform Test Case WI2VSAT-1-Pikalert * Inspect DW and verify storage of TIM containing a visibility report, along with the condition causing it * Confirmation shows Wyoming CV System generates a visibility report, along with the condition causing it, report every 5 minutes, as specified in Section 3.1.4.2 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

2.12 Table WI2VSAT-1-511-L Description - Message Display in Travel Lanes – 511 Test Case Description

Table 2-12. WI2VSAT-1-511-L Description - Message Display in Travel Lanes – 511 Test Case Description

Test Case ID	**WI2VSAT-1-511-L**	**Test Engineer Verification and Remarks**
Test Case Name	Message Display in Travel Lanes - 511	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WI2VSAT-1-511-Requirements	
Objective	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization.	

Test Case ID	WI2VSAT-1-511-L	Test Engineer Verification and Remarks
	• Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	511 System	
TIM	Truck Parking Advisory TIM	
Host Vehicle OBU/ Vehicle	Lear Roadstar OBU	
Vehicle direction versus message direction	Same direction	
Vehicle Lane of travel	Roadway Travel lanes	
Host Vehicle Driving Scenario (TC Input)	Host vehicle driving in travel lanes in "message direction". This is performed for 511 (Truck Parking).	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Driver observes beginning display of Truck Parking Advisory TIM Advisory/Warning within 8 meters of beginning of TIM specified geofence and cease of display within 8 meters of end of TIM specified geofence.	
Log File Analysis and Verification Method (Test Case Output 2)	Log files confirm beginning display of Truck Parking Advisory TIM Advisory/Warning within 8 meters of beginning of TIM specified geofence and cease of display within 8 meters of end of TIM specified geofence.	
Expected Result (Pass/Fail Criteria)	*Driver Advisory/Warning begins display within 8 meters of beginning of TIM specified geofence and ceases display within 8 meters of end of TIM specified geofence. Verified visually and by inspection of HMI logs.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* 1. Verify WYDOT CV Pilot TMC System is operational and ready for test 2. Verify RSUs are operational and ready for test 3. Cycle Host Vehicle power and reboot vehicle system.	

Test Case ID	WI2VSAT-1-511-L	Test Engineer Verification and Remarks
	4. Verify Host vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix 5. Conduct Safety Inspection of the test area and vehicle path and confirm ready for test a. No obstructions or interference b. All staff where they are supposed to be, no staff where they aren't supposed to be c. Weather is acceptable and will not lead to hazardous driving conditions d. Road surface is acceptable and will not lead to hazardous driving conditions 6. Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational 7. Host vehicle driver inspects driving area and confirm track is clear and ready for test. 8. Host Vehicle Driver and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure 9. I2V SA TIM is formulated by Data Broker and distributed to test RSU. **10.** • Host vehicle enters track from outside communication range and performs Host Vehicle Scenario.	

2.13 Table WI2VSAT-1-511-L Results - Message Display in Travel Lanes - 511

Table 2-13. WI2VSAT-1-511-L Results - Message Display in Travel Lanes - 511

Test Case ID	WI2VSAT-1-511-L	Test Engineer Verification and Remarks
Test Case Name	Message Display in Travel Lanes - 511	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*

Test Case ID	WI2VSAT-1-511-L	Test Engineer Verification and Remarks
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.14 Table WI2VSAT-1-511 Requirements Verification Analysis

Table 2-14. WI2VSAT-1-511 Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-511 -- Message Display in Travel Lanes - 511	WCVS-REQ-4.6 -- Parking	The Wyoming CV System shall generate a parking report within 5 minutes of receiving parking availability notification, as specified in Section 3.1.4.3 of the SDD.	* Perform Test Case WI2VSAT-1-511 * Inspect DB logs and verify generation of TIMs for a parking report within 5 minutes of receiving parking availability notification * Inspect TIM and verify output of a parking report * Confirmation shows Wyoming CV System generates a parking report within 5 minutes of receiving parking availability notification, as specified in Section 3.1.4.3 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-511 -- Message Display in Travel Lanes - 511	VS-REQ-13 -- SA TIM-Exit Services	The Vehicle System shall ingest received TIMs to identify Exit Services (Part III content choice exitService defined in J2735 section 6.142). This is used to provide parking information if necessary. Data ingest is defined as obtaining and importing data for use or storage	* Perform test Case WI2VSAT-1-511 * Inspect OBU Logs * Confirm receipt of 1 or more TIMs by OBU. * Confirm receipt of TIMs identifying truck parking availability from 511 (Truck Parking) * Confirm message display in travel lanes. * Confirmation shows the Vehicle System ingests received TIMs to identify Exit Services (Part III content choice exitService defined in J2735 section 6.142), thereby verifying the requirement is satisfied. (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	Requirement Verification Confirmed by:
WI2VSAT-1-511 -- Message Display in Travel Lanes - 511	DW-REQ-1.1.6 -- Store Alerts/Advisories-Parking	The Data Warehouse shall store all generated parking alerts and advisories, as defined in WCVS-REQ-12.	* Perform Test Case WI2VSAT-1-511 * Inspect DW and verify storage of TIM containing a parking report * Confirmation shows Wyoming CV System generates a parking report within 5 minutes of receiving parking availability notification, as specified in Section 3.1.4.3 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

2.15 Table WI2VSAT-1-RCRS-L Description - Message Display in Travel Lanes – RCRS Test Case Description

Table 2-15. WI2VSAT-1-RCRS-L Description - Message Display in Travel Lanes – RCRS Test Case Description

Test Case ID	WI2VSAT-1-RCRS-L	Test Engineer Verification and Remarks
Test Case Name	Message Display in Travel Lanes - RCRS	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WI2VSAT-1- RCRS-Requirements	
Objective	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	RCRS	
TIM	Road Condition Advisory TIM	
Host Vehicle OBU/ Vehicle	Lear Roadstar OBU	

Test Case ID	WI2VSAT-1-RCRS-L	Test Engineer Verification and Remarks
Vehicle direction versus message direction	Same direction	
Vehicle Lane of travel	Roadway Travel lanes	
Host Vehicle Driving Scenario (TC Input)	Host vehicle driving in travel lanes in "message direction". This is performed for RCRS (Road condition).	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Driver observes beginning display of Road condition Advisory TIM Advisory/Warning within 8 meters of beginning of TIM specified geofence and cease of display within 8 meters of end of TIM specified geofence.	
Log File Analysis and Verification Method (Test Case Output 2)	Log files confirm beginning display of Road condition Advisory TIM Advisory/Warning within 8 meters of beginning of TIM specified geofence and cease of display within 8 meters of end of TIM specified geofence.	
Expected Result (Pass/Fail Criteria)	*Driver Advisory/Warning begins display within 8 meters of beginning of TIM specified geofence and ceases display within 8 meters of end of TIM specified geofence. Verified visually and by inspection of HMI logs.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* 1. Verify WYDOT CV Pilot TMC System is operational and ready for test 2. Verify RSUs are operational and ready for test 3. Cycle Host Vehicle power and reboot vehicle system. 4. Verify Host vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix 5. Conduct Safety Inspection of the test area and vehicle path and confirm ready for test a. No obstructions or interference b. All staff where they are supposed to be, no staff where they aren’t supposed to be c. Weather is acceptable and will not lead to hazardous driving conditions	

Test Case ID	WI2VSAT-1-RCRS-L	Test Engineer Verification and Remarks
	d. Road surface is acceptable and will not lead to hazardous driving conditions 6. Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational 7. Host vehicle driver inspects driving area and confirm track is clear and ready for test. 8. Host Vehicle Driver and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure 9. I2V SA TIM is formulated by Data Broker and distributed to test RSU. **10.** Host vehicle enters track from outside communication range and performs Host Vehicle Scenario.	

2.16 Table WI2VSAT-1-RCRS-L Results - Message Display in Travel Lanes - RCRS

Table 2-16. WI2VSAT-1-RCRS-L Results - Message Display in Travel Lanes - RCRS

Test Case ID	WI2VSAT-1-RCRS-L	Test Engineer Verification and Remarks
Test Case Name	Message Display in Travel Lanes - RCRS	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*

Test Case ID	WI2VSAT-1-RCRS-L	Test Engineer Verification and Remarks
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.17 Table WI2VSAT-1-RCRS Requirements Verification Analysis

Table 2-17. WI2VSAT-1-RCRS Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-RCRS -- Message Display in Travel Lanes - RCRS	RCRS-REQ-1.1 -- Road Condition	The Wyoming CV System shall receive road condition information from the RCRS following the 8 Code System.	* Perform Test Case WI2VSAT-1-RCRS * Inspect DB Logs and locate 1 or more instances of receipt of road condition information from the RCRS * Confirm information follows the 8 Code System. * Receipt of RCRS information following the 8 codes system confirms the Wyoming CV System receives road condition information from the RCRS following the 8 Code System, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-RCRS -- Message Display in Travel Lanes - RCRS	RCRS-REQ-1.2 -- Weather	The Wyoming CV System shall receive atmospheric information from the RCRS following the 9 Code System.	* Perform Test Case WI2VSAT-1-RCRS * Inspect DB Logs and locate 1 or more instances of receipt of atmospheric information from the RCRS * Confirm information follows the 9 Code System. * Receipt of RCRS information following the 9 codes system confirms the Wyoming CV System receive atmospheric information from the RCRS following the 9 Code System, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-RCRS -- Message Display in	RCRS-REQ-1.3 -- Other Road Condition	The Wyoming CV System shall receive other road information	* Perform Test Case WI2VSAT-1-RCRS * Inspect DB Logs and locate 1 or more instances of receipt of other road information from the RCRS	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
Travel Lanes - RCRS		from RCRS following the 10 Code System.	* Confirm information follows the 10 Code System. * Receipt of RCRS information following the 10 codes system confirms The Wyoming CV System receives other road information from RCRS following the 10 Code System, thereby verifying the requirement is satisfied.	
WI2VSAT-1-RCRS -- Message Display in Travel Lanes - RCRS	RCRS-REQ-1.4 -- Report Time	The Wyoming CV System shall receive reports from RCRS containing a timestamp of when the operator entered the information into the app.	* Perform Test Case WI2VSAT-1-RCRS * Inspect DB Logs and locate 1 or more instances of receipt of road condition information from the RCRS * Verify reports from RCRS contain a timestamp of when the operator entered the information into the app * Timestamp of when the operator entered the information into the app confirms the Wyoming CV System receives reports from RCRS containing a timestamp of when the operator entered the information into the app, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-RCRS -- Message Display in Travel Lanes - RCRS	RCRS-REQ-1.5 -- Location	The Wyoming CV System shall receive reports from RCRS containing a location reference of when the operator entered the information into the app	* Perform Test Case WI2VSAT-1-RCRS * Inspect DB Logs and locate 1 or more instances of receipt of road condition information from the RCRS * Confirm reports from RCRS contain a location reference of when the operator entered the information into the app. * Location reference confirms The Wyoming CV System receives reports from RCRS containing a location reference of when the operator entered the information into the app, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-RCRS -- Message Display in Travel Lanes - RCRS	RCRS-REQ-1.6 -- Transmit Time	The Wyoming CV System shall receive reports from RCRS containing a timestamp of when the report was transmitted to the TMC. The transmitting timestamp may be different from the reporting time	* Perform Test Case WI2VSAT-1-RCRS * Inspect DB Logs and locate 1 or more instances of receipt of road condition information from the RCRS * Verify reports from RCRS contain a timestamp of when the report was transmitted to the TMC * Timestamp of when the report was transmitted to the TMC confirms the Wyoming CV System receives reports from RCRS containing a timestamp of when	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			the report was transmitted to the TMC, thereby verifying the requirement is satisfied.	

2.18 Table WI2VSAT-1-IC-L Description - Message Display in Travel Lanes – IC Test Case Description

Table 2-18. WI2VSAT-1-IC-L Description - Message Display in Travel Lanes – IC Test Case Description

Test Case ID	**WI2VSAT-1-IC-L**	**Test Engineer Verification and Remarks**
Test Case Name	Message Display in Travel Lanes - IC	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WI2VSAT-1-IC-Requirements	
Objective	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	IC	

Test Case ID	WI2VSAT-1-IC-L	Test Engineer Verification and Remarks
TIM	Incident Advisory TIM	
Host Vehicle OBU/ Vehicle	Lear Roadstar OBU	
Vehicle direction versus message direction	Same direction	
Vehicle Lane of travel	Roadway Travel lanes	
Host Vehicle Driving Scenario (TC Input)	Host vehicle driving in travel lanes in "message direction". This is performed for IC (Incident caution).	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Driver observes beginning display of Incident Advisory TIM Advisory/Warning within 8 meters of beginning of TIM specified geofence and cease of display within 8 meters of end of TIM specified geofence.	
Log File Analysis and Verification Method (Test Case Output 2)	Log files confirm beginning display of Incident Advisory TIM Advisory/Warning within 8 meters of beginning of TIM specified geofence and cease of display within 8 meters of end of TIM specified geofence.	
Expected Result (Pass/Fail Criteria)	*Driver Advisory/Warning begins display within 1 second of beginning of TIM specified geofence and ceases display within 8 meters of end of TIM specified geofence. Verified visually and by inspection of HMI logs.	
Detailed Execution Steps	**Verify Readiness** 1. Host vehicle has Lear LocoMate 300 OBU installed with antenna and HMI, configured according to the WYDOT CV Pilot OBU configuration. A lap top computer must be connected via an Ethernet cable or WiFi to the OBU to implement initial log file offload verification. 2. Confirm that the test location Lear LocoMate RSUs are installed and configured according to the WYDOT CV Pilot RSU configuration. 3. Identify offload location where vehicles can drive to, to be within the offload range of a test location RSU. 4. Confirm that the test team includes both a driver and recorder for the host vehicle.	

Test Case ID	WI2VSAT-1-IC-L	Test Engineer Verification and Remarks

5. Define the test set of TIM messages and locations along the test corridor for each TIM. Using the WYDOT Incident Console (IC) application create incident TIM messages at the specified test corridor locations. Record the configuration data for each TIM and confirm that they are the correct TIM type, at the correct location and for the correct start time and end time for test period.

Test Start Up

6. Drive both the host and remote vehicles to the offload location, power up each OBU in the host and remote vehicle.
7. Confirm that each OBU powers up correctly and is linked to it's corresponding HMI. Confirm this by driving a short distance and validating that the vehicle speed and location are updated on the HMI to reflect the short drive.
8. While parked at the offload location execute the following steps to confirm log file generation and offload.
   a. Log into each OBU and from the system shell issue a ping6 command to the backend host server for the WYDOT CV Pilot environment. This will confirm the full IPv6 connectivity from the OBU through the RSU to the WYDOT backend server. The ping command to issue is:
      i. #ping6 <backend server IPv6 address>
   b. For each OBU confirm that log files are being generated. Confirm this by reviewing the event log directory on the OBU and checking that various log files are increasing in size. The specific log files to see increasing are:
      i. /var/eventlog/bsmLogDuringEvent.csv
      ii. /var/eventlog/rxMsg.csv
   c. For each OBU confirm that log files are being offloaded, when vehicle is at the designated offload location. Confirm this by reviewing the offload subdirectories on the OBU and ensuring that they do not continuously accumulate log files. A few log files may accumulate (2-3), but within 30 seconds they should all offload and be removed from the log directory. The specific offload subdirectories to check are:
      i. /var/storage/bsmLogDuringEvent

Test Case ID	WI2VSAT-1-IC-L	Test Engineer Verification and Remarks
	ii. /var/storage/rxMsg Once the log file generation and offload are confirmed the test repetitions can begin. **Driving the Test** 9. Drive the host vehicle along the test corridor through the defined TIM zones. 10. When driving through each defined TIM zone, the recorder monitors the HMI and notes the times when TIM icons appear and disappear from the display. 11. After driving the full distance through the defined TIM zones, the host vehicle returns to its starting location to repeat the test again if necessary. After final test repetition, the host vehicle drives to a defined offload location and confirms that generated log files are offloaded (see test startup step 3). **Analysis Procedure** 29. Execute a set of queries on the DW to extract bsm and driver alert log records for the period of time during each transition of a TIM zone. These queries are implemented in a script that generates a KML file for display in Google Earth. This allows each bsm and driver alert record from each test vehicle to be plotted in the Google Earth application. The follow example command line runs the query script to generate the KML file for a test executed along the I-80 corridor starting at 03 Jul 2018 3:50:00 pm MST and ended at 04:09:00 pm MST. python create_kml.py circle --lat 41.150576 --long -104.654964 --distance 2000 --beginTime '2018-07-03 21:50:00' --endTime '2018-07-03 21:09:00' 30. Open the resulting KML file in Google Earth. The bsm records and driver alert records for each vehicle will be visible along the paths they traveled at the test site location. Bsm records from each vehicle will be in a different color. Driver alert records will be shown as white triangles at each point in the vehicle trajectory that	

Test Case ID	WI2VSAT-1-IC-L	Test Engineer Verification and Remarks
	the driver alert was issued or removed. Adjust the time slider so that appropriate bsm and driver alerts around the entrance of a TIM zone are visible. 31. Locate the beginning latitude and longitude location of the TIM geo-fence (based on the known TIM definition) on the Google Earth map. 32. Identify the closest BSM to the geofence boundary point. Record the time and vehicle speed associated with this BSM. 33. Identify the first TIM alert associated with the host vehicle crossing the TIM geofence boundary. Confirm that the TIM alert type matches the defined test TIM. Record the time of this TIM alert. 34. Subtract the geofence boundary BSM time from the TIM alert time to determine the time from boundary crossing to alert. Confirm this time is less than or equal to 1 second. 35. Locate the latitude and longitude of the TIM ending geo-fence (based on the known TIM definition) on the Google Earth map. 36. Identify the closest BSM to the geofence boundary point. Record the time and vehicle speed associated with this BSM. 37. Identify the TIM driver alert associated with the host vehicle crossing the TIM geo-fence boundary (this defines when the TIM was removed). Confirm that the TIM message type matches the defined test TIM. Record the time of this TIM alert. 38. Subtract the geofence boundary BSM time from the TIM alert time to determine the time from boundary crossing to alert. Confirm this time is less than or equal to 1 second.	

2.19 Table WI2VSAT-1-IC-L Results - Message Display in Travel Lanes - IC

Table 2-19. WI2VSAT-1-IC-L Results - Message Display in Travel Lanes - IC

Test Case ID	**WI2VSAT-1-IC-L**	**Test Engineer Verification and Remarks**
Test Case Name	Message Display in Travel Lanes - IC	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.20 Table WI2VSAT-1-IC Requirements Verification Analysis

Table 2-20. WI2VSAT-1-IC Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-IC -- Message Display in Travel Lanes - IC	TPI-REQ-1 -- TPI Data	The Wyoming CV System shall transmit traffic condition information to the WYDOT TPI, as described in Section 5.36.1 of the ICD.	* Conduct Test Case WI2VSAT-1-IC. * Inspect DW logs. * Confirm DW sends incident information to TPI. * DW distribution of incident information to TPI confirms the Wyoming CV System transmits traffic condition information to the WYDOT TPI, as described in Section 5.36.1 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-IC -- Message Display in Travel Lanes - IC	IC-REQ-1 -- IC Data Sharing	The Wyoming CV System shall receive timestamped incident information from the IC.	* Perform Test Case WI2VSAT-1-IC * Inspect DB Logs * Confirm receipt of incident information from the IC * Confirm incident information is timestamped. * Receipt confirms the Wyoming CV System receives timestamped incident information from the IC, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-IC -- Message Display in Travel Lanes - IC	IC-REQ-2 -- Protocol	The Wyoming CV System shall receive incident information, based on HTTP protocol, from the IC. The HTTP protocol used will be based on the six part specifications RFC 7230-RFC 7235.	* Perform Test Case WI2VSAT-1-IC * Inspect DB Logs * Confirm receipt of work zone information from the IC * Verify transmittal is based upon HTTP Protocol * Receipt confirms the Wyoming CV System receives incident information, based on HTTP protocol, from the IC, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-IC -- Message Display in Travel Lanes - IC	IC-REQ-3 -- Schema	The Wyoming CV System shall receive incident information from WYDOT IC, as described in Section 5.31.1 of the ICD.	* Perform Test Case WI2VSAT-1-IC * Inspect DB Logs * Confirm receipt of incident information from the IC * Receipt confirms the Wyoming CV System receives incident information from WYDOT IC, as	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			described in Section 5.32.1 of the ICD, thereby verifying the requirement is satisfied.	
WI2VSAT-1-IC -- Message Display in Travel Lanes - IC	IC-REQ-4 -- Transmission	The Wyoming CV System shall receive Road Incident data from WYDOT Incident Console within five minutes of generation	* Perform Test Case WI2VSAT-1-IC * Inspect CA Logs and verify transmission of incident information from the IC * Determine time incident information was available. * Inspect DB Logs and verify receipt of incident information from the IC * Determine time incident information was received by DB * Compute latency of delivery. * Receipt within 5 minutes confirms the Wyoming CV System receives incident information from WYDOT IC within five minutes of generation, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-IC -- Message Display in Travel Lanes - IC	WCVS-REQ-4.5 -- Incident Hazard	The Wyoming CV System shall generate an incident report within 5 minutes of receiving incident notifications from the Incident Console (defined in IC-REQ-1), as specified in Section 3.1.4.3 of the SDD.	* Perform Test Case WI2VSAT-1-IC * Inspect DB logs and verify generation of TIMs for an incident report within 5 minutes of receiving incident notifications from the Incident Console * Inspect TIM and verify output of an incident report * Confirmation shows Wyoming CV System generates an incident report within 5 minutes of receiving incident notifications from the Incident Console (defined in IC-REQ-1), as specified in Section 3.1.4.3 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-IC -- Message Display in Travel Lanes - IC	DW-REQ-1.1.5 -- Store Alerts/Advisories-Incident Hazard	The Data Warehouse shall store all generated incident hazard alerts and advisories, as defined in WCVS-REQ-12.	* Perform Test Case WI2VSAT-1-IC * Inspect DW and verify storage of TIM containing an incident report * Confirmation shows Wyoming CV System generates an incident report within 5 minutes of receiving incident notifications from the Incident Console (defined in IC-REQ-1), as specified in Section 3.1.4.3 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-IC -- Message Display in Travel Lanes - IC	DW-REQ-2.1 -- Share Data with TPI	The Data Warehouse shall transmit information to the TPI, as defined in Section 5.36.1 of the ICD.	* Perform Test Case WI2VSAT-1-IC. * Inspect DB Logs and locate 1 or more instances of formation of TIMs. * Inspect Data Warehouse logs and located corresponding 1 or more instances of TIMs received. * Inspect Data Warehouse logs and locate corresponding 1 or more instances of TIM information sent to TPI * Confirmation shows the Data Warehouse transmit information to the TPI, as defined in Section 5361 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

2.21 Table WI2VSAT-1-CA-L Description - Message Display in Travel Lanes – CA Test Case Description

Table 2-21. WI2VSAT-1-CA-L Description - Message Display in Travel Lanes - CA Test Case Description

Test Case ID	**WI2VSAT-1-CA-L**	**Test Engineer Verification and Remarks**
Test Case Name	Message Display in Travel Lanes - CA	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WI2VSAT-1-CA-Requirements	
Objective	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	CA	
TIM	Work Zone Warning TIM	
Host Vehicle OBU/ Vehicle	Lear Roadstar OBU	

Test Case ID	WI2VSAT-1-CA-L	Test Engineer Verification and Remarks
Vehicle direction versus message direction	Same direction	
Vehicle Lane of travel	Roadway Travel lanes	
Host Vehicle Driving Scenario (TC Input)	Host vehicle driving in travel lanes in "message direction". This is performed for CA (Work Zone Warning).	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Driver observes beginning display of Work Zone Warning TIM Advisory/Warning within 8 meters of beginning of TIM specified geofence and cease of display within 8 meters of end of TIM specified geofence.	
Log File Analysis and Verification Method (Test Case Output 2)	Log files confirm beginning display of Work Zone Warning TIM Advisory/Warning within 8 meters of beginning of TIM specified geofence and cease of display within 8 meters of end of TIM specified geofence.	
Expected Result (Pass/Fail Criteria)	*Driver Advisory/Warning begins display within 8 meters of beginning of TIM specified geofence and ceases display within 8 meters of end of TIM specified geofence. Verified visually and by inspection of HMI logs.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* **1.** Verify WYDOT CV Pilot TMC System is operational and ready for test **2.** Verify RSUs are operational and ready for test **3.** Cycle Host Vehicle power and reboot vehicle system. **4.** Verify Host vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix **5.** Conduct Safety Inspection of the test area and vehicle path and confirm ready for test a. No obstructions or interference b. All staff where they are supposed to be, no staff where they aren’t supposed to be c. Weather is acceptable and will not lead to hazardous driving conditions	

Test Case ID	WI2VSAT-1-CA-L	Test Engineer Verification and Remarks
	d. Road surface is acceptable and will not lead to hazardous driving conditions **6.** Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational **7.** Host vehicle driver inspects driving area and confirm track is clear and ready for test. **8.** Host Vehicle Driver and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure **9.** I2V SA TIM is formulated by Data Broker and distributed to test RSU. **10.** Host vehicle enters track from outside communication range and performs Host Vehicle Scenario.	

2.22 Table WI2VSAT-1-CA-L Results - Message Display in Travel Lanes - CA

Table 2-22. WI2VSAT-1-CA-L Results - Message Display in Travel Lanes - CA

Test Case ID	WI2VSAT-1-CA-L	Test Engineer Verification and Remarks
Test Case Name	Message Display in Travel Lanes - CA	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*

Test Case ID	WI2VSAT-1-CA-L	Test Engineer Verification and Remarks
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.23 Table WI2VSAT-1-CA Requirements Verification Analysis

Table 2-23. WI2VSAT-1-CA Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-CA -- Message Display in Travel Lanes - CA	CA-REQ-1 -- CA Data Sharing	The Wyoming CV System shall receive timestamped work zone information from the CA.	* Perform Test Case WI2VSAT-1-CA * Inspect DB Logs * Confirm receipt of work zone information from the CA * Confirm work zone information is timestamped. * Receipt confirms the Wyoming CV System receives timestamped work zone information from the CA, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-CA -- Message Display in Travel Lanes - CA	CA-REQ-2 -- Protocol	The Wyoming CV System shall receive work zone information, based on HTTP protocol, from the CA.	* Perform Test Case WI2VSAT-1-CA * Inspect DB Logs * Confirm receipt of work zone information from the CA * Verify transmittal is based upon HTTP Protocol * Receipt confirms the Wyoming CV System receives work zone information, based on HTTP protocol, from the CA, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-CA -- Message Display in Travel Lanes - CA	CA-REQ-3 -- Schema	The Wyoming CV System shall receive work zone information from WYDOT CA, as described in Section 5.32.1 of the ICD.	* Perform Test Case WI2VSAT-1-CA * Inspect DB Logs and * Confirm receipt of work zone information from the CA * Receipt confirms the Wyoming CV System receives work zone information from WYDOT CA, as described in Section 5.32.1 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-CA -- Message Display in Travel Lanes - CA	CA-REQ-4 -- Transmission	The Wyoming CV System shall receive work zone data from WYDOT Construction Administrator within thirty minutes of generation.	* Perform Test Case WI2VSAT-1-CA * Inspect CA Logs and verify transmission of work zone information from the CA * Determine time work zone information was available. * Inspect DB Logs and verify receipt of work zone information from the CA. * Determine time work zone information was received by DB. * Compute latency of delivery. * Receipt within 30 minutes confirms the Wyoming CV System receives work zone data from WYDOT Construction Administrator within thirty minutes of generation, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-CA -- Message Display in Travel Lanes - CA	WCVS-REQ-4.4 -- Work Zone Hazard	The Wyoming CV System shall generate a work zone report within 5 minutes of receiving work zone information from the Construction Administration (defined in CA-REQ-1), as specified in Section 3.1.5.4 of the SDD.	* Perform Test Case WI2VSAT-1-CA * Inspect DB logs and verify generation of TIMs for work zone report within 5 minutes of receiving work zone information * Inspect TIM and verify output of a work zone report * Confirmation shows Wyoming CV System generates a work zone report within 5 minutes of receiving work zone information from the Construction Administration (defined in CA-REQ-1), as specified in Section 3.1.5.4 of the SDD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-CA -- Message Display in Travel Lanes - CA	VS-REQ-19 -- WZW TIM	The Vehicle System shall ingest received TIMs to identify work zone warnings (Part III content	* Perform Test Case WI2VSAT-1-CA * Inspect OBU logs. * Confirm receipt of TIMs by OBU	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		choice workZone defined in J2735 section 6.142). Data ingest is defined as obtaining and importing data for use or storage.	* Confirm receipt of TIMs identifying alerts from CA (Work Zone Warning) * Confirmation shows the Vehicle System ingests received TIMs to identify work zone warnings (Part III content choice workZone defined in J2735 section 6.142), thereby verifying the requirement is satisfied.	
WI2VSAT-1-CA -- Message Display in Travel Lanes - CA	VS-REQ-20 -- WZW TIM-Region	The Vehicle System shall ingest received TIMs to identify the applicable regions of use geographical path (Part II defined in J2735 section 6.142). Data ingest is defined as obtaining and importing data for use or storage.	* Perform Test Case WI2VSAT-1-CA * Inspect OBU logs. * Confirm receipt of TIMs by OBU * Confirm receipt of TIMs identifying alerts from CA (Work Zone Warning) * Confirm message begins and ends display at correct geofence milepost * Confirmation shows the Vehicle System ingests received TIMs to identify the applicable regions of use geographical path (Part II defined in J2735 section 6.142), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-CA -- Message Display in Travel Lanes - CA	VS-REQ-31 -- IVAA WZW	The Vehicle System shall alert the vehicle operator of a work zone, based on the information defined in requirement CA-REQ-3, when host vehicle is traveling towards and within two miles of the location of a work zone using an inform message as defined in Section 2.6.4 of the SyRS.	* Perform Test Case WI2VSAT-1-CA * Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm receipt of TIMs identifying alerts from CA (Work Zone Warning) * Confirm issuance of advisories and alerts at the location specified in the TIM. * Confirmation shows the Vehicle System alerts the vehicle operator of a work zone, based on the information defined in requirement CA-REQ-3, when host vehicle is traveling towards and within two miles of the location of a work zone using an inform message as defined in Section 2.6.4 of the SyRS, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-CA -- Message Display in Travel Lanes - CA	DW-REQ-1.1.4 -- Store Alerts/Advisories-Work Zone Hazard	The Data Warehouse shall store all generated work zone hazard alerts and advisories, as defined in WCVS-REQ-12.	* Perform Test Case WI2VSAT-1-CA * Inspect DW and verify storage of TIM containing a work zone report * Confirmation shows Wyoming CV System	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			generates a work zone report within 5 minutes of receiving work zone information from the Construction Administration (defined in CA-REQ-1), as specified in Section 3.1.5.4 of the SDD, thereby verifying the requirement is satisfied.	

2.24 Table WI2VSAT-1- WTI-Speed-L Description - Message Display in Travel Lanes- WTI-Speed Test Case Description

Table 2-24. WI2VSAT-1- WTI-Speed-L Description - Message Display in Travel Lanes- WTI-Speed Test Case Description

Test Case ID	**WI2VSAT-1-WTI-Speed-L**	**Test Engineer Verification and Remarks**
Test Case Name	Message Display in Travel Lanes - WTI Speed	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WI2VSAT-1-WTI Speed-Requirements	
Objective	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	

Test Case ID	WI2VSAT-1-WTI-Speed-L	Test Engineer Verification and Remarks
Back Office Component	WTI	
TIM	Variable Speed Limit Advisory	
Host Vehicle OBU/ Vehicle	Lear Roadstar OBU	
Vehicle direction versus message direction	Same direction	
Vehicle Lane of travel	Roadway Travel lanes	
Host Vehicle Driving Scenario (TC Input)	Host vehicle driving in travel lanes in "message direction". This is performed for WTI (Variable Speed Limit).	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Driver observes beginning display of Variable Speed Limit Advisory TIM Advisory/Warning within 8 meters of beginning of TIM specified geofence and cease of display within 8 meters of end of TIM specified geofence.	
Log File Analysis and Verification Method (Test Case Output 2)	Log files confirm beginning display of Variable Speed Limit Advisory TIM Advisory/Warning within 8 meters of beginning of TIM specified geofence and cease of display within 8 meters of end of TIM specified geofence.	
Expected Result (Pass/Fail Criteria)	*Driver Advisory/Warning begins display within 8 meters of beginning of TIM specified geofence and ceases display within 8 meters of end of TIM specified geofence. Verified visually and by inspection of HMI logs.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* **1.** Verify WYDOT CV Pilot TMC System is operational and ready for test **2.** Verify RSUs are operational and ready for test **3.** Cycle Host Vehicle power and reboot vehicle system. **4.** Verify Host vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix	

Test Case ID	WI2VSAT-1-WTI-Speed-L	Test Engineer Verification and Remarks
	5. Conduct Safety Inspection of the test area and vehicle path and confirm ready for test a. No obstructions or interference b. All staff where they are supposed to be, no staff where they aren't supposed to be c. Weather is acceptable and will not lead to hazardous driving conditions d. Road surface is acceptable and will not lead to hazardous driving conditions **6.** Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational **7.** Host vehicle driver inspects driving area and confirm track is clear and ready for test. **8.** Host Vehicle Driver and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure **9.** I2V SA TIM is formulated by Data Broker and distributed to test RSU. **10.** Host vehicle enters track from outside communication range and performs Host Vehicle Scenario.	

2.25 Table WI2VSAT-1- WTI-Speed-L Results - Message Display in Travel Lanes- WTI-Speed

Table 2-25. WI2VSAT-1- WTI-Speed-L Results - Message Display in Travel Lanes- WTI-Speed

Test Case ID	WI2VSAT-1-WTI-Speed-L	Test Engineer Verification and Remarks
Test Case Name	Message Display in Travel Lanes - WTI Speed	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*

Test Case ID	WI2VSAT-1-WTI-Speed-L	Test Engineer Verification and Remarks
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.26 Table WI2VSAT-1-WTI-Speed Requirements Verification Analysis

Table 2-26. WI2VSAT-1-WTI-Speed Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-WTI-Speed -- Message Display in Travel Lanes - WTI Speed	WTI-REQ-2.1 -- Posted Speed	The Wyoming CV System shall receive notification that current posted speed for a segment is changed	* Perform Test Case WI2VSAT-1-WTI-Speed. * Inspect WTI Logs and verify output of current information for corridor roadway segments. * Verify receipt of notification that current posted speed for the segment has changed * Receipt confirms that the Wyoming CV System receives notification that current posted speed for the segment is changed, thereby verifying the requirement	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-WTI-Speed -- Message Display in Travel Lanes - WTI Speed	VS-REQ-11 -- SA TIM-Advisories	The Vehicle System shall ingest received TIMs to identify advisories (Part III content choice ITIS.ITIScodesAndText defined in J2735 section 6.142). Data ingest is defined as obtaining and importing data for use or storage	* Perform test Case WI2VSAT-1-WTI-Speed * Inspect OBU Logs * Confirm receipt of 1 or more TIMs by OBU. * Confirm message display in travel lanes * Confirmation shows the Vehicle System ingests received TIMs to identify advisories (Part III content choice ITIS.ITIScodesAndText defined in J2735 section 6.142), thereby verifying the requirement is satisfied. (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	Requirement Verification Confirmed by:
WI2VSAT-1-WTI-Speed -- Message Display in Travel Lanes - WTI Speed	VS-REQ-12 -- SA TIM-Speed Limit	The Vehicle System shall ingest received TIMs to identify speed limits (Part III content choice speedLimit defined in J2735 section 6.142). Data ingest is defined as obtaining and importing data for use or storage	* Perform test Case WI2VSAT-1-WTI-Speed * Inspect OBU Logs * Confirm receipt of 1 or more TIMs by OBU. * Confirm receipt of TIMs identifying speed limits from WTI (Variable Speed Limit) * Confirm message display in travel lanes. * Confirmation shows the Vehicle System ingests received TIMs to identify speed limits (Part III content choice speedLimit defined in J2735 section 6.142), thereby verifying the requirement is satisfied. (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	Requirement Verification Confirmed by:
WI2VSAT-1-WTI-Speed -- Message Display in Travel Lanes - WTI Speed	VS-REQ-29 -- IVAA SA-VSL	The Vehicle System shall inform the vehicle operator of the current speed limit of the variable speed limit zone the vehicle is within using an inform message. Additionally, when the host vehicle is traveling towards and within one mile of a variable speed limit	* Perform Test Case WI2VSAT-1-WTI-Speed * Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm receipt of TIMs identifying speed limits from WTI (Variable Speed Limit) * Confirm issuance of advisories and alerts at the location specified in the TIM. * Confirmation shows the Vehicle System informs	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		zone, the Vehicle System shall inform the vehicle operator of the speed limit using an inform message.	the vehicle operator of the current speed limit of the variable speed limit zone the vehicle is within using an inform message. Additionally, when the host vehicle is traveling towards and within one mile of a variable speed limit zone, the Vehicle System informs the vehicle operator of the speed limit using an inform message, thereby verifying the requirement is satisfied.	
WI2VSAT-1-WTI-Speed -- Message Display in Travel Lanes - WTI Speed	DB-REQ-8 -- Receive Data from DW	The DB shall receive current TIM information from the DW. Current TIM information is defined in DB-REQ-7.	* Perform Test Case WI2VSAT-1-WTI-Speed * Note: When a new TIM is issued to RSUs and Satellite the TIM data is also stored in the Data Warehouse. When an existing TIM needs to be updated, the existing TIM is retrieved from the Data Warehouse, revised, and resent to the RSUs and Satellite, rather than generating a new TIM. * Initiate variable speed limit for corridor roadway segment and specify new speed limit. * Inspect WTI Logs and verify output of specified speed for corridor roadway segments. * Inspect DW Logs * Confirm DW receipt of 1 or more instances of TIMs with specified Speed for corridor roadway segments. * Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm receipt of TIMs specifying new speed limit from WTI (Variable Speed Limit) * Change specified speed for corridor roadway segment in WTI. * Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm receipt of TIMs specifying changed speed limit from WTI (Variable Speed Limit) * Receipt of TIM with changed speed limit confirms DB receives current TIM information from the DW, thereby verifying the requirement.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-WTI-Speed -- Message Display in Travel Lanes - WTI Speed	DW-REQ-2.4 -- Share Data with DB	The DW shall share current TIM information, including starting and stopping milepost, TIM ID, active RSU ID, and RSU TIM index, with the DB. The DW receives TIM information from the DB, as defined in DB-REQ-7	* Perform Test Case WI2VSAT-1-WTI-Speed * Note: When a new TIM is issued to RSUs and Satellite the TIM data is also stored in the Data Warehouse. When an existing TIM needs to be updated, the existing TIM is retrieved from the Data Warehouse, revised, and resent to the RSUs and Satellite, rather than generating a new TIM. * Initiate variable speed limit for corridor roadway segment and specify new speed limit. * Inspect WTI Logs and verify output of specified speed for corridor roadway segments. * Inspect DW Logs * Confirm DW receipt of 1 or more instances of TIMs with specified Speed for corridor roadway segments. * Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm receipt of TIMs specifying new speed limit from WTI (Variable Speed Limit) * Change specified speed for corridor roadway segment in WTI. * Inspect DB logs. * Verify receipt of current TIM information, including starting and stopping milepost, TIM ID, active RSU ID, and RSU TIM index. * Receipt of current TIM information, including starting and stopping milepost, TIM ID, active RSU ID, and RSU TIM index confirms receipt of current information from the DW, thereby verifying the requirement. * Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm receipt of TIMs specifying changed speed limit from WTI (Variable Speed Limit) * Receipt of TIM with changed speed limit confirms DB receives current TIM information from the DW, thereby verifying the requirement.	Requirement Verification Confirmed by:

2.27 Table WI2VSAT-1- WTI-Restriction Description - Message Display in Travel Lanes - WTI-Restriction Test Case Description

Table 2-27. WI2VSAT-1- WTI-Restriction Description - Message Display in Travel Lanes - WTI-Restriction Test Case Description

Test Case ID	**WI2VSAT-1-WTI-Restriction-L**	**Test Engineer Verification and Remarks**
Test Case Name	Message Display in Travel Lanes - WTI - Restriction	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WI2VSAT-1-WTI-Restriction-Requirements	
Objective	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	WTI	
TIM	Vehicle Restriction Advisory	
Host Vehicle OBU/ Vehicle	Lear Roadstar OBU	

Vehicle direction versus message direction	Same direction	
Vehicle Lane of travel	Roadway Travel lanes	
Host Vehicle Driving Scenario (TC Input)	Host vehicle driving in travel lanes in "message direction". This is performed for WTI (Vehicle Restriction).	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Driver observes beginning display of Vehicle Restriction Advisory TIM Advisory/Warning within 8 meters of beginning of TIM specified geofence and cease of display within 8 meters of end of TIM specified geofence.	
Log File Analysis and Verification Method (Test Case Output 2)	Log files confirm beginning display of Vehicle Restriction Advisory TIM Advisory/Warning within 8 meters of beginning of TIM specified geofence and cease of display within 8 meters of end of TIM specified geofence.	
Expected Result (Pass/Fail Criteria)	*Driver Advisory/Warning begins display within 8 meters of beginning of TIM specified geofence and ceases display within 8 meters of end of TIM specified geofence. Verified visually and by inspection of HMI logs.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* **1.** Verify WYDOT CV Pilot TMC System is operational and ready for test **2.** Verify RSUs are operational and ready for test **3.** Cycle Host Vehicle power and reboot vehicle system. **4.** Verify Host vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix **5.** Conduct Safety Inspection of the test area and vehicle path and confirm ready for test a. No obstructions or interference b. All staff where they are supposed to be, no staff where they aren’t supposed to be c. Weather is acceptable and will not lead to hazardous driving conditions d. Road surface is acceptable and will not lead to hazardous driving conditions	

	6. Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational **7.** Host vehicle driver inspects driving area and confirm track is clear and ready for test. **8.** Host Vehicle Driver and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure **9.** I2V SA TIM is formulated by Data Broker and distributed to test RSU. **10.** Host vehicle enters track from outside communication range and performs Host Vehicle Scenario.

2.28 Table WI2VSAT-1- WTI-Restriction Results - Message Display in Travel Lanes - WTI-Restriction

Table 2-28. WI2VSAT-1- WTI-Restriction Results - Message Display in Travel Lanes - WTI-Restriction

Test Case ID	WI2VSAT-1-WTI-Restriction-L	Test Engineer Verification and Remarks
Test Case Name	Message Display in Travel Lanes - WTI - Restriction	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*

Test Case ID	WI2VSAT-1-WTI-Restriction-L	Test Engineer Verification and Remarks
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.29 Table WI2VSAT-1- WTI-Restriction Requirements Verification Analysis

Table 2-29. WI2VSAT-1- WTI-Restriction Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-WTI-Restriction -- Message Display in Travel Lanes - WTI Restriction	WTI-REQ-2.2.1 -- Restriction Information	The Wyoming CV System shall receive details on the restriction in effect for affected segments. Restrictions can consist of one or more of the following: • Width restriction, • Height restriction, • Weight restrictions, • High-Profile restrictions, • Chain Law Level 1, • Chain Law Level 2	* Perform Test Case WI2VSAT-1-WTI-Restriction. * Inspect WTI Logs and verify output of current information for corridor roadway segments. * Confirm receipt of notification of details on the restriction in effect for affected segments * Receipt confirms the Wyoming CV System receives details on the restriction in effect for affected segments, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-WTI-Restriction -- Message Display in Travel Lanes - WTI Restriction	WTI-REQ-2.2.2 -- Restriction Start Time	Wyoming CV System shall receive the start time of restrictions in effect for segments.	* Perform Test Case WI2VSAT-1-WTI-Restriction. * Inspect WTI Logs and verify output of current information for corridor roadway segments. * Confirm receipt of the start time of restrictions in effect for segments * Receipt confirms the Wyoming CV System receives the start time of restrictions in effect for segments, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

2.30 Table WI2VSAT-1- WTI-DMS-L Description - Message Display in Travel Lanes - WTI-DMS Test Case Description

Table 2-30. WI2VSAT-1- WTI-DMS-L Description - Message Display in Travel Lanes - WTI-DMS Test Case Description

Test Case ID	WI2VSAT-1-WTI-DMS-L	Test Engineer Verification and Remarks
Test Case Name	Message Display in Travel Lanes - DMS	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WI2VSAT-1-WTI-DMS-Requirements	
Objective	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	WTI	
TIM	DMS Advisory	
Host Vehicle OBU/ Vehicle	Lear Roadstar OBU	

Test Case ID	WI2VSAT-1-WTI-DMS-L	Test Engineer Verification and Remarks
Vehicle direction versus message direction	Same direction	
Vehicle Lane of travel	Roadway Travel lanes	
Host Vehicle Driving Scenario (TC Input)	Host vehicle driving in travel lanes in "message direction". This is performed for WTI (DMS Message).	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Driver observes beginning display of DMS Advisory TIM Advisory/Warning within 8 meters of beginning of TIM specified geofence and cease of display within 8 meters of end of TIM specified geofence.	
Log File Analysis and Verification Method (Test Case Output 2)	Log files confirm beginning display of DMS Advisory TIM Advisory/Warning within 8 meters of beginning of TIM specified geofence and cease of display within 8 meters of end of TIM specified geofence.	
Expected Result (Pass/Fail Criteria)	*Driver Advisory/Warning begins display within 8 meters of beginning of TIM specified geofence and ceases display within 8 meters of end of TIM specified geofence. Verified visually and by inspection of HMI logs.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* **1.** Verify WYDOT CV Pilot TMC System is operational and ready for test **2.** Verify RSUs are operational and ready for test **3.** Cycle Host Vehicle power and reboot vehicle system. **4.** Verify Host vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix **5.** Conduct Safety Inspection of the test area and vehicle path and confirm ready for test a. No obstructions or interference b. All staff where they are supposed to be, no staff where they aren’t supposed to be	

Test Case ID	WI2VSAT-1-WTI-DMS-L	Test Engineer Verification and Remarks
	c. Weather is acceptable and will not lead to hazardous driving conditions d. Road surface is acceptable and will not lead to hazardous driving conditions **6.** Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational **7.** Host vehicle driver inspects driving area and confirm track is clear and ready for test. **8.** Host Vehicle Driver and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure **9.** I2V SA TIM is formulated by Data Broker and distributed to test RSU. **10.** Host vehicle enters track from outside communication range and performs Host Vehicle Scenario.	

2.31 Table WI2VSAT-1- WTI-DMS-L Results - Message Display in Travel Lanes - WTI-DMS

Table 2-31. WI2VSAT-1- WTI-DMS-L Results - Message Display in Travel Lanes - WTI-DMS

Test Case ID	WI2VSAT-1-WTI-DMS-L	Test Engineer Verification and Remarks
Test Case Name	Message Display in Travel Lanes - DMS	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*

Test Case ID	WI2VSAT-1-WTI-DMS-L	Test Engineer Verification and Remarks
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.32 Table WI2VSAT-1-WTI-DMS Requirements Verification Analysis

Table 2-32. WI2VSAT-1-WTI-DMS Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-WTI-DMS -- Message Display in Travel Lanes - DMS	WTI-REQ-2.3 -- Posted Messages	The Wyoming CV System shall receive the notification of DMS messages that have been set in the corridor	* Perform Test Case WI2VSAT-1-WTI-DMS * Inspect WTI Logs and verify output of current information for corridor roadway segments * Confirm receipt of the notification of DMS messages that have been set in the corridor * Receipt confirms the Wyoming CV System receives the notification of DMS messages that have been set in the corridor, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-WTI-DMS -- Message Display in Travel Lanes - DMS	WTI-REQ-2.3.1 -- Message Information	Wyoming CV System shall receive the content of the posted DMS message	* Perform Test Case WI2VSAT-1-WTI-DMS. * Inspect WTI Logs and verify output of current information for corridor roadway segments. * Verify receipt of receive the content of the posted DMS message * Receipt confirms Wyoming CV System receives	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			the content of the posted DMS message, thereby verifying the requirement is satisfied.	

2.33 Table WI2VSAT-1- WTI-Closure-L Description - Message Display in Travel Lanes - WTI-Closure Test Case Description

Table 2-33. WI2VSAT-1- WTI-Closure-L Description - Message Display in Travel Lanes - WTI-Closure Test Case Description

Test Case ID	WI2VSAT-1-WTI-Closure-L	Test Engineer Verification and Remarks
Test Case Name	Message Display in Travel Lanes - Closures	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WI2VSAT-1-WTI-Closure-Requirements	
Objective	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	

Test Case ID	WI2VSAT-1-WTI-Closure-L	Test Engineer Verification and Remarks
Back Office Component	WTI	
TIM	Road Closure Advisory	
Host Vehicle OBU/ Vehicle	Lear Roadstar OBU	
Vehicle direction versus message direction	Same direction	
Vehicle Lane of travel	Roadway Travel lanes	
Host Vehicle Driving Scenario (TC Input)	Host vehicle driving in travel lanes in "message direction". This is performed for WTI (Road Closure).	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Driver observes beginning display of Road Closure Advisory TIM Advisory/Warning within 8 meters of beginning of TIM specified geofence and cease of display within 8 meters of end of TIM specified geofence.	
Log File Analysis and Verification Method (Test Case Output 2)	Log files confirm beginning display of Road Closure Advisory TIM Advisory/Warning within 8 meters of beginning of TIM specified geofence and cease of display within 8 meters of end of TIM specified geofence.	
Expected Result (Pass/Fail Criteria)	*Driver Advisory/Warning begins display within 8 meters of beginning of TIM specified geofence and ceases display within 8 meters of end of TIM specified geofence. Verified visually and by inspection of HMI logs.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* **1.** Verify WYDOT CV Pilot TMC System is operational and ready for test **2.** Verify RSUs are operational and ready for test **3.** Cycle Host Vehicle power and reboot vehicle system. **4.** Verify Host vehicle systems are operational and ready for test a. OBU to HMI communications	

Test Case ID	WI2VSAT-1-WTI-Closure-L	Test Engineer Verification and Remarks
	b. GPS fix **5.** Conduct Safety Inspection of the test area and vehicle path and confirm ready for test a. No obstructions or interference b. All staff where they are supposed to be, no staff where they aren't supposed to be c. Weather is acceptable and will not lead to hazardous driving conditions d. Road surface is acceptable and will not lead to hazardous driving conditions **6.** Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational **7.** Host vehicle driver inspects driving area and confirm track is clear and ready for test. **8.** Host Vehicle Driver and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure **9.** I2V SA TIM is formulated by Data Broker and distributed to test RSU. **10.** Host vehicle enters track from outside communication range and performs Host Vehicle Scenario.	

2.34 Table WI2VSAT-1- WTI-Closure-L Results - Message Display in Travel Lanes - WTI-Closure

Table 2-34. WI2VSAT-1- WTI-Closure-L Results - Message Display in Travel Lanes - WTI-Closure

Test Case ID	WI2VSAT-1-WTI-Closure-L	Test Engineer Verification and Remarks
Test Case Name	Message Display in Travel Lanes - Closures	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*

Test Case ID	WI2VSAT-1-WTI-Closure-L	Test Engineer Verification and Remarks
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.35 Table WI2VSAT-1-WTI-Closure Requirements Verification Analysis

Table 2-35. WI2VSAT-1-WTI-Closure Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-WTI-Closure -- Message Display in Travel Lanes - Closures	WTI-REQ-2.4.1 -- Closure Beginning	The Wyoming CV System shall receive notification of the beginning point of the closure.	* Perform Test Case WI2VSAT-1-WTI-Closure. * Inspect WTI Logs and verify output of current information for corridor roadway segments. * Verify receipt of notification of the beginning point of the closure. * Receipt confirms the Wyoming CV System receives notification of the beginning point of the closure, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-1-WTI-Closure -- Message Display in Travel Lanes - Closures	WTI-REQ-2.4.2 -- Closure End	The Wyoming CV System shall receive notification of the ending point of the closure.	* Perform Test Case WI2VSAT-1-WTI-Closure. * Inspect WTI Logs and verify output of current information for corridor roadway segments. * Verify receipt of notification of the ending point of the closure. * Receipt confirms the Wyoming CV System receives notification of the ending point of the closure, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-1-WTI-Closure -- Message Display in Travel Lanes - Closures	WTI-REQ-2.4.3 -- Closure Start Time	The Wyoming CV System shall receive notification of the starting time of the closure.	* Perform Test Case WI2VSAT-1-WTI-Closure. * Inspect WTI Logs and verify output of current information for corridor roadway segments. * Verify receipt of notification of the starting time of the closure. * Receipt confirms the Wyoming CV System receives notification of the starting time of the closure, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

2.36 Table WI2VSAT-2-L Description - Message Display in Shoulder Lanes Test Case Description

Table 2-36. WI2VSAT-2-L Description - Message Display in Shoulder Lanes Test Case Description

Test Case ID	WI2VSAT-2-L	Test Engineer Verification and Remarks
Test Case Name	Message Display in Shoulder Lanes	
Test Case Completion Date		
Priority	Required	

Test Case ID	WI2VSAT-2-L	Test Engineer Verification and Remarks
Requirements Verified (Tracing)	Compiled in Table WI2VSAT-2-Requirements	
Objective	Verify I2V SA TIM geofence is parsed correctly and messages begins and ends display on shoulders at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	Representative TIM Back Office Component	
TIM	Representative TIM	
Host Vehicle OBU/ Vehicle	Lear Roadstar OBU	
Vehicle direction versus message direction	Same direction	
Vehicle Lane of travel	Outside Roadway Shoulder	
Host Vehicle Driving Scenario (TC Input)	Host vehicle traveling in "message direction" on inside shoulder and outside shoulder. This is performed using “representative” TIM message.	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Driver observes beginning display of Representative TIM Advisory/Warning TIM Advisory/Warning within 8 meters of beginning of TIM specified geofence and cease of display within 8 meters of end of TIM specified geofence. (Note: Test Case WI2VMCT-1 does not issue driver advisories or alerts.)	

Test Case ID	WI2VSAT-2-L	Test Engineer Verification and Remarks
WI2VSAT-2-L Log File Analysis and Verification Method (Test Case Output 2)	Log files confirm beginning display of Representative TIM Advisory/Warning TIM Advisory/Warning within 8 meters of beginning of TIM specified geofence and cease of display within 8 meters of end of TIM specified geofence.	
WI2VMCT-1 Log File Analysis and Verification Method (Test Case Output 2)	Log files confirm a configurable threshold percentage of I2V SA TIMs are received and processed by OBU when vehicle is at least 300 meters away.	
WI2VSAT-2-L Expected Result (Pass/Fail Criteria)	*Driver Advisory/Warning begins display within 8 meters of beginning of TIM specified geofence and ceases display within 8 meters of end of TIM specified geofence. Verified visually and by inspection of HMI logs.	
WI2VMCT-1 Expected Result (Pass/Fail Criteria)	A configurable threshold percentage of I2V SA TIMs sent by the Data Broker are received and processed by OBU when vehicle is at least 300 meters away. Verified by logs.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* **1.** Verify WYDOT CV Pilot TMC System is operational and ready for test **2.** Verify RSUs are operational and ready for test **3.** Cycle Host Vehicle power and reboot vehicle system. **4.** Verify Host vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix **5.** Conduct Safety Inspection of the test area and vehicle path and confirm ready for test a. No obstructions or interference b. All staff where they are supposed to be, no staff where they aren't supposed to be c. Weather is acceptable and will not lead to hazardous driving conditions d. Road surface is acceptable and will not lead to hazardous driving conditions **6.** Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational	

Test Case ID	WI2VSAT-2-L	Test Engineer Verification and Remarks
	7. Host vehicle driver inspects driving area and confirm track is clear and ready for test. **8.** Host Vehicle Driver and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure **9.** I2V SA TIM is formulated by Data Broker and distributed to test RSU. **10.** Host vehicle enters track from outside communication range and performs Host Vehicle Scenario.	

2.37 Table WI2VSAT-2-L Results - Message Display in Shoulder Lanes

Table 2-37. WI2VSAT-2-L Results - Message Display in Shoulder Lanes

Test Case ID	Rep	WI2VSAT-2-L	Test Engineer Verification and Remarks
Test Case Name		Message Display in Shoulder Lanes	*Performed and Confirmed by:*
Test Case Completion Date			*Performed and Confirmed by:*
WI2VSAT-2-REP-L Test Case Log File Analysis Results	**Rep 1**		*Performed and Confirmed by:*
WI2VSAT-1-REP-L Test Case Log File Analysis Results	**Rep 1**		*Performed and Confirmed by:*
WI2VSAT-2-REP-L Test Case Log File Analysis Results	**Rep 2**		*Performed and Confirmed by:*
WI2VSAT-1-REP-L Test Case Log File Analysis Results			
WI2VSAT-2-REP-L Test Case Log File Analysis Results	**Rep 3**		*Performed and Confirmed by:*

Test Case ID	Rep	WI2VSAT-2-L	Test Engineer Verification and Remarks
WI2VSAT-2-REP-L Test Case Log File Analysis Results	**Rep 4**		*Performed and Confirmed by:*
WI2VSAT-2-REP-L Test Case Log File Analysis Results *	**Rep 5**		*Performed and Confirmed by:*
Test Case Analysis Tables			*Performed and Confirmed by:*
WI2VSAT-2-REP-L Pass/Fail Assessment			*Performed and Confirmed by:*
WI2VMCT-1-L Pass/Fail Assessment			

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.38 Table WI2VSAT-2-S Description - Message Display in Shoulder Lanes Test Case Description

Table 2-38. WI2VSAT-2-S Description - Message Display in Shoulder Lanes Test Case Description

Test Case ID	WI2VSAT-2-S	Test Engineer Verification and Remarks
Test Case Name	Message Display in Shoulder Lanes	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WI2VSAT-2-Requirements	

Test Case ID	WI2VSAT-2-S	Test Engineer Verification and Remarks
Objective	Verify I2V SA TIM geofence is parsed correctly and messages begins and ends display on shoulders at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	Representative TIM Back Office Component	
TIM	Representative TIM	
Host Vehicle OBU/ Vehicle	SiriusXM OBU	
Vehicle direction versus message direction	Same direction	
Vehicle Lane of travel	Outside Roadway Shoulder	
Host Vehicle Driving Scenario (TC Input)	Host vehicle traveling in "message direction" on inside shoulder and outside shoulder. This is performed using “representative” TIM message.	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Driver observes beginning display of Representative TIM Advisory/Warning TIM Advisory/Warning within 8 meters of beginning of TIM specified geofence and cease of display within 8 meters of end of TIM specified geofence.	
Log File Analysis and Verification Method (Test Case Output 2)	Log files confirm beginning display of Representative TIM Advisory/Warning TIM Advisory/Warning within 8 meters of beginning of TIM specified geofence and cease of display within 8 meters of end of TIM specified geofence.	

Test Case ID	WI2VSAT-2-S	Test Engineer Verification and Remarks
Expected Result (Pass/Fail Criteria)	*Driver Advisory/Warning begins display within 8 meters of beginning of TIM specified geofence and ceases display within 8 meters of end of TIM specified geofence. Verified visually and by inspection of HMI logs.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* **1.** Verify WYDOT CV Pilot TMC System is operational and ready for test **2.** Verify RSUs are operational and ready for test **3.** Cycle Host Vehicle power and reboot vehicle system. **4.** Verify Host vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix **5.** Conduct Safety Inspection of the test area and vehicle path and confirm ready for test a. No obstructions or interference b. All staff where they are supposed to be, no staff where they aren't supposed to be c. Weather is acceptable and will not lead to hazardous driving conditions d. Road surface is acceptable and will not lead to hazardous driving conditions **6.** Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational **7.** Host vehicle driver inspects driving area and confirm track is clear and ready for test. **8.** Host Vehicle Driver and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure **9.** I2V SA TIM is formulated by Data Broker and distributed to test RSU. **10.** Host vehicle enters track from outside communication range and performs Host Vehicle Scenario.	

2.39 Table WI2VSAT-2-S Description - Message Display in Shoulder Lanes

Table 2-39. WI2VSAT-2-S Description - Message Display in Shoulder Lanes

Test Case ID	**WI2VSAT-2-S**	**Test Engineer Verification and Remarks**
Test Case Name	Message Display in Shoulder Lanes	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.40 Table WI2VSAT-2 Requirements Verification Analysis

Table 2-40. WI2VSAT-2 Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-2 -- Message Display in Shoulder Lanes	I2VSAP-REQ-2 -- Message Display in Shoulder Lanes	Situational Awareness Message(s) shall display in vehicles traveling on shoulders of the roadway in the direction specified in the I2V SA TIM.	* Perform Test Case WI2VSAT-2 * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine Roadway and lane of travel of vehicle. * Confirm Situational Awareness Message displays in vehicles traveling on shoulders of the roadway specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) display in vehicles traveling on shoulders of the roadway in the direction specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WI2VSAT-2 -- Message Display in Shoulder Lanes	I2VSAP-REQ-3 -- Message Display in Acceleration Lane	Situational Awareness Message(s) shall display in vehicles in entrance acceleration lane of the roadway in the direction specified in the I2V SA TIM.	* Perform Test Case WI2VSAT-2 * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine Roadway and lane of travel of vehicle. * Confirm Situational Awareness Message displays in vehicles traveling on entrance acceleration lane (and shoulder) of the roadway specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) display in vehicles in entrance acceleration lane of the roadway in the direction specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

2.41 Table WI2VSAT-3-L Description - Message Display on Adjacent Service Road Test Case Description

Table 2-41. WI2VSAT-3-L Description - Message Display on Adjacent Service Road Test Case Description

Test Case ID	WI2VSAT-3-L	Test Engineer Verification and Remarks
Test Case Name	Message Display on Adjacent Service Road	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WI2VSAT-3-Requirements	
Objective	Verify I2V SA TIM geofence is parsed correctly and messages do not display on adjacent service roads. Verify GPS accuracy supports accurate display of I2V SA Messages.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	Representative TIM Back Office Component	
TIM	Representative TIM	
Host Vehicle OBU/ Vehicle	Lear Roadstar OBU	

Test Case ID	WI2VSAT-3-L	Test Engineer Verification and Remarks
Vehicle direction versus message direction	Same direction	
Vehicle Lane of travel	Adjacent Service Road	
Host Vehicle Driving Scenario (TC Input)	Host vehicle traveling in "message direction" on adjacent service road. This is performed using “representative” TIM message	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Driver observes no message is displayed.	
Log File Analysis and Verification Method (Test Case Output 2)	Log files confirm no message is displayed.	
Expected Result (Pass/Fail Criteria)	No message is displayed	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* **1.** Verify WYDOT CV Pilot TMC System is operational and ready for test **2.** Verify RSUs are operational and ready for test **3.** Cycle Host Vehicle power and reboot vehicle system. **4.** Verify Host vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix **5.** Conduct Safety Inspection of the test area and vehicle path and confirm ready for test a. No obstructions or interference b. All staff where they are supposed to be, no staff where they aren’t supposed to be c. Weather is acceptable and will not lead to hazardous driving conditions	

Test Case ID	WI2VSAT-3-L	Test Engineer Verification and Remarks
	d. Road surface is acceptable and will not lead to hazardous driving conditions **6.** Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational **7.** Host vehicle driver inspects driving area and confirm track is clear and ready for test. **8.** Host Vehicle Driver and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure **9.** I2V SA TIM is formulated by Data Broker and distributed to test RSU. **10.** Host vehicle enters track from outside communication range and performs Host Vehicle Scenario.	

2.42 Table WI2VSAT-3-L Results - Message Display on Adjacent Service Road

Table 2-42. WI2VSAT-3-L Results - Message Display on Adjacent Service Road

Test Case ID	WI2VSAT-3-L	Test Engineer Verification and Remarks
Test Case Name	Message Display on Adjacent Service Road	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*

Test Case ID	WI2VSAT-3-L	Test Engineer Verification and Remarks
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.43 Table WI2VSAT-3-S Description - Message Display on Adjacent Service Road Test Case Description

Table 2-43. WI2VSAT-3-S Description - Message Display on Adjacent Service Road Test Case Description

Test Case ID	WI2VSAT-3-S	Test Engineer Verification and Remarks
Test Case Name	Message Display on Adjacent Service Road	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WI2VSAT-3-Requirements	
Objective	Verify I2V SA TIM geofence is parsed correctly and messages do not display on adjacent service roads. Verify GPS accuracy supports accurate display of I2V SA Messages.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for I2V	

Test Case ID	WI2VSAT-3-S	Test Engineer Verification and Remarks
	Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	Representative TIM Back Office Component	
TIM	Representative TIM	
Host Vehicle OBU/ Vehicle	SiriusXM OBU	
Vehicle direction versus message direction	Same direction	
Vehicle Lane of travel	Adjacent Service Road	
Host Vehicle Driving Scenario (TC Input)	Host vehicle traveling in "message direction" on adjacent service road. This is performed using “representative” TIM message	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Driver observes no message is displayed.	
Log File Analysis and Verification Method (Test Case Output 2)	Log files confirm no message is displayed.	
Expected Result (Pass/Fail Criteria)	No message is displayed	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* **1.** Verify WYDOT CV Pilot TMC System is operational and ready for test **2.** Verify RSUs are operational and ready for test	

Test Case ID	WI2VSAT-3-S	Test Engineer Verification and Remarks
	3. Cycle Host Vehicle power and reboot vehicle system. **4.** Verify Host vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix **5.** Conduct Safety Inspection of the test area and vehicle path and confirm ready for test a. No obstructions or interference b. All staff where they are supposed to be, no staff where they aren't supposed to be c. Weather is acceptable and will not lead to hazardous driving conditions d. Road surface is acceptable and will not lead to hazardous driving conditions **6.** Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational **7.** Host vehicle driver inspects driving area and confirm track is clear and ready for test. **8.** Host Vehicle Driver and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure **9.** I2V SA TIM is formulated by Data Broker and distributed to test RSU. **10.** Host vehicle enters track from outside communication range and performs Host Vehicle Scenario.	

2.44 Table WI2VSAT-3-S Results - Message Display on Adjacent Service Road

Table 2-44. WI2VSAT-3-S Results - Message Display on Adjacent Service Road

Test Case ID	WI2VSAT-3-S	Test Engineer Verification and Remarks
Test Case Name	Message Display on Adjacent Service Road	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*

Test Case ID	WI2VSAT-3-S	Test Engineer Verification and Remarks
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.45 Table WI2VSAT-3 Requirements Verification Analysis

Table 2-45. WI2VSAT-3 Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-3 -- Message Display on Adjacent Service Road	I2VSAP-REQ-7 -- Message Display on Adjacent Service Road	Situational Awareness Message(s) shall not display in vehicles on roadways adjacent to that specified in the I2V SA TIM.	* Perform Test Case WI2VSAT-3 * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine roadway and lane of travel of vehicle. * Confirm Situational Awareness Message does not display in vehicles on roadways adjacent to that	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) not display in vehicles on roadways adjacent to that specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	

2.46 Table WI2VSAT-4-L Description - Message Display Perpendicular to Travel Lanes Test Case Description

Table 2-46. WI2VSAT-4-L Description - Message Display Perpendicular to Travel Lanes Test Case Description

Test Case ID	WI2VSAT-4-L	Test Engineer Verification and Remarks
Test Case Name	I2V SA - Message Display Perpendicular to Travel Lanes	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WI2VSAT-4-Requirements	
Objective	Verify I2V SA TIM geofence is parsed correctly and messages do not display when approaching on perpendicular service roads. Verify GPS accuracy supports accurate display of I2V SA Messages.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization.	

Test Case ID	WI2VSAT-4-L	Test Engineer Verification and Remarks
	• Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	Representative TIM Back Office Component	
TIM	Representative TIM	
Host Vehicle OBU/ Vehicle	Lear Roadstar OBU	
Vehicle direction versus message direction	Perpendicular to message direction	
Vehicle Lane of travel	Roadway travel lanes Perpendicular to message direction	
Host Vehicle Driving Scenario (TC Input)	Host vehicle approaches "travel lanes" on intersecting road perpendicular to "message direction". This is performed using “representative” TIM message	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Driver observes no message is displayed.	
Log File Analysis and Verification Method (Test Case Output 2)	Log files confirm no message is displayed.	
Expected Result (Pass/Fail Criteria)	No message is displayed.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* **1.** Verify WYDOT CV Pilot TMC System is operational and ready for test **2.** Verify RSUs are operational and ready for test **3.** Cycle Host Vehicle power and reboot vehicle system. **4.** Verify Host vehicle systems are operational and ready for test	

Test Case ID	WI2VSAT-4-L	Test Engineer Verification and Remarks
	a. OBU to HMI communications b. GPS fix **5.** Conduct Safety Inspection of the test area and vehicle path and confirm ready for test a. No obstructions or interference b. All staff where they are supposed to be, no staff where they aren't supposed to be c. Weather is acceptable and will not lead to hazardous driving conditions d. Road surface is acceptable and will not lead to hazardous driving conditions **6.** Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational **7.** Host vehicle driver inspects driving area and confirm track is clear and ready for test. **8.** Host Vehicle Driver and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure **9.** I2V SA TIM is formulated by Data Broker and distributed to test RSU. **10.** Host vehicle enters track from outside communication range and performs Host Vehicle Scenario.	

2.47 Table WI2VSAT-4-L Results - Message Display Perpendicular to Travel Lanes

Table 2-47. WI2VSAT-4-L Results - Message Display Perpendicular to Travel Lanes

Test Case ID	WI2VSAT-4-L	Test Engineer Verification and Remarks
Test Case Name	I2V SA - Message Display Perpendicular to Travel Lanes	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*

Test Case ID	WI2VSAT-4-L	Test Engineer Verification and Remarks
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.48 Table WI2VSAT-4-S Description - Message Display Perpendicular to Travel Lanes Test Case Description

Table 2-48. WI2VSAT-4-S Description - Message Display Perpendicular to Travel Lanes Test Case Description

Test Case ID	WI2VSAT-4-S	Test Engineer Verification and Remarks
Test Case Name	I2V SA - Message Display Perpendicular to Travel Lanes	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WI2VSAT-4-Requirements	

Test Case ID	WI2VSAT-4-S	Test Engineer Verification and Remarks
Objective	Verify I2V SA TIM geofence is parsed correctly and messages do not display when approaching on perpendicular service roads. Verify GPS accuracy supports accurate display of I2V SA Messages.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	Representative TIM Back Office Component	
TIM	Representative TIM	
Host Vehicle OBU/ Vehicle	SiriusXM OBU	
Vehicle direction versus message direction	Perpendicular to message direction	
Vehicle Lane of travel	Roadway travel lanes Perpendicular to message direction	
Host Vehicle Driving Scenario (TC Input)	Host vehicle approaches "travel lanes" on intersecting road perpendicular to "message direction". This is performed using “representative” TIM message	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Driver observes no message is displayed.	

Test Case ID	WI2VSAT-4-S	Test Engineer Verification and Remarks
Log File Analysis and Verification Method (Test Case Output 2)	Log files confirm no message is displayed.	
Expected Result (Pass/Fail Criteria)	No message is displayed.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* **1.** Verify WYDOT CV Pilot TMC System is operational and ready for test **2.** Verify RSUs are operational and ready for test **3.** Cycle Host Vehicle power and reboot vehicle system. **4.** Verify Host vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix **5.** Conduct Safety Inspection of the test area and vehicle path and confirm ready for test a. No obstructions or interference b. All staff where they are supposed to be, no staff where they aren't supposed to be c. Weather is acceptable and will not lead to hazardous driving conditions d. Road surface is acceptable and will not lead to hazardous driving conditions **6.** Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational **7.** Host vehicle driver inspects driving area and confirm track is clear and ready for test. **8.** Host Vehicle Driver and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure **9.** I2V SA TIM is formulated by Data Broker and distributed to test RSU. **10.** Host vehicle enters track from outside communication range and performs Host Vehicle Scenario.	

2.49 Table WI2VSAT-4-S Results - Message Display Perpendicular to Travel Lanes

Table 2-49. WI2VSAT-4-S Results - Message Display Perpendicular to Travel Lanes

Test Case ID	**WI2VSAT-4-S**	**Test Engineer Verification and Remarks**
Test Case Name	I2V SA - Message Display Perpendicular to Travel Lanes	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.50 Table WI2VSAT-4 Requirements Verification Analysis

Table 2-50. WI2VSAT-4 Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-4 -- I2V SA * Message Display Perpendicular to Travel Lanes	I2VSAP-REQ-8 -- Message Display in Perpendicular to Travel Lanes	Situational Awareness Message(s) shall not display in vehicles on roadways intersecting that specified in the I2V SA TIM.	* Perform Test Case WI2VSAT-4 * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine roadway and lane of travel of vehicle. * Confirm Situational Awareness Message does not display in vehicles traveling on roadways perpendicular to that specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) not display in vehicles on roadways intersecting that specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

2.51 Table WI2VSAT-5-L Description - Message Display in Travel Lanes sent via Satellite Test Case Description

Table 2-51. WI2VSAT-5-L Description - Message Display in Travel Lanes sent via Satellite Test Case Description

Test Case ID	WI2VSAT-5-L	Test Engineer Verification and Remarks
Test Case Name	Message Display in Travel Lanes sent via Satellite	
Test Case Completion Date		

Test Case ID	WI2VSAT-5-L	Test Engineer Verification and Remarks
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WI2VSAT-5-Requirements	
Objective	- Verify I2V SA TIM sent via Satellite is identical to I2V SA TIM sent via DSRC in WI2VSAT-1. Verify messages are parsed correctly and message begins and ends display at correct geofence geofence milepost. - Verify End-to-end Communication (DB to OBU) of I2V SA TIMs via satellite.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	Representative TIM Back Office Component	
TIM	Representative TIM	
Host Vehicle OBU/ Vehicle	Lear Roadstar OBU	
Vehicle direction versus message direction	Same direction	
Vehicle Lane of travel	Roadway Travel lanes	
Host Vehicle Driving Scenario (TC Input)	Similar to WI2VSAT-1, Host vehicle driving in travel lanes in "message direction". This is performed using “representative” TIM message.	

Test Case ID	WI2VSAT-5-L	Test Engineer Verification and Remarks
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Driver observes beginning display of Representative TIM Advisory/Warning within 8 meters of beginning of TIM specified geofence and cease of display within 8 meters of end of TIM specified geofence.	
Log File Analysis and Verification Method (Test Case Output 2)	- Log files confirm beginning display of Representative TIM Advisory/Warning within 8 meters of beginning of TIM specified geofence and cease of display within 8 meters of end of TIM specified geofence. - Log files confirm a configurable threshold percentage of I2V SA TIMs are received by satellite and processed by OBU.	
Expected Result (Pass/Fail Criteria)	*Driver Advisory/Warning begins display within 8 meters of beginning of TIM specified geofence and ceases display within 8 meters of end of TIM specified geofence. Verified visually and by inspection of HMI logs. - A configurable threshold percentage of I2V SA TIMs are received by satellite and processed by OBU.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* **1.** Verify WYDOT CV Pilot TMC System is operational and ready for test **2.** Verify RSUs are operational and ready for test **3.** Cycle Host Vehicle power and reboot vehicle system. **4.** Verify Host vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix **5.** Conduct Safety Inspection of the test area and vehicle path and confirm ready for test a. No obstructions or interference b. All staff where they are supposed to be, no staff where they aren't supposed to be c. Weather is acceptable and will not lead to hazardous driving conditions d. Road surface is acceptable and will not lead to hazardous driving conditions **6.** Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational	

Test Case ID	WI2VSAT-5-L	Test Engineer Verification and Remarks
	7. Host vehicle driver inspects driving area and confirm track is clear and ready for test. **8.** Host Vehicle Driver and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure **9.** I2V SA TIM is formulated by Data Broker and distributed to test RSU. **10.** Host vehicle enters track from outside communication range and performs Host Vehicle Scenario.	

2.52 Table WI2VSAT-5-L Results - Message Display in Travel Lanes sent via Satellite

Table 2-52. WI2VSAT-5-L Results - Message Display in Travel Lanes sent via Satellite

Test Case ID	WI2VSAT-5-L	Test Engineer Verification and Remarks
Test Case Name	Message Display in Travel Lanes sent via Satellite	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*

Test Case ID	WI2VSAT-5-L	Test Engineer Verification and Remarks
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.53 Table WI2VSAT-5-S Description - Message Display in Travel Lanes sent via Satellite Test Case Description

Table 2-53. WI2VSAT-5-S Description - Message Display in Travel Lanes sent via Satellite Test Case Description

Test Case ID	WI2VSAT-5-S	Test Engineer Verification and Remarks
Test Case Name	Message Display in Travel Lanes sent via Satellite	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WI2VSAT-5-Requirements	
Objective	- Verify I2V SA TIM sent via Satellite is identical to I2V SA TIM sent via DSRC in WI2VSAT-1. Verify messages are parsed correctly and message begins and ends display at correct geofence geofence milepost. - Verify End-to-end Communication (DB to OBU) of I2V SA TIMs via satellite.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution	

Test Case ID	WI2VSAT-5-S	Test Engineer Verification and Remarks
	steps for each system component to support consistent implementation by test staff.	
Back Office Component	Representative TIM Back Office Component	
TIM	Representative TIM	
Host Vehicle OBU/ Vehicle	SiriusXM OBU	
Vehicle direction versus message direction	Same direction	
Vehicle Lane of travel	Roadway Travel lanes	
Host Vehicle Driving Scenario (TC Input)	Similar to WI2VSAT-1, Host vehicle driving in travel lanes in "message direction". This is performed using “representative” TIM message.	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	- Log files confirm beginning display of Representative TIM Advisory/Warning within 8 meters of beginning of TIM specified geofence and cease of display within 8 meters of end of TIM specified geofence. - Log files confirm a configurable threshold percentage of I2V SA TIMs are received by satellite and processed by OBU.	
Log File Analysis and Verification Method (Test Case Output 2)	*Driver Advisory/Warning begins display within 8 meters of beginning of TIM specified geofence and ceases display within 8 meters of end of TIM specified geofence. Verified visually and by inspection of HMI logs. - A configurable threshold percentage of I2V SA TIMs are received by satellite and processed by OBU.	
Expected Result (Pass/Fail Criteria)	*Driver Advisory/Warning begins display within 8 meters of beginning of TIM specified geofence and ceases display within 8 meters of end of TIM specified geofence. Verified visually and by inspection of HMI logs.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* **1.** Verify WYDOT CV Pilot TMC System is operational and ready for test	

Test Case ID	WI2VSAT-5-S	Test Engineer Verification and Remarks
	2. Verify RSUs are operational and ready for test **3.** Cycle Host Vehicle power and reboot vehicle system. **4.** Verify Host vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix **5.** Conduct Safety Inspection of the test area and vehicle path and confirm ready for test a. No obstructions or interference b. All staff where they are supposed to be, no staff where they aren't supposed to be c. Weather is acceptable and will not lead to hazardous driving conditions d. Road surface is acceptable and will not lead to hazardous driving conditions **6.** Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational **7.** Host vehicle driver inspects driving area and confirm track is clear and ready for test. **8.** Host Vehicle Driver and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure **9.** I2V SA TIM is formulated by Data Broker and distributed to test RSU. **10.** Host vehicle enters track from outside communication range and performs Host Vehicle Scenario.	

2.54 Table WI2VSAT-5-S Results - Message Display in Travel Lanes sent via Satellite

Table 2-54. WI2VSAT-5-S Results - Message Display in Travel Lanes sent via Satellite

Test Case ID	**WI2VSAT-5-S**	**Test Engineer Verification and Remarks**
Test Case Name	Message Display in Travel Lanes sent via Satellite	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.55 Table WI2VSAT-5 Requirements Verification Analysis

Table 2-55. WI2VSAT-5 Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-5 -- *Message Display in Travel Lanes sent via Satellite	SDW-REQ-1 -- Data Provided to the SDW	The Wyoming CV System shall transmit traveler information messages (TIMs) generated by the system to the SDW within five minutes of generation. TIMs are formatted as defined in J2735 – 5.16 Message: MSG_TravelerInformation Message (TIM).	* Perform Test Case WI2VSAT-5 * Inspect DB Logs and locate 1 or more instances of formation of TIMs Record * Time each located TIM was generated by DB * Time each located TIM was sent to SDW Compute * Time difference between generation and distribution Confirm and Verify * Time difference less than 5 minutes, confirms the Wyoming CV System transmits traveler information messages (TIMs) generated by the system to the SDW within five minutes of generation, thereby verifying the requirement is satisfied. (Note: WYDOT Team does not have access to SDW logs to verify TIM was received and what time TIM it was received by SDW.)	Requirement Verification Confirmed by:
WI2VMCT-2 -- End-to-end & Satellite Delivery of I2V SA TIMs (Integrated with WI2VSAT-5)	VS-REQ-2.2 -- Receive TIM through Satellite	The Vehicle System shall wirelessly receive a packet containing traveler information from the Wyoming CV System (via the Situational Data Warehouse) through satellite.	* Perform Test Case WI2VMCT-2(WI2VSAT-5) * Inspect DB Logs and locate 1 or more instances of formation of TIMs. * Inspect OBU logs and locate corresponding instances of TIMs received by OBU via satellite. * Confirmation shows the Vehicle System wirelessly receives a packet containing traveler information from the Wyoming CV System (via the Situational Data Warehouse) through satellite , thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

2.56 Table WI2VSAT-6-L Description - Message Display in Opposing Travel Lanes Test Case Description

Table 2-56. WI2VSAT-6-L Description - Message Display in Opposing Travel Lanes Test Case Description

Test Case ID	**WI2VSAT-6-L**	**Test Engineer Verification and Remarks**
Test Case Name	I2V SA - Message Display in Opposing Travel Lanes	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WI2VSAT-6-Requirements	
Objective	Verify I2V SA TIM geofence is parsed correctly and messages do not display when approaching in travel lanes opposite from specified message direction. Verify GPS accuracy supports accurate display of I2V SA Messages.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	Representative TIM Back Office Component	
TIM	Representative TIM	
Host Vehicle OBU/ Vehicle	Lear Roadstar OBU	

Test Case ID	WI2VSAT-6-L	Test Engineer Verification and Remarks
Vehicle direction versus message direction	Opposite to message direction	
Vehicle Lane of travel	Roadway travel lanes opposite to message direction	
Host Vehicle Driving Scenario (TC Input)	Host vehicle approaches in travel lanes opposite to TIM "message direction". This is performed using “representative” TIM message.	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Driver observes no message is displayed.	
Log File Analysis and Verification Method (Test Case Output 2)	Log files confirm no message is displayed.	
Expected Result (Pass/Fail Criteria)	No message is displayed.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* **1.** Verify WYDOT CV Pilot TMC System is operational and ready for test **2.** Verify RSUs are operational and ready for test **3.** Cycle Host Vehicle power and reboot vehicle system. **4.** Verify Host vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix **5.** Conduct Safety Inspection of the test area and vehicle path and confirm ready for test a. No obstructions or interference b. All staff where they are supposed to be, no staff where they aren’t supposed to be c. Weather is acceptable and will not lead to hazardous driving conditions	

Test Case ID	WI2VSAT-6-L	Test Engineer Verification and Remarks
	d. Road surface is acceptable and will not lead to hazardous driving conditions **6.** Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational **7.** Host vehicle driver inspects driving area and confirm track is clear and ready for test. **8.** Host Vehicle Driver and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure **9.** I2V SA TIM is formulated by Data Broker and distributed to test RSU. **10.** Host vehicle enters track from outside communication range and performs Host Vehicle Scenario.	

2.57 Table WI2VSAT-6-L Results - Message Display in Opposing Travel Lanes

Table 2-57. WI2VSAT-6-L Results - Message Display in Opposing Travel Lanes

Test Case ID	WI2VSAT-6-L	Test Engineer Verification and Remarks
Test Case Name	I2V SA - Message Display in Opposing Travel Lanes	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*

Test Case ID	WI2VSAT-6-L	Test Engineer Verification and Remarks
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.58 Table WI2VSAT-6-S Description - Message Display in Opposing Travel Lanes Test Case Description

Table 2-58. WI2VSAT-6-S Description - Message Display in Opposing Travel Lanes Test Case Description

Test Case ID	WI2VSAT-6-S	Test Engineer Verification and Remarks
Test Case Name	I2V SA - Message Display in Opposing Travel Lanes	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WI2VSAT-6-Requirements	
Objective	Verify I2V SA TIM geofence is parsed correctly and messages do not display when approaching in travel lanes opposite from specified message direction. Verify GPS accuracy supports accurate display of I2V SA Messages.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization.	

Test Case ID	WI2VSAT-6-S	Test Engineer Verification and Remarks
	• Prepare each system and test component in accordance with Initialization for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	Representative TIM Back Office Component	
TIM	Representative TIM	
Host Vehicle OBU/ Vehicle	SiriusXM OBU	
Vehicle direction versus message direction	Opposite to message direction	
Vehicle Lane of travel	Roadway travel lanes opposite to message direction	
Host Vehicle Driving Scenario (TC Input)	Host vehicle approaches in travel lanes opposite to TIM "message direction". This is performed using "representative" TIM message.	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Driver observes no message is displayed.	
Log File Analysis and Verification Method (Test Case Output 2)	Log files confirm no message is displayed.	
Expected Result (Pass/Fail Criteria)	No message is displayed.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* **1.** Verify WYDOT CV Pilot TMC System is operational and ready for test	

Test Case ID	WI2VSAT-6-S	Test Engineer Verification and Remarks
	2. Verify RSUs are operational and ready for test **3.** Cycle Host Vehicle power and reboot vehicle system. **4.** Verify Host vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix **5.** Conduct Safety Inspection of the test area and vehicle path and confirm ready for test a. No obstructions or interference b. All staff where they are supposed to be, no staff where they aren't supposed to be c. Weather is acceptable and will not lead to hazardous driving conditions d. Road surface is acceptable and will not lead to hazardous driving conditions **6.** Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational **7.** Host vehicle driver inspects driving area and confirm track is clear and ready for test. **8.** Host Vehicle Driver and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure **9.** I2V SA TIM is formulated by Data Broker and distributed to test RSU. **10.** Host vehicle enters track from outside communication range and performs Host Vehicle Scenario.	

2.59 Table WI2VSAT-6-S Results - Message Display in Opposing Travel Lanes

Table 2-59. WI2VSAT-6-S Results - Message Display in Opposing Travel Lanes

Test Case ID	WI2VSAT-6-S	Test Engineer Verification and Remarks
Test Case Name	I2V SA - Message Display in Opposing Travel Lanes	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.60 Table WI2VSAT-6 Requirements Verification Analysis

Table 2-60. WI2VSAT-6 Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-6 -- Message Display in Opposing Travel Lanes	I2VSAP-REQ-6 -- Message Display in Opposing Travel Lanes	Situational Awareness Message(s) shall not display in vehicles traveling in a direction other than that specified in the I2V SA TIM.	* Perform Test Case WI2VSAT-6 * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine roadway and lane of travel of vehicle. * Confirm Situational Awareness Message does not display in vehicles traveling in a direction other than that specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) not display in vehicles traveling in a direction other than that specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

2.61 Table WI2VSAT-7-L Description - Simultaneous DSRC and Satellite TIM Processing Test Case Description

Table 2-61. WI2VSAT-7-L Description - Simultaneous DSRC and Satellite TIM Processing Test Case Description

Test Case ID	**WI2VSAT-7-L**	**Test Engineer Verification and Remarks**
Test Case Name	Simultaneous DSRC and Satellite TIM Processing	
Test Case Completion Date		
Priority	Required	

Test Case ID	WI2VSAT-7-L	Test Engineer Verification and Remarks
Requirements Verified (Tracing)	Compiled in Table WI2VSAT-7-Requirements	
Objective	Verify correct processing of end-to-end communication (DB to OBU) of I2V SA TIMs simultaneously via satellite and via DSRC.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	Representative TIM Back Office Component. I2V SA TIM is formulated by Data Broker and distributed to test RSU and to satellite service provider.	
TIM	Representative TIM	
Host Vehicle OBU/ Vehicle	Lear Roadstar OBU	
Vehicle direction versus message direction	Same direction	
Vehicle Lane of travel	Roadway Travel lanes	
Host Vehicle Driving Scenario (TC Input)	Host vehicle approaches RSU from outside of DSRC communication range, while in satellite communication range. Host vehicle driving in travel lanes in "message direction". This is performed using “representative” TIM message.	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Driver observes beginning display of Representative TIM Advisory/Warning within 8 meters of beginning of TIM specified geofence and cease of display within 8 meters of end of TIM specified geofence.	

Test Case ID	WI2VSAT-7-L	Test Engineer Verification and Remarks
Log File Analysis and Verification Method (Test Case Output 2)	Log files confirm OBU correctly processes identical I2V SA TIMs from DSRC and satellite. Log files confirm OBU beginning display of Representative TIM Advisory/Warning within 8 meters of beginning of TIM specified geofence and cease of display within 8 meters of end of TIM specified geofence.	
Expected Result (Pass/Fail Criteria)	OBU correctly processes identical I2V SA TIMs from DSRC and satellite. Driver Advisory/Warning begins display within 8 meters of beginning of TIM specified geofence and ceases display within 8 meters of end of TIM specified geofence. Verified visually and by inspection of HMI logs.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* **1.** Verify WYDOT CV Pilot TMC System is operational and ready for test **2.** Verify RSUs are operational and ready for test **3.** Cycle Host Vehicle power and reboot vehicle system. **4.** Verify Host vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix **5.** Conduct Safety Inspection of the test area and vehicle path and confirm ready for test a. No obstructions or interference b. All staff where they are supposed to be, no staff where they aren't supposed to be c. Weather is acceptable and will not lead to hazardous driving conditions d. Road surface is acceptable and will not lead to hazardous driving conditions **6.** Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational **7.** Host vehicle driver inspects driving area and confirm track is clear and ready for test. **8.** Host Vehicle Driver and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure **9.** I2V SA TIM is formulated by Data Broker and distributed to test RSU. **10.** Host vehicle enters track from outside communication range and performs Host Vehicle Scenario.	

2.62 Table WI2VSAT-7-L Results - Simultaneous DSRC and Satellite TIM Processing

Table 2-62. WI2VSAT-7-L Results - Simultaneous DSRC and Satellite TIM Processing

Test Case ID	**WI2VSAT-7-L**	**Test Engineer Verification and Remarks**
Test Case Name	Simultaneous DSRC and Satellite TIM Processing	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.63 Table WI2VSAT-7-S Description - Simultaneous DSRC and Satellite TIM Processing Test Case Description

Table 2-63. WI2VSAT-7-S Description - Simultaneous DSRC and Satellite TIM Processing Test Case Description

Test Case ID	WI2VSAT-7-S	Test Engineer Verification and Remarks
Test Case Name	Simultaneous DSRC and Satellite TIM Processing	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WI2VSAT-7-Requirements	
Objective	Verify correct processing of end-to-end communication (DB to OBU) of I2V SA TIMs simultaneously via satellite and via DSRC.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	Representative TIM Back Office Component. I2V SA TIM is formulated by Data Broker and distributed to test RSU and to satellite service provider.	
TIM	Representative TIM	
Host Vehicle OBU/ Vehicle	SiriusXM OBU	

Test Case ID	WI2VSAT-7-S	Test Engineer Verification and Remarks
Vehicle direction versus message direction	Same direction	
Vehicle Lane of travel	Roadway Travel lanes	
Host Vehicle Driving Scenario (TC Input)	Host vehicle approaches RSU from outside of DSRC communication range, while in satellite communication range. Host vehicle driving in travel lanes in "message direction". This is performed using “representative” TIM message.	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Driver observes beginning display of Representative TIM Advisory/Warning within 8 meters of beginning of TIM specified geofence and cease of display within 8 meters of end of TIM specified geofence.	
Log File Analysis and Verification Method (Test Case Output 2)	Log files confirm OBU correctly processes identical I2V SA TIMs from DSRC and satellite. Log files confirm OBU beginning display of Representative TIM Advisory/Warning within 8 meters of beginning of TIM specified geofence and cease of display within 8 meters of end of TIM specified geofence.	
Expected Result (Pass/Fail Criteria)	OBU correctly processes identical I2V SA TIMs from DSRC and satellite. Driver Advisory/Warning begins display within 8 meters of beginning of TIM specified geofence and ceases display within 8 meters of end of TIM specified geofence. Verified visually and by inspection of HMI logs.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* **1.** Verify WYDOT CV Pilot TMC System is operational and ready for test **2.** Verify RSUs are operational and ready for test **3.** Cycle Host Vehicle power and reboot vehicle system. **4.** Verify Host vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix **5.** Conduct Safety Inspection of the test area and vehicle path and confirm ready for test a. No obstructions or interference	

Test Case ID	WI2VSAT-7-S	Test Engineer Verification and Remarks
	b. All staff where they are supposed to be, no staff where they aren't supposed to be c. Weather is acceptable and will not lead to hazardous driving conditions d. Road surface is acceptable and will not lead to hazardous driving conditions **6.** Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational **7.** Host vehicle driver inspects driving area and confirm track is clear and ready for test. **8.** Host Vehicle Driver and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure **9.** I2V SA TIM is formulated by Data Broker and distributed to test RSU. **10.** Host vehicle enters track from outside communication range and performs Host Vehicle Scenario.	

2.64 Table WI2VSAT-7-S Results - Simultaneous DSRC and Satellite TIM Processing

Table 2-64. WI2VSAT-7-S Results - Simultaneous DSRC and Satellite TIM Processing

Test Case ID	WI2VSAT-7-L	Test Engineer Verification and Remarks
Test Case Name	Simultaneous DSRC and Satellite TIM Processing	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*

Test Case ID	WI2VSAT-7-L	Test Engineer Verification and Remarks
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.65 Table WI2VSAT-7 Requirements Verification Analysis

Table 2-65. WI2VSAT-7 Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-7 -- Simultaneous DSRC and Satellite I2V SA TIMs communications	I2VSAP-REQ-14 -- Simultaneous DSRC and Satellite TIM Processing	Vehicle Systems shall support processing of identical I2V SA TIMs received via DSRC and satellite without conflict or error.	* Perform Test Case WI2VSAT-7 * Inspect OBU logs * Confirm receipt of broadcast of I2V SA TIMs by both DSRC and Satellite. * Inspect HMI logs * Confirm accurate display of TIM driver alerts. * Confirmation shows Vehicle Systems support processing of identical I2V SA TIMs received via DSRC and satellite without conflict or error, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

2.66 Table WI2VSAT-8-L Description - Message Display Start Time Test Case Description

Table 2-66. WI2VSAT-8-L Description - Message Display Start Time Test Case Description

Test Case ID	WI2VSAT-8-L	Test Engineer Verification and Remarks
Test Case Name	Message Display Start Time	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WI2VSAT-8-Requirements	
Objective	Verify geofence implementation and I2V SA TIM start and stop time functionality and performance on I-80. Verify GPS accuracy supports accurate display of I2V SA Messages.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	Representative TIM Back Office Component	
Message Type (TC Input 1)	Representative TIM	
Host Vehicle OBU/ Vehicle	Lear Roadstar OBU	

Test Case ID	WI2VSAT-8-L	Test Engineer Verification and Remarks
Vehicle direction versus message direction	Same direction	
Vehicle Lane of travel	Roadway Travel lanes	
Host Vehicle Driving Scenario (TC Input)	Host vehicle driving in travel lanes in "message direction". Vehicle enters geofence 10 seconds before start time. This is performed using "representative" TIM message.	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Driver observes message begins displays approximately within 1 second of specified start date and time (while inside the geofence).	
Log File Analysis and Verification Method (Test Case Output 2)	Log files confirm message begins displays within 1 second of specified start date and time (while inside the geofence).	
Expected Result (Pass/Fail Criteria)	Message begins displays within 1 second of specified start date and time (while inside the geofence).	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* **Verify Readiness for Test** **1.** Verify WYDOT CV Pilot TMC System is operational and ready for test **2.** Verify RSUs are operational and ready for test **3.** Cycle Host Vehicle power and reboot vehicle system. **4.** Verify Host vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix **5.** Conduct Safety Inspection of the test area and vehicle path and confirm ready for test a. No obstructions or interference b. All staff where they are supposed to be, no staff where they aren't supposed to be	

Test Case ID	WI2VSAT-8-L	Test Engineer Verification and Remarks
	c. Weather is acceptable and will not lead to hazardous driving conditions d. Road surface is acceptable and will not lead to hazardous driving conditions **Test Start Up** **6.** Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational **7.** Host vehicle driver inspects driving area and confirm track is clear and ready for test. **8.** Host Vehicle Driver and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure **Driving the Test** **9.** I2V SA TIM is formulated by Data Broker and distributed to test RSU. **10.** Host vehicle enters track from outside communication range and performs Test Case Host Vehicle Scenario.	

2.67 Table WI2VSAT-8-L Results - Message Display Start Time

Table 2-67. WI2VSAT-8-L Results - Message Display Start Time

Test Case ID	WI2VSAT-8-L	Test Engineer Verification and Remarks
Test Case Name	Message Display Start Time	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*

Test Case ID	WI2VSAT-8-L	Test Engineer Verification and Remarks
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.68 Table WI2VSAT-8-S Description - Message Display Start Time Test Case Description

Table 2-68. WI2VSAT-8-S Description - Message Display Start Time Test Case Description

Test Case ID	WI2VSAT-8-S	Test Engineer Verification and Remarks
Test Case Name	Message Display Start Time	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WI2VSAT-8-Requirements	

Test Case ID	WI2VSAT-8-S	Test Engineer Verification and Remarks
Objective	Verify geofence implementation and I2V SA TIM start and stop time functionality and performance on I-80. Verify GPS accuracy supports accurate display of I2V SA Messages.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	Representative TIM Back Office Component	
Message Type (TC Input 1)	Representative TIM	
Host Vehicle OBU/ Vehicle	SiriusXM OBU	
Vehicle direction versus message direction	Same direction	
Vehicle Lane of travel	Roadway Travel lanes	
Host Vehicle Driving Scenario (TC Input)	Host vehicle driving in travel lanes on I-80 in "message direction". Vehicle enters geofence 10 seconds before start time. This is performed using “representative” TIM message.	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Driver observes message begins displays approximately within 1 second of specified start date and time (while inside the geofence).	
Log File Analysis and Verification Method (Test Case Output 2)	Log files confirm message begins displays within 1 second of specified start date and time (while inside the geofence).	

Test Case ID	WI2VSAT-8-S	Test Engineer Verification and Remarks
Expected Result (Pass/Fail Criteria)	Message begins displays within 1 second of specified start date and time (while inside the geofence).	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* **Verify Readiness for Test** **1.** Verify WYDOT CV Pilot TMC System is operational and ready for test **2.** Verify RSUs are operational and ready for test **3.** Cycle Host Vehicle power and reboot vehicle system. **4.** Verify Host vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix **5.** Conduct Safety Inspection of the test area and vehicle path and confirm ready for test a. No obstructions or interference b. All staff where they are supposed to be, no staff where they aren't supposed to be c. Weather is acceptable and will not lead to hazardous driving conditions d. Road surface is acceptable and will not lead to hazardous driving conditions **Test Start Up** **6.** Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational **7.** Host vehicle driver inspects driving area and confirm track is clear and ready for test. **8.** Host Vehicle Driver and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure **Driving the Test** **9.** I2V SA TIM is formulated by Data Broker and distributed to test RSU. **10.** Host vehicle enters track from outside communication range and performs Test Case Host Vehicle Scenario.	

2.69 able WI2VSAT-8-S Results - Message Display Start Time

Table 2-69. WI2VSAT-8-S Results - Message Display Start Time

Test Case ID	**WI2VSAT-8-S**	**Test Engineer Verification and Remarks**
Test Case Name	Message Display Start Time	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.70 Table WI2VSAT-8 Requirements Verification Analysis

Table 2-70. WI2VSAT-8 Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-8 -- Message Display Start Time	I2VSAP-REQ-9 -- Message Display Start Time	Situational Awareness Message(s) shall begin display within 1 second of the time specified in the I2V SA TIM.	* Perform Test Case WI2VSAT-8 * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine Roadway and lane of travel of vehicle. * Confirm Situational Awareness Message displays within 1 second of the beginning time specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) begin display within 1 second of the time specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

2.71 Table WI2VSAT-9-L Description - Message Display Stop Time Test Case Description

Table 2-71. WI2VSAT-9-L Description - Message Display Stop Time Test Case Description

Test Case ID	**WI2VSAT-9-L**	**Test Engineer Verification and Remarks**
Test Case Name	Message Display Stop Time	
Test Case Completion Date		

Test Case ID	WI2VSAT-9-L	Test Engineer Verification and Remarks
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WI2VSAT-9-Requirements	
Objective	Verify geofence implementation and I2V SA TIM start and stop time functionality and performance on I-80. Verify GPS accuracy supports accurate display of I2V SA Messages.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	Representative TIM Back Office Component	
Message Type (TC Input 1)	Representative TIM	
Host Vehicle OBU/ Vehicle	Lear Roadstar OBU	
Vehicle direction versus message direction	Same direction	
Vehicle Lane of travel	Roadway Travel lanes	
Host Vehicle Driving Scenario (TC Input)	Host vehicle driving in travel lanes in "message direction". Vehicle enters geofence at least 10 seconds before message stop time. This is performed using “representative” TIM message.	
Driver Advisory/ Warning Visual	Driver observes message ceases displays approximately within 1 second of specified stop date and time (while inside the geofence).	

Test Case ID	WI2VSAT-9-L	Test Engineer Verification and Remarks
Verification (Test Case Output 1)		
Log File Analysis and Verification Method (Test Case Output 2)	Log files confirm message ceases displays within 1 second of specified stop date and time (while inside the geofence).	
Expected Result (Pass/Fail Criteria)	Message ceases displays within 1 second of specified stop date and time (while inside the geofence).	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* **Verify Readiness for Test** **1.** Verify WYDOT CV Pilot TMC System is operational and ready for test **2.** Verify RSUs are operational and ready for test **3.** Cycle Host Vehicle power and reboot vehicle system. **4.** Verify Host vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix **5.** Conduct Safety Inspection of the test area and vehicle path and confirm ready for test a. No obstructions or interference b. All staff where they are supposed to be, no staff where they aren't supposed to be c. Weather is acceptable and will not lead to hazardous driving conditions d. Road surface is acceptable and will not lead to hazardous driving conditions **Test Start Up** **6.** Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational **7.** Host vehicle driver inspects driving area and confirm track is clear and ready for test.	

Test Case ID	WI2VSAT-9-L	Test Engineer Verification and Remarks
	8. Host Vehicle Driver and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure **Driving the Test** **9.** I2V SA TIM is formulated by Data Broker and distributed to test RSU. **10.** Host vehicle enters track from outside communication range and performs Test Case Host Vehicle Scenario.	

2.72 Table WI2VSAT-9-L Results - Message Display Stop Time

Table 2-72. WI2VSAT-9-L Results - Message Display Stop Time

Test Case ID	WI2VSAT-9-L	Test Engineer Verification and Remarks
Test Case Name	Message Display Stop Time	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*

Test Case ID	WI2VSAT-9-L	Test Engineer Verification and Remarks
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.73 Table WI2VSAT-9-S Description - Message Display Stop Time Test Case Description

Table 2-73. WI2VSAT-9-S Description - Message Display Stop Time Test Case Description

Test Case ID	WI2VSAT-9-S	Test Engineer Verification and Remarks
Test Case Name	Message Display Stop Time	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WI2VSAT-9-Requirements	
Objective	Verify geofence implementation and I2V SA TIM start and stop time functionality and performance on I-80. Verify GPS accuracy supports accurate display of I2V SA Messages.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for I2V Situational Awareness Test Procedure and Test Cases described in Table WI2VSAT-CI I2V Situational Awareness Test Configuration and Initialization.	

Test Case ID	WI2VSAT-9-S	Test Engineer Verification and Remarks
	• Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	Representative TIM Back Office Component	
Message Type (TC Input 1)	Representative TIM	
Host Vehicle OBU/ Vehicle	SiriusXM OBU	
Vehicle direction versus message direction	Same direction	
Vehicle Lane of travel	Roadway Travel lanes	
Host Vehicle Driving Scenario (TC Input)	Host vehicle driving in travel lanes in "message direction". Vehicle enters geofence at least 10 seconds before message stop time. This is performed using “representative” TIM message.	
Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Driver observes message ceases displays approximately within 1 second of specified stop date and time (while inside the geofence).	
Log File Analysis and Verification Method (Test Case Output 2)	Log files confirm message ceases displays within 1 second of specified stop date and time (while inside the geofence).	
Expected Result (Pass/Fail Criteria)	Message ceases displays within 1 second of specified stop date and time (while inside the geofence).	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* **Verify Readiness for Test** **1.** Verify WYDOT CV Pilot TMC System is operational and ready for test	

Test Case ID	WI2VSAT-9-S	Test Engineer Verification and Remarks
	2. Verify RSUs are operational and ready for test **3.** Cycle Host Vehicle power and reboot vehicle system. **4.** Verify Host vehicle systems are operational and ready for test a. OBU to HMI communications b. GPS fix **5.** Conduct Safety Inspection of the test area and vehicle path and confirm ready for test a. No obstructions or interference b. All staff where they are supposed to be, no staff where they aren't supposed to be c. Weather is acceptable and will not lead to hazardous driving conditions d. Road surface is acceptable and will not lead to hazardous driving conditions **Test Start Up** **6.** Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational **7.** Host vehicle driver inspects driving area and confirm track is clear and ready for test. **8.** Host Vehicle Driver and Test Staff notify each other that vehicles, drivers and track are ready to conduct Test Procedure **Driving the Test** **9.** I2V SA TIM is formulated by Data Broker and distributed to test RSU. **10.** Host vehicle enters track from outside communication range and performs Test Case Host Vehicle Scenario.	

2.74 Table WI2VSAT-9-S Results - Message Display Stop Time

Table 2-74. WI2VSAT-9-S Results - Message Display Stop Time

Test Case ID	**WI2VSAT-9-S**	**Test Engineer Verification and Remarks**
Test Case Name	Message Display Stop Time	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.75 Table WI2VSAT-9 Requirements Verification Analysis

Table 2-75. WI2VSAT-9 Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WI2VSAT-9 -- Message Display Stop Time	I2VSAP-REQ-10 -- Message Display Stop Time	Situational Awareness Message(s) shall cease display within 1 second of the time specified in the I2V SA TIM.	* Perform Test Case WI2VSAT-9 * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine Roadway and lane of travel of vehicle. * Confirm Situational Awareness Message ceases display within 1 second of the end display time specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) cease display within 1 second of the time specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

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ITS Joint Program Office-HOIT
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Washington, DC 20590

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FHWA-JPO-17-472B.5

U.S. Department of Transportation

Connected Vehicle Pilot Deployment Program Phase 2

WYDOT CV Pilot – Distress Notification Test Procedure and Test Cases

www.its.dot.gov/index.htm
Final Report — July 30, 2018
FHWA-JPO-17-472B.6

U.S. Department of Transportation

Produced by DTFH6116H00027

U.S. Department of Transportation

Notice

Technical Report Documentation Page

<table>
<tr><td>1. Report No.
FHWA-JPO-17-472B.6</td><td>2. Government Accession No.</td><td>3. Recipient’s Catalog No.</td></tr>
<tr><td colspan="2" rowspan="2">4. Title and Subtitle
WYDOT CV Pilot - Distress Notification Test Procedure and Test Cases</td><td>5. Report Date
3/16/2018</td></tr>
<tr><td>6. Performing Organization Code</td></tr>
<tr><td colspan="2">7. Author(s)
Denny Stephens (Vital Assurance), Tony English (Trihydro), Nayel Ureña Serulle (ICF), Deepak Gopalakrishna (ICF), Vince Garcia (Wyoming DOT)</td><td>8. Performing Organization Report No.
Task 2G: Operational Readiness Test and Demonstration Planning</td></tr>
<tr><td colspan="2" rowspan="2">9. Performing Organization Name and Address
Wyoming DOT, 5300 Bishop Boulevard, Cheyenne, WY 82009
ICF International, 1725 Eye St NW, Washington DC, 20006
Trihydro Corporation, 1252 Commerce Drive, Laramie, WY 82070
Vital Assurance, 175 S. Third St., Suite 200, Columbus, OH 43215</td><td>10. Work Unit No. (TRAIS)</td></tr>
<tr><td>11. Contract or Grant No.
DTFH6116H00027</td></tr>
<tr><td colspan="2" rowspan="2">12. Sponsoring Agency Name and Address
U.S Department of Transportation 1200 New Jersey Ave, SE Washington, DC 20590</td><td>13. Type of Report and Period Covered
Operational Readiness Plan, 09/01/2016 to 7/30/2018</td></tr>
<tr><td>14. Sponsoring Agency Code</td></tr>
<tr><td colspan="3">15. Supplementary Notes
Kate Hartman (COR), Sarah Tarpgaard (CO)</td></tr>
<tr><td colspan="3">16. Abstract
The Wyoming Department of Transportation’s (WYDOT) Connected Vehicle (CV) Pilot Deployment Program is intended to develop a suite of applications that utilize vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communication technology to reduce the impact of adverse weather on truck travel in the I-80 corridor. These applications support a flexible range of services from advisories, roadside alerts, parking notifications and dynamic travel guidance. Information from these applications are made available directly to the equipped fleets or through data connections to fleet management centers (who will then communicate it to their trucks using their own systems). The pilot will be conducted in three Phases. Phase 1 includes the planning for the CV pilot including the concept of operations development. Phase 2 is the design, development, and testing phase. Phase 3 includes a real-world demonstration of the applications developed as part of this pilot.

This document presents the template of the Distress Notification Test Procedure and Test Cases of the Wyoming Department of Transportation (WYDOT) Connected Vehicle (CV) Pilot project as part of the United States Department of Transportation’s (USDOT) CV program. These tests are part of the WYDOT CV Pilot Operational Test Plan - Attachment B.</td></tr>
<tr><td colspan="2">17. Key Words
Connected Vehicle Technology, I-80 Corridor, Road Weather, Truck Safety, System Architecture</td><td>18. Distribution Statement
This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161</td></tr>
<tr><td>19. Security Classif. (of this report)
None</td><td>20. Security Classif. (of this page)
None</td><td>21. No. of Pages
52
22. Price
NA</td></tr>
</table>

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

Acknowledgements

The Operational Readiness Plan development team would like to thank USDOT and Noblis for their technical assistance throughout the development of this document.

Table of Contents

1 Introduction 1

1.1 Project Scope 1

1.2 Purpose of this Test 2

2 Distress Notification Test Procedure and Test Cases 3

2.1 Table WDNR-SUM. Distress Notification Test Case Summary 4

2.2 Table WDNR-TP Distress Notification Test Procedure 6

2.3 Table WDNR-CI Distress Notification Configuration and Initialization 8

2.4 Table WDNR-1-Description Same direction Distress Notification relay to RSU Test Case Description 12

2.5 Table WDNR-1 Results Same direction Distress Notification relay to RSU 19

2.6 Table WDNR-2 Description Opposite direction Distress Notification relay to RSU and Following Vehicle Test Case Description 22

2.7 Table WDNR-2 Results Opposite direction Distress Notification relay to RSU and Following Vehicle 31

2.8 Table WDNR-Requirements Requirements Verification Analysis 33

List of Tables

Table 2-1. WDNR-SUM. Distress Notification Test Case Summary 4
Table 2-2. WDNR-TP Distress Notification Test Procedure 6
Table 2-3. WDNR-CI Distress Notification Configuration and Initialization 8
Table 2-4. WDNR-1-Description Same direction Distress Notification relay to RSU Test Case Description 12
Table 2-5. WDNR-1 Results Same direction Distress Notification relay to RSU 19
Table 2-6. WDNR-2 Description Opposite direction Distress Notification relay to RSU and Following Vehicle Test Case Description 22
Table 2-7. WDNR-2 Results Opposite direction Distress Notification relay to RSU and Following Vehicle 31
Table 2-8. WDNR-Requirements Requirements Verification Analysis 33

1 Introduction

1.1 Project Scope

Wyoming is one of the first wave of CV Pilot sites selected to showcase the value of and spur the adoption of CV technology in the United States. CV technology is a broad term to describe the applications and the systems that leverage dedicated short-range communications (DSRC) for vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I) and infrastructure-to-vehicle (I2V) communication to improve safety, mobility and productivity of the users of the nation's transportation system.

As one of the three selected pilots, WYDOT is focusing on improving safety and mobility by creating new ways to communicate road and travel information to commercial truck drivers and fleet managers along the 402 miles of Interstate 80 (I-80 henceforth) in the State. For the pilot project, WYDOT concluded Phase 1 (planning) in September 2016 and then initiated Phase 2 (deployment) which is scheduled to conclude in mid-2018. This will be followed by an 18-month demonstration period in the third phase.

Systems and applications developed in the pilot will enable drivers of connected vehicles to have improved awareness of potential hazards and of situations they cannot see. At a very high level, the pilot scope includes the following implementation elements:

- **Deploy about 75 roadside units (RSU)** that can receive and broadcast messages using DSRC along various sections on I-80.
- **Equip around 400 vehicles, a combination of fleet vehicles and commercial trucks, with on-board units (OBU).** Of the 400 vehicles, at least 150 are planned to be heavy trucks. All vehicles are expected to be regular users of I-80. Several types of OBUs are being procured as part of the pilot and differ based on their communication capabilities, ability to integrate with the in-vehicle network, and connectivity to ancillary devices and sensors. All OBUs will have the functionality to broadcast Basic Safety Messages (BSM) and will include a human-machine interface (HMI) to share alerts and advisories to drivers of these vehicles.
- **Develop several V2V, V2I, I2V applications** that will enable communication to drivers of alerts and advisories regarding various road conditions. These applications include support for in-vehicle dissemination of advisories for collision avoidance, speed management, detours, parking, and presence of work zones and maintenance and emergency vehicles downstream of their current location.
- **Enable overall improvements in WYDOT's traffic management and traveler information practices** by using data collected from connected vehicles. Targeted improvements include ingesting more location specific mobile road weather information system (RWIS) data, using Pikalert®[1] to provide for more accurate and road segment specific conditions to define better variable speed limits (VSLs), and improving road

[1] Pikalert is a trademark of the University Corporation for Atmospheric Research.

condition dissemination via 511, Dynamic Message Signs (DMS) and other WYDOT sources.

1.2 Purpose of this Test

This document presents the test results of the *Distress Notification Test Procedure and Test Cases* for the Wyoming Department of Transportation (WYDOT) Connected Vehicle (CV) Pilot project as part of the United States Department of Transportation's (USDOT) CV program. These tests are part of the WYDOT CV Pilot Operational Test Plan - Attachment B.

The purpose of this document is to describe the results of a sequence of end-to-end tests conducted to validate the successful operation of the system in terms of Distress Notification.

2 Distress Notification Test Procedure and Test Cases

This chapter describes *Test Procedure ID WDNR -- Distress Notification Test Procedures and Test Cases*. Table WDNR-SUM is a high-level summary of the test cases addressed in this test procedure, providing a summary and orientation for the reader. Table WDNR-TP details the Test Procedure itself. Table WDNR-CI describes the configuration of each of the WYDOT CV Pilot System components for the Test Procedure and the Initialization to be performed for each prior to conducting the Test Cases. Tables WDNR-1-Description through WDNR-2-Description provide the detailed description of Test Cases to be performed under this Test Procedure. Tables WDNR-1-Results through WDNR-2-Results capture the results of each repetition of each Test Case. Finally, Tables WDNR-1-Requirements through WDNR-2-Requirements describe the requirement verification methodology and capture the Test Engineer’s confirmation that each requirement is verified. Appendix A of the ORTP provides a list of all system requirements, the test case in which they are verified, and their individual requirements verification methodology.

In this chapter, the following Test Cases are integrated with WDNR -1 - Same Direction Distress Notification relay to RSU for efficiency in conducting the tests.

- WV2VMCT-2 V2V exchange of DNMs
- WV2IMCT-1 V2I and End-to-end communication of DNMs
- WDNT-1 Manual Distress Notification

2.1 Table WDNR-SUM. Distress Notification Test Case Summary

Table 2-1. WDNR-SUM. Distress Notification Test Case Summary

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID	Requirements Verified
WDNR-1	Same direction Distress Notification relay to RSU	* Verify the functionality and performance of the Distress Notification Application for same direction relay.	* Distressed vehicle enters roadway and pulls to shoulder at specified safe location, outside of DSRC communication range from RSUs. * Driver manually initiates Distress Notification. * Same Direction Relay Vehicle approaches in same direction from outside DSRC communication range, passes host vehicle and continues, passing and relaying message to RSU.	* Same Direction Relay Vehicle receives DNM at least 300 meters before reaching Distressed Vehicle. * Same Direction Relay Vehicle OBU issues caution to driver upon receipt of DNM. * RSU receives DNM from Same Direction Relay Vehicle. * DNMs are received and processed by Data Broker. * TRAC receives DNM after receipt by RSU and issues distress notification message to operator. * Verified by inspection of logs.		Compiled in Table WDNR-Requirements
WDNR-2	Opposite direction Distress Notification relay to RSU and Following Vehicle	Verify the functionality and performance of the Distress Notification Application for opposite direction relay.	* 'Distressed vehicle enters roadway and pulls to shoulder at specified safe location, outside of DSRC communication range from RSUs. * Driver manually	* Opposing Direction Relay Vehicle receives DNM at least 300 meters before reaching Distressed Vehicle. * Opposing Direction Relay Vehicle OBU issues caution to driver upon		Compiled in Table WDNR-Requirements

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID	Requirements Verified
			initiates Distress Notification. * Opposing Direction Relay Vehicle approaches Distressed Vehicle from opposite direction, outside DSRC communication range, and passes Distressed Vehicle, receiving DNM. * Opposing Direction Relay Vehicle continues to the nearest RSU, where it uploads DNM, and continues relaying DNM to vehicles approaching from same direction as Distressed Vehicle for a configurable distance or time. * Opposing Direction Relay Vehicle continues relays DNM to Same Direction Following Vehicle before it is within communication range of Distressed Vehicle. * Same Direction Following Vehicle continues to the nearest RSU, where it	receipt of DNM. * RSU receives DNM from Opposing Direction Relay Vehicle at least 300 meters before reaching RSU. * TRAC receives DNM and issues distress notification message to operator. * Same Direction Following Vehicle receives DNM from Opposing Direction Relay Vehicle at least 300 meters before reaching Opposing Direction Relay Vehicle. * Same Direction Following Vehicle issues caution to driver a configurable distance before reaching Distressed Vehicle. * Same Direction Following Vehicle relays DNM to Opposing Direction Vehicles for a configurable distance or time from Distressed Vehicle. * Verified by inspection of logs.		

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID	Requirements Verified
			uploads DNM, and continues relaying DNM to Opposing Direction Vehicles for a configurable distance or time. (Note: Distressed Vehicle shall be over 5 miles downstream from RSU to enable Opposing Direction Relay Vehicle to cease broadcasting DNMs and go silent after 5 miles (or configurable distance), and prior to encountering the RSU for upload of the DNM.)			

2.2 Table WDNR-TP Distress Notification Test Procedure

Table 2-2. WDNR-TP Distress Notification Test Procedure

Test Procedure ID	WDNR	Test Engineer Verification and Remarks
Test Procedure Name	Distress Notification Test Procedure	
Test Procedure Completion Date		
Priority	Required	

Test Procedure ID	WDNR	Test Engineer Verification and Remarks

Objectives	• Verify that message relay is successful when the Distressed Vehicle is outside the range of the RSU.
	• (TC WDNR-1) Verify that vehicles traveling in the same direction as distressed vehicle
	   o receive DNMs,
	   o notify the driver of a distressed vehicle ahead in the same direction of travel,
	   o do not relay DNMs to vehicles approaching from the opposing direction,
	   o and relay DNMs to the nearest (same direction) RSU.
	• (TC WDNR-2) Verify that vehicles traveling in the opposite direction from the distressed vehicles
	   o receive DNMs,
	   o notify the driver of distressed vehicle in the opposing direction,
	   o relay DNMs to vehicles approaching from the same direction as distressed vehicle,
	   o cease broadcasting DNMs to opposing vehicles after a configurable distance from the distressed vehicle, and
	   o relay DNMs to the nearest (opposing direction) RSU, regardless of the distance.
	• Verify requirements associated with each Test Case	

Relationship to Other Procedures	• Precondition is successful development and integration of the WYDOT CV Pilot System, as described in the SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	
Discussion, Guidance, and Rationales	• 300m is the design communication range for DSRC SAE J2735 messages. • This application is supported only by Lear Roadstar OBU	
Prior to Conducting Test	• Verify configuration of each system and test component complies with **Configuration for Distress Notification Test Procedure and Test Cases** described in Table WDNR-CI. • Prepare each system and test component in accordance with **Initialization for Distress Notification Test Procedure and Test Cases** described in Table WDNR-CI.	

Test Procedure ID	WDNR	Test Engineer Verification and Remarks
	• Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff. • Verify condition of each system component in accordance with Table WDNR-3.	
Test Cases Performed under This Procedure	For this procedure conduct the following Test Cases detailed later in this section. • WDNR-1 • WDNR-2 (Note: Distress Notification is supported only by the Lear Roadstar OBU)	

2.3 Table WDNR-CI Distress Notification Configuration and Initialization

Table 2-3. WDNR-CI Distress Notification Configuration and Initialization

System Component	Applicable Test Procedure and Cases	Configuration for Distress Notification Test Procedure and Test Cases	Initialization for Distress Notification Test Procedure and Test Cases
Roadway	All WDNR Test Cases	• I-80 or comparable highway location supporting 2-way traffic. • Staging area outside DSRC communication range from distressed vehicle location.	• Identify Distressed Vehicle location outside DSRC communication range from RSUs (to avoid communications or interference with DNM relay). • Place traffic cones at location on both sides of roadway clearly visible to drivers. • Identify maximum DSRC communication range distance upstream and downstream and place traffic cones on both sides of roadway clearly visible to drivers. • Place cautionary signage and boundary markers in advance of

System Component	Applicable Test Procedure and Cases	Configuration for Distress Notification Test Procedure and Test Cases	Initialization for Distress Notification Test Procedure and Test Cases
			test area and Distressed Vehicle location to warn test staff and visitors • On roadway, place any additional signage required by WYDOT Safety Manager • Verify vehicle preparation and staging area is outside DSRC communication range of Distressed Vehicle interaction locations.
Transportation Reporting and Action Console	All WDNR Test Cases	TRAC fully integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Verify TRAC configuration files are correct for this test set • Download/Copy DB configuration files to Test Case Folder for Test Record
Data Broker (DB)	All WDNR Test Cases	DB fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Delete (all) existing TIMs messages • Remove old log files • Verify DB configuration files are correct for this test set • Download/Copy DB configuration files to Test Case Folder for Test Record • Reinitialize, if practical
Operational Data Environment (ODE)	All WDNR Test Cases	ODE fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Archive and Delete (all) existing Event Log Files • Remove old log files • Verify ODE configuration files are correct for this test case • Download/Copy ODE configuration files to Test Case Folder for Test Record

System Component	Applicable Test Procedure and Cases	Configuration for Distress Notification Test Procedure and Test Cases	Initialization for Distress Notification Test Procedure and Test Cases
			• Reinitialize, if practical
Data Warehouse (DW)	All WDNR Test Cases	DW fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Verify DW configuration files are correct for this test case • Download/Copy DW configuration files to Test Case Folder for Test Record
Security Credential Management System (SCMS)	All WDNR Test Cases	SCMS fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Verify SCMS configuration files are correct for this test case • Download/Copy SCMS configuration files to Test Case Folder for Test Record
RSU(s)	All WDNR Test Cases	One RSU fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment. RSU is located outside DSRC communication range from WI2VSAT geofence.	• Verify RSU is located outside DSRC communication range from WDNR stopped or slowing remote vehicle event location. • Delete (all) existing TIMs on RSU (avoid interfere with V2V communications) • Remove old log files • Verify RSU configuration files are correct for this test case • Download/Copy RSU configuration files to Test Case Folder for Test Record • Reboot RSU, if practical
Data Logging	All WDNR Test Cases	Data logging for each of the following components fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment: • ODE (for Event Log Files) • OBU (all vehicles) • HMI (all vehicles)	• Remove old log files after storage and archival • Initialize Test Log Folder with Unique Test Identifier

System Component	Applicable Test Procedure and Cases	Configuration for Distress Notification Test Procedure and Test Cases	Initialization for Distress Notification Test Procedure and Test Cases
		• TRAC	
External Storage Location for Each Test Set	All WDNR Test Cases	Storage location external to the system for backup and archiving of log files and test records.	• Initialize Test Record Folder with Unique Test Identifier
WYDOT Maint Vehicle	WYDOT Maint Vehicle or Integrated Commercial Vehicle w/Lear Roadstar OBU are used for Host Vehicle, Same Direction Relay Vehicle and Opposing Direction Relay Vehicle	Lear Roadstar OBU with antenna configuration planned for deployment and HMI fully developed, integrated with vehicle and CAN interface per SDD and ICD, ready for production deployment. May be tested with development environment or production environment, as long as it is ready for production deployment.	• Remove old log files • Initialize log file folders for this Test Case with Unique Identifier • Verify OBU and HMI configuration files are correct for this test case • Download/Copy OBU and HMI configuration files to Test Case Folder for Test Record
Integrated Truck	WYDOT Maint Vehicle or Integrated Commercial Vehicle w/Lear Roadstar OBU are used for Host Vehicle, Same Direction Relay Vehicle and Opposing Direction Relay Vehicle	Lear Roadstar OBU with antenna configuration planned for deployment and HMI fully developed, installed in vehicle per SDD and ICD, ready for production deployment. May be tested with development environment or production environment, as long as it is ready for production deployment.	• Remove old log files • Initialize log file folders for this Test Case with Unique Identifier • Verify OBU and HMI configuration files are correct for this test case • Download/Copy OBU and HMI configuration files to Test Case Folder for Test Record
Drivers	All WDNR Test Cases	Drivers qualified and experienced in driving the assigned vehicles. Drivers trained in what to expect from WDNR Applications and practiced in conducting driving scenarios safely and reliably with existing traffic.	• Conduct driver safety briefing • Review and practice test scenario, as required to ensure maneuvers can be conducted safely and reliably with existing traffic
Test Staff	All WDNR Test Cases	Test staff trained in what to expect from WI2V Applications and practiced in supporting driving scenarios safely and reliably with existing traffic.	• Conduct safety briefing and review danger zones • Verify that Test Staff wear safety vests

System Component	Applicable Test Procedure and Cases	Configuration for Distress Notification Test Procedure and Test Cases	Initialization for Distress Notification Test Procedure and Test Cases
			• Review and practice test scenario, as required to ensure maneuvers can be conducted safely and reliably with existing traffic
Visitors and Non-Test Staff	All WDNR Test Cases	Visitors and Non-Test Staff instructed in what to expect from WI2V Applications and informed in observing driving scenarios safely and reliably with existing traffic.	• Review test scenario • Conduct safety briefing and review danger zones

2.4 Table WDNR-1-Description Same direction Distress Notification relay to RSU Test Case Description

Table 2-4. WDNR-1-Description Same direction Distress Notification relay to RSU Test Case Description

Test Case ID	**WDNR-1**	**Test Engineer Verification and Remarks**
Test Case Name	Same direction Distress Notification relay to RSU	
Test Case Completion Date	June 21, 2018	
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WDNR-Requirements	
Objectives	• WDNR-1 o Verify the functionality and performance of the Distress Notification Application for same direction relay.	

Test Case ID	WDNR-1	Test Engineer Verification and Remarks
	o Demonstrate End-to-end communication of Manual Distress Notification to nearby RSU and to TRAC. Distress Notification is activated manually on stationary vehicle. • WV2VMCT-2 o Verify V2V DN Communication Range and Antenna Performance • WV2IMCT-1 o Verify End-to-end Communication of DNMs and V2I DNM communication range	
Preconditions	• Verify configuration of each system and test component complies with Configuration for Distress Notification Test Procedure and Test Cases described in Table WDNR-CI Distress Notification Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for Distress Notification Test Procedure and Test Cases described in Table WDNR-CI Distress Notification Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Distressed Vehicle OBU/ Vehicle	WYDOT Maint Vehicle or Integrated Comm Vehicle w/Lear Roadstar OBU	
Opposing Direction Relay Vehicle OBU/ Vehicle	WYDOT Maint Vehicle or Integrated Comm Vehicle w/Lear Roadstar OBU	
Same Direction Relay Vehicle OBU/ Vehicle	WYDOT Maint Vehicle or Integrated Comm Vehicle w/Lear Roadstar OBU	
Distress Vehicle Scenario (Input 1)	Distressed vehicle enters highway drives to specified safe location and pulls to shoulder. Driver manually initiates Distress Notification.	
Opposing Direction Relay Vehicle Scenario (Input 2)	NA	

Test Case ID	WDNR-1	Test Engineer Verification and Remarks
Same Direction Relay Vehicle Scenario (Input 3)	Relay Vehicle approaches in same direction from outside DSRC communication range, passes Distress Vehicle and continues to nearest (same direction) RSU outside of Distressed Vehicle DSRC communication range.	
WDNR-1 Driver Advisory/ Warning Visual Verification (Test Case Output 1)	Same Direction Relay Vehicle Driver receives notification of distressed vehicle ahead in same direction of travel. (Note: Test Cases WDNT-1, WV2VMCT-2, and WV2IMCT-1 do not issue driver advisories or alerts.)	
WDNR-1 Log File Analysis and Verification Method (Test Case Output 2)	• Same Direction Relay Vehicle log files confirm OBU receives DNM at least 2 to 300 meters before reaching Distressed Vehicle. • ODE logs confirm upload of DNM from Same Direction Relay Vehicle • TRAC logs confirm receipt of DNM and issues distress notification message to operator.	
WDNT-1 Log File Analysis and Verification Method (Test Case Output 2)	• Time between activation and notification received by TRAC	
WV2VMCT-2 Log File Analysis and Verification Method (Test Case Output 2)	• Distance at which a configurable threshold percentage of BSMs or DN TIMs sent by Host vehicle OBU are received and logged by Remote vehicle OBU. • Distance at which a configurable threshold percentage of BSMs or DN TIMs sent by Remote vehicle OBU are received and logged by Host vehicle OBU.	
WV2IMCT-1 Log File Analysis and Verification Method (Test Case Output 2)	• Vehicle distance when messages received by or through RSU	
WDNR-1 Expected Result (Pass/Fail Criteria)	• Same Direction Relay Vehicle Driver receives notification of distressed vehicle ahead in same direction of travel • Same Direction Relay Vehicle OBU receives DNM at least 2 to 300 meters before reaching Distressed Vehicle.	

Test Case ID	WDNR-1	Test Engineer Verification and Remarks
	• ODE receives upload of DNM from Same Direction Relay Vehicle • TRAC receives DNM and issues distress notification message to operator.	
WDNT-1 Expected Result (Pass/Fail Criteria)	• Manual Distress Notification is received by TRAC and displayed to operator.	
WV2VMCT-2 Expected Result (Pass/Fail Criteria)	• A configurable threshold percentage of DN TIMs sent are received and logged by host and remote vehicle OBUs, when vehicles are at least 2 to 300 meters apart.	
WV2IMCT-1 Expected Result (Pass/Fail Criteria)	• A configurable threshold percentage of DNMs are received and processed by RSUs when vehicle is at least 2 to 300 meters away. TIMs are received and processed by Data Broker. Verified by logs.	
Detailed Execution Steps	**Verify Readiness** 1. Host and remote vehicle have Lear LocoMate 300 OBU's installed with antenna and HMI, configured according to the WYDOT CV Pilot OBU configuration. A lap top computer must be connected via an Ethernet cable or Wi-Fi to the OBU to implement initial log file offload verification. 2. Confirm that the test track Lear LocoMate 300 RSU is installed and configured according to the WYDOT CV Pilot RSU configuration. 3. Confirm that the WYDOT TRAC system is operating. 4. Identify offload location where vehicles can drive to, to be within the offload range of the test track RSU. 5. Identify specific test track location for remote vehicle to stop and be stationary. Identify path that host vehicle will use to approach stationary remote vehicle. The approach path must start at least 300 meters from stationary vehicle location. 6. Provide a conference call to provide concurrent communication between all of the driving test participants. This is necessary as the test vehicles are widely separated during the test sequence, and well out of visual range of each other. **Test Start Up**	

Test Case ID	WDNR-1	Test Engineer Verification and Remarks
	7. Drive both the host and remote vehicles to the offload location, power up each OBU in the host and remote vehicle. 8. Confirm that each OBU powers up correctly and is linked to it's corresponding HMI. Confirm this by driving a short distance and validating that the vehicle speed and location are updated on the HMI to reflect the short drive. 9. While parked at the offload location execute the following steps to confirm log file generation and offload. a. Log into each OBU and from the system shell issue a ping6 command to the backend host server for the WYDOT CV Pilot environment. This will confirm the full IPv6 connectivity from the OBU through the RSU to the WYDOT backend server. The ping command to issue is: i. #ping6 <backend server IPv6 address> b. For each OBU confirm that log file are being generated. Confirm this by reviewing the event log directory on the OBU and checking that various log files are increasing in size. The specific log files to see increasing are: i. /var/eventlog/bsmLogDuringEvent.csv ii. /var/eventlog/rxMsg.csv iii. /var/eventlog/driverAlert.csv c. For each OBU confirm that log files are being offloaded, when vehicle is at the designated offload location. Confirm this by reviewing the offload subdirectories on the OBU and ensuring that they do not continuously accumulate log files. A few log files may accumulate (2-3), but within 30 seconds they should all offload and be removed from the log directory. The specific offload subdirectories to check are: i. /var/storage/bsmLogDuringEvent ii. /var/storage/rxMsg iii. /var/storage/driverAlert Once the log file generation and offload are confirmed the test repetitions can begin. **Driving the Test** 1. Begin by driving the remote (same direction relay) vehicle to its designated start position on the test path.	

Test Case ID	WDNR-1	Test Engineer Verification and Remarks
	2. Drive the host vehicle (distress vehicle) to the designated distressed vehicle location. Ensure that the host vehicle follows defined approach path to the distressed vehicle location. 3. Once the host vehicle is stationary at the distressed vehicle location, the host vehicle manually initiates the distress notification on their HMI/OBU. Upon initiation of the distress notification, the host vehicle driver announces the test repetition start to all test participants. 4. Drive the same direction relay vehicle along the defined path towards the distressed vehicle location. 5. During the approach to the distress vehicle, the relay vehicle driver identifies any advisory and warnings issued to the driver. 6. After passing the distressed vehicle location, the relay vehicle continues downstream to the defined offload RSU. 7. Once the relay vehicle has reached the offload RSU and stops at a designated offload location the driver manually records any advisory and warning messages received during the distressed vehicle bypass and the approximate time of offload. The driver also confirms offload of log files (see test startup third step) and then announces the test repetition end to all test participants. 8. At the end of the test repetition, both the host and remote vehicle power cycle their respective OBUs. This OBU reset ensures that the distress notification is cleared from both OBUs prior to the next repetition. 9. The remote vehicle (relay vehicle) then returns to the previously defined test start position. 10. The host vehicle (distress vehicle) also resets its position, leaving the distress location then following the designated approach path to return to the distress location. 11. The next test repetition can only start when the relay vehicle has returned to its path start location. 12. After final test repetition, the host vehicle drives to a designated RSU offload location and confirms that generated log files are offloaded (see test startup third step). **Analysis Procedure**	

Test Case ID	WDNR-1	Test Engineer Verification and Remarks
	13. Execute a set of queries on the DW to extract bsm and driver alert log records for the period of time around each DN test run. These queries are implemented in a script that generates a KML file for display in Google Earth. This allows each bsm and driver alert record from each test vehicle to be plotted in the Google Earth application. The follow example command line runs the query script to generate the KML file for a test executed at the I-80 test area that started 21 Jun 2018 03:40:00 pm MST and ended at 04:10:00 pm MST. python create_kml.py circle --lat 41.123537 --long -104.758474 --distance 2000 --beginTime '2018-06-21 21:40:00' --endTime '2018-06-21 22:10:00' 14. Open the resulting KML file in Google Earth. The bsm records and driver alert records for each vehicle will be visible along the paths they traveled at the test location. Bsm records from each vehicle will be in a different color. Driver alert records will be shown as white triangles at each point in the vehicle trajectory that the driver alert was issued. Adjust the time slider so that appropriate bsm and driver alerts around the DN test are visible. 15. Using the Google Earth ruler tool, measure the distance in meters from the first advisory DN (stalled vehicle alert) to the location of the stationary distressed vehicle. Confirm this distance is within the required alert distance for the distress notification. 16. Logging onto the ODE server where the vehicle log files were offloaded. Check the modification times of the log files and identify those that were offloaded by the relay vehicle during each of the DN test repetitions. The existence of these files at the corresponding offload times confirms that the offload occurred from the relay vehicle. 17. Record the modification time to the second of these DN log files. Use this modification time and identify a bsm record that corresponds to this time from the Google Earth KML file. Use the Google Earth ruler tool to measure the distance in meters between the bsm record and the RSU location. Confirm this distance is within the required distance for log file offload. 18. Query the TRAC database and record the received DN messages. Correlate each of the DN messages with a DN log file offload from the relay vehicle.	

2.5 Table WDNR-1 Results Same direction Distress Notification relay to RSU

Table 2-5. WDNR-1 Results Same direction Distress Notification relay to RSU

Test Case ID	Rep	WDNR-1	Test Engineer Verification and Remarks
Test Case Name		Same direction Distress Notification relay to RSU	*Performed and Confirmed by:*
Test Case Completion Date			*Performed and Confirmed by:*
WDNR-1 Driver Advisory/ Warning Visual Results	**Rep 1**		*Performed and Confirmed by:*
WDNR-1 Log Analysis Test Case Log File Analysis Results	**Rep 1**		*Performed and Confirmed by:*
WDNT-1 Log Analysis Test Case Log File Analysis Results	**Rep 1**		*Performed and Confirmed by:*
WV2VMCT-2 Log Analysis Test Case Log File Analysis Results	**Rep 1**		*Performed and Confirmed by:*
WV2IMCT-1 Log Analysis Test Case Log File Analysis Results	**Rep 1**		*Performed and Confirmed by:*
WDNR-1 Driver Advisory/ Warning Visual Results	**Rep 2**		*Performed and Confirmed by:*
WDNR-1 Log Analysis Test Case Log File Analysis Results	**Rep 2**		*Performed and Confirmed by:*
WDNT-1 Log Analysis Test Case Log File Analysis Results	**Rep 2**		*Performed and Confirmed by:*
WV2VMCT-2 Log Analysis Test Case Log File Analysis Results	**Rep 2**		*Performed and Confirmed by:*

Test Case ID	Rep	WDNR-1	Test Engineer Verification and Remarks
WV2IMCT-1 Log Analysis Test Case Log File Analysis Results	**Rep 2**		*Performed and Confirmed by:*
WDNR-1 Driver Advisory/ Warning Visual Results	**Rep 3**		*Performed and Confirmed by:*
WDNR-1 Log Analysis Test Case Log File Analysis Results	**Rep 3**		*Performed and Confirmed by:*
WDNT-1 Log Analysis Test Case Log File Analysis Results	**Rep 3**		*Performed and Confirmed by:*
WV2VMCT-2 Log Analysis Test Case Log File Analysis Results	**Rep 3**		*Performed and Confirmed by:*
WV2IMCT-1 Log Analysis Test Case Log File Analysis Results	**Rep 3**		*Performed and Confirmed by:*
WDNR-1 Driver Advisory/ Warning Visual Results	**Rep 4**		*Performed and Confirmed by:*
WDNR-1 Log Analysis Test Case Log File Analysis Results	**Rep 4**		*Performed and Confirmed by:*
WDNT-1 Log Analysis Test Case Log File Analysis Results	**Rep 4**		*Performed and Confirmed by:*
WV2VMCT-2 Log Analysis Test Case Log File Analysis Results	**Rep 4**		*Performed and Confirmed by:*
WV2IMCT-1 Log Analysis Test Case Log File Analysis Results	**Rep 4**		*Performed and Confirmed by:*
WDNR-1 Driver Advisory/ Warning Visual Results	**Rep 5**		*Performed and Confirmed by:*

Test Case ID	Rep	WDNR-1	Test Engineer Verification and Remarks
WDNR-1 Log Analysis Test Case Log File Analysis Results	**Rep 5**		*Performed and Confirmed by:*
WDNT-1 Log Analysis Test Case Log File Analysis Results	**Rep 5**		*Performed and Confirmed by:*
WV2VMCT-2 Log Analysis Test Case Log File Analysis Results	**Rep 5**		*Performed and Confirmed by:*
WV2IMCT-1 Log Analysis Test Case Log File Analysis Results	**Rep 5**		*Performed and Confirmed by:*
Test Case Analysis Tables			*Performed and Confirmed by:*
WDNR-1 Pass/Fail Assessment			*Performed and Confirmed by:*
WDNT-1 Pass/Fail Assessment			*Performed and Confirmed by:*
WV2VMCT-2 Pass/Fail Assessment			*Performed and Confirmed by:*
WV2IMCT-1 Pass/Fail Assessment			*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.6 Table WDNR-2 Description Opposite direction Distress Notification relay to RSU and Following Vehicle Test Case Description

Table 2-6. WDNR-2 Description Opposite direction Distress Notification relay to RSU and Following Vehicle Test Case Description

Test Case ID	**WDNR-2**	**Test Engineer Verification and Remarks**
Test Case Name	Opposite direction Distress Notification relay to RSU and Following Vehicle	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WDNR-Requirements	
Objective	Verify the functionality and performance of the Distress Notification Application for opposite direction relay.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for Distress Notification Test Procedure and Test Cases described in Table WDNR-CI. • Prepare each system and test component in accordance with Initialization for Distress Notification Test Procedure and Test Cases described in Table WDNR-CI. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Distressed Vehicle OBU/ Vehicle	WYDOT Maint Vehicle or Integrated Comm Vehicle w/Lear Roadstar OBU	
Opposing Direction Relay Vehicle OBU/ Vehicle	WYDOT Maint Vehicle or Integrated Comm Vehicle w/Lear Roadstar OBU	
Same Direction Relay Vehicle OBU/ Vehicle	WYDOT Maint Vehicle or Integrated Comm Vehicle w/Lear Roadstar OBU	

Test Case ID	WDNR-2	Test Engineer Verification and Remarks
Distress Vehicle Scenario (Input 1)	Distressed vehicle enters highway drives to specified safe location and pulls to shoulder. Driver manually initiates Distress Notification.	
Opposing Direction Relay Vehicle Scenario (Input 2)	• Opposing Direction Relay Vehicle 1 approaches from opposite direction, outside DSRC communication range, passes Distressed Vehicle. • Opposing Direction Relay Vehicle continues and passes nearest RSU. • Opposing Direction Relay Vehicle continues and passes Same Direction Relay Vehicle.	
Same Direction Relay Vehicle Scenario (Input 3)	Same Direction Relay Vehicle approaches and passes Opposing Direction Relay Vehicle before entering communication range of the Distressed Vehicle.	
Driver Advisory/ Warning (TC Output)	• Opposing Direction Relay Vehicle Driver receives notification of distressed vehicle ahead in opposing direction of travel. • Same Direction Relay Vehicle Driver receives notification of distressed vehicle ahead in same direction of travel.	
Log File Analysis and Verification Method (Test Case Output 2)	• Opposing Direction Relay Vehicle OBU logs confirm receipt of DNM at least 2 to 300 meters before reaching Distressed Vehicle. • ODE logs confirm upload of DNM from nearest (opposing direction) RSU from Opposing Direction Relay Vehicle at least 2 to 300 meters before reaching RSU. • TRAC logs confirm receipt of DNM and issues distress notification message to operator. • Same Direction Relay Vehicle OBU logs confirm receipt of DNM from Opposing Direction Relay Vehicle at least 2 to 300 meters before reaching Opposing Direction Relay Vehicle. • Opposing Direction Relay Vehicle OBU logs confirm cease broadcasting DNMs after a configurable distance from the distressed vehicle Distressed Vehicle.	
Expected Result (Pass/Fail Criteria)	• Opposing Direction Relay Vehicle Driver receives notification of distressed vehicle ahead in opposing direction of travel. • Same Direction Relay Vehicle Driver receives notification of distressed vehicle ahead in same direction of travel. • Opposing Direction Relay Vehicle receives DNM at least 2 to 300 meters before reaching Distressed Vehicle. • Nearest (opposing direction) RSU receives DNM from Opposing Direction Relay Vehicle at least 2 to 300 meters before reaching RSU. • TRAC receives DNM and issues distress notification message to operator.	

Test Case ID	WDNR-2	Test Engineer Verification and Remarks
	• Same Direction Relay Vehicle receives DNM from Opposing Direction Relay Vehicle at least 2 to 300 meters before reaching Opposing Direction Relay Vehicle. • Opposing Direction Relay Vehicle ceases broadcasting DNMs after a configurable distance from the distressed vehicle Distressed Vehicle.	
Detailed Execution Steps	**Verify Readiness** 1. Host and two remote vehicles have Lear LocoMate 300 OBU's installed with antenna and HMI, configured according to the WYDOT CV Pilot OBU configuration. A lap top computer must be connected via an Ethernet cable to the OBU to implement initial log file offload verification. 2. Confirm that the test track Lear LocoMate 300 RSU is installed and configured according to the WYDOT CV Pilot RSU configuration. 3. Confirm that the WYDOT TRAC system is operating. 4. Identify offload location where vehicles can drive to, to be within the offload range of the test track RSU. 5. Identify specific test track location for remote vehicle to stop and be stationary. Identify path that each remote vehicle will use to approach stationary host vehicle. The approach path must start at least 300 meters from stationary vehicle location. 6. Provide a conference call to provide concurrent communication between all of the driving test participants. This is necessary as the test vehicles are widely separated during the test sequence, and well out of visual range of each other. **Test Start Up** 7. Drive the host and remote vehicles to the offload location, power up each OBU in the host and remote vehicle.	

Test Case ID	WDNR-2	Test Engineer Verification and Remarks

	8. Confirm that each OBU powers up correctly and is linked to its corresponding HMI. Confirm this by driving a short distance and validating that the vehicle speed and location are updated on the HMI to reflect the short drive.
	9. While parked at the offload location execute the following steps to confirm log file generation and offload.
	    d. Log into each OBU and from the system shell issue a ping6 command to the backend host server for the WYDOT CV Pilot environment. This will confirm the full IPv6 connectivity from the OBU through the RSU to the WYDOT backend server. The ping command to issue is:
	        i. #ping6 <backend server IPv6 address>
	    e. For each OBU confirm that log files are being generated. Confirm this by reviewing the event log directory on the OBU and checking that various log files are increasing in size. The specific log files to see increasing are:
	        i. /var/eventlog/bsmLogDuringEvent.csv
	        ii. /var/eventlog/rxMsg.csv
	        iii. /var/eventlog/driverAlert.csv
	    f. For each OBU confirm that log files are being offloaded, when vehicle is at the designated offload location. Confirm this by reviewing the offload subdirectories on the OBU and ensuring that they do not continuously accumulate log files. A few log files may accumulate (2-3), but within 30 seconds they should all offload and be removed from the log directory. The specific offload subdirectories to check are:
	        i. /var/storage/bsmLogDuringEvent
	        ii. /var/storage/rxMsg
	        iii. /var/storage/driverAlert	

Test Case ID	WDNR-2	Test Engineer Verification and Remarks
	Once the log file generation and offload are confirmed the test repetitions can begin. **Driving the Test** 10. Begin by driving the two remote vehicles (same and opposite direction relay) to their designated start positions on the test path. 11. Drive the host vehicle (distress vehicle) to the designated distressed vehicle location. Ensure that the host vehicle follows defined approach path to the distressed vehicle location. 12. Once the host vehicle is stationary at the distressed vehicle location, the host vehicle manually initiates the distress notification on their HMI/OBU. Upon initiation of the distress notification the host vehicle driver announces the test repetition start to all test participants. 13. Drive the opposite direction relay vehicle along the defined path towards the distressed vehicle location. 14. During the approach to the distress vehicle, the opposite direction relay vehicle driver identifies any advisory and warnings issued to the driver. 15. After passing the distress vehicle location, the opposite direction relay vehicle continues downstream. The distress vehicle driver announces the opposite direction relay vehicle passing the distress vehicle. 16. Once the opposite direction relay vehicle has passed the distress vehicle, the same direction relay vehicle leaves its start location and starts driving towards the distress vehicle. This is timed so that the same direction relay vehicle should pass the opposite direction relay vehicle at least a mile away from the distress vehicle and less than 5 miles away from the distress vehicle. 17. During the approach to the opposite direction relay vehicle, the same direction relay vehicle driver identifies any advisory and warnings issued to the driver.	

Test Case ID	WDNR-2	Test Engineer Verification and Remarks
	18. After passing the opposite direction relay vehicle, the same direction relay vehicle continues downstream towards the distress vehicle. The opposite direction relay vehicle continues on its path away from the distressed vehicle and towards its defined offload RSU. 19. After passing the distress vehicle location, the same direction relay vehicle continues downstream. The distress vehicle driver announces the same direction relay vehicle passing the distress vehicle. 20. Once the same direction relay vehicle has reached its offload RSU and stops at a designated offload location the driver manually records any advisory and warning messages received during the distressed vehicle bypass and the approximate time of offload. The driver also confirms offload of log files (see test startup third step). After confirming the offload, the driver power cycles their OBU and announces his offload status to all test participants. 21. After the same direction relay vehicle has passed the distress vehicle and is at least ½ mile downstream, the distress vehicle driver turns off the distress notification and power cycles their OBU. This eliminates the distress notification from the OBU. Once the OBU has repowered, the driver confirms that the HMI is connecting and operating (see test startup second step). 22. The formally distressed vehicle now departs the distress location and travels in the same direction as the opposite direction relay vehicle. At this time, the opposite direction relay vehicle should be several miles ahead of the formally distressed vehicle. 23. Once the opposite direction relay vehicle reaches its offload RSU and stops at a designated offload location the driver manually records any advisory and warning messages received during the distressed vehicle bypass and the approximate time of offload. The driver also confirms	

Test Case ID	WDNR-2	Test Engineer Verification and Remarks
	offload of log files (see test startup third step). After confirming the offload, announces his offload status to all test participants. 24. The opposite direction relay vehicle then departs the RSU offload location and heads back towards the distress vehicle location. 25. The opposite direction relay vehicle then passes the formally distressed vehicle which is now a clean vehicle without any distress notification. This pass should occur well outside of a 5 mile radius around the original distress location. 26. After passing the opposite direction relay vehicle the clean vehicle (formally distress vehicle) continues to the RSU location and turns around to head back towards the original distress location. 27. As the opposite direction relay vehicle now approaches the original distress location, the driver identifies any advisory and warnings issued to the driver. Once the opposite direction relay vehicle approaches within 5 miles of the original distress location, they should receive a distress notification advisory, as it still carries the original distress notification. 28. As the clean vehicle (formally distress vehicle) approaches the original distress location, the driver identifies any advisory warnings issued to the driver. The clean vehicle should not receive any distress notification when it approaches within 5 miles of the original distress location. This lack of a distress notification, confirms that the opposite direction relay vehicle had stopped broadcasting the distress notification after it exceeded 5 miles from the original distress location. 29. The opposite direction relay vehicle proceeds to the distress location and stops. The driver manually records any advisory and warning messages received during the approach to the distress vehicle location. Finally, the driver power cycles their OBU to delete the distress notification and announces the end of the test to all test participants.	

<table>
<tr><th>Test Case ID</th><th>WDNR-2</th><th>Test Engineer Verification and Remarks</th></tr>
<tr><td></td><td>
30. The vehicles then reset their positions, the first as the opposite direction relay, the second as the same direction relay, and finally the third as the distress vehicle. The distress vehicle must reset its position, leaving the distress location then following the designated approach path to return to the distress location.
31. The next test repetition can only start when all vehicles are at their designated start locations.
32. After final test repetition, the all vehicles drive to a designated RSU offload location and confirm that all generated log files are offloaded (see test startup third step).

Analysis Procedure

33. Execute a set of queries on the DW to extract bsm and driver alert log records for specific time periods during each DN test run. These queries are implemented in a script that generates a KML file for display in Google Earth. This allows each bsm and driver alert record from each test vehicle to be plotted in the Google Earth application. The follow example command line runs the query script to generate the KML file for a test executed at the I-80 test area within a 2000 meter radius of the specified point (distress location in this example). The query also specifies a time window starting from 22 Jun 2018 03:15:10 pm MST and ended at 03:16:00 pm MST.
python create_kml.py circle --lat 41.123537 --long -104.758474 --distance 2000 --beginTime '2018-06-22 21:15:10' --endTime '2018-06-22 21:16:00'

34. Open the resulting KML file in Google Earth. The bsm records and driver alert records for each vehicle will be visible along the paths they traveled at the test location. Bsm records from each vehicle will be in a different
</td><td></td></tr>
</table>

Test Case ID	WDNR-2	Test Engineer Verification and Remarks
	color. Driver alert records will be shown as white triangles at each point in the vehicle trajectory that the driver alert was issued. Adjust the time slider so that appropriate bsm and driver alerts around the DN test are visible. 35. Retrieving the data at the time the opposite direction relay received the distress notification, use the Google Earth ruler tool, measure the distance in meters from the first advisory DN (stalled vehicle alert) to the location of the stationary distressed vehicle. Confirm this distance is within the required alert distance for the distress notification. 36. Retrieving the data at the time the opposite and same direction vehicles passed, use the Google Earth ruler tool to measure the distance in meters from the first advisory DN for the forward relay vehicle to the location of the opposite direction relay vehicle at the same time. Confirm this distance is within the required alert distance for distress notification. 37. Logging onto the ODE server where the vehicle log files were offloaded. Check the modification times of the log files and identify those that were offloaded by each of the relay vehicles during each of the DN test repetition. The existence of these files at the corresponding offload times confirms that the offloads occurred from the relay vehicles. 38. Record the modification time to the second of these DN log files. Use this modification time and identify a bsm record that corresponds to this time from the Google Earth KML file. Use the Google Earth ruler tool to measure the distance in meters between the bsm record and the RSU location. Confirm this distance is within the required distance for log file offload. 39. Query the TRAC database and record the received DN messages. Correlate each of the DN messages with a DN log file offload from the relay vehicle.	
Log Analysis Actual Result	*Distance at which Opposing Direction Relay Vehicle receives DNM from Distressed Vehicle (WDNR-2) *Distance at which RSU receives DNM from Opposing Direction Relay Vehicle receives	

Test Case ID	WDNR-2	Test Engineer Verification and Remarks
	DNM (WDNR-2) *Distance at which Same Direction Relay Vehicle receives DNM from Opposing Direction Relay Vehicle (WDNR-2)	

2.7 Table WDNR-2 Results Opposite direction Distress Notification relay to RSU and Following Vehicle

Table 2-7. WDNR-2 Results Opposite direction Distress Notification relay to RSU and Following Vehicle

Test Case ID	Rep	WDNR-2	Test Engineer Verification and Remarks
Test Case Name		Opposite direction Distress Notification relay to RSU and Following Vehicle	*Performed and Confirmed by:*
Test Case Completion Date			*Performed and Confirmed by:*
Test Case Driver Advisory/ Warning Visual Results	**Rep 1**		*Performed and Confirmed by:*
Test Case Log File Analysis Results	**Rep 1**		*Performed and Confirmed by:*
Test Case Driver Advisory/ Warning Visual Results	**Rep 2**		*Performed and Confirmed by:*
Test Case Log File Analysis Results	**Rep 2**		*Performed and Confirmed by:*

Test Case ID	Rep	WDNR-2	Test Engineer Verification and Remarks
Test Case Driver Advisory/ Warning Visual Results	**Rep 3**		*Performed and Confirmed by:*
Test Case Log File Analysis Results	**Rep 3**		*Performed and Confirmed by:*
Test Case Driver Advisory/ Warning Visual Results	**Rep 4**		*Performed and Confirmed by:*
Test Case Log File Analysis Results	**Rep 4**		*Performed and Confirmed by:*
Test Case Driver Advisory/ Warning Visual Results	**Rep 5**		*Performed and Confirmed by:*
Test Case Log File Analysis Results *	**Rep 5**		*Performed and Confirmed by:*
Test Case Analysis Tables			*Performed and Confirmed by:*
Pass/Fail Assessment			*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.8 Table WDNR-Requirements Requirements Verification Analysis

Table 2-8. WDNR-Requirements Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WDNR-1 -- Same direction Distress Notification relay to RSU	TRAC-REQ-1.1 -- Distress Notification	The Wyoming CV System shall transmit received distress notifications to TRAC. Distress notifications are defined in WCVS-REQ-1.3.	* Perform Test Case WDNR-1 * Inspect Relay Vehicle OBU Logs and confirm receipt of DNM from Distressed Vehicle * Inspect DB logs and locate and confirm receipt of DNM from Relay Vehicle * Inspect TRAC logs and confirm 1 confirm receipt of DNM from DB * TRAC Display of Distress Notifications verifies Wyoming CV System transmits received distress notifications to TRAC, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDNR-1 -- Same direction Distress Notification relay to RSU	TRAC-REQ-1.1.1 -- Transmission Time	They Wyoming CV System shall transmit distress notifications to TRAC within five minutes of its generation in the system.	* Perform Test Case WDNR-1 * Inspect Relay Vehicle OBU Logs and confirm receipt of DNM from Distressed Vehicle * Inspect DB Logs and locate and confirm receipt of DNM from Relay Vehicle and the time received by the DB * Inspect TRAC logs and confirm receipt of DNM from DB and the time received by the TRAC * Compute time between receipt by the DB and receipt by the TRAC * TRAC log of Distress Notifications within 5 minutes verifies Wyoming CV System transmits distress notifications to TRAC within five minutes of its generation in the system, thereby verifying the requirement is satisfied. (Note: the DNM is generated by the vehicle system, rather than the Wyoming CV system. "Generation in the system" is interpreted as "received by the DB".)	Requirement Verification Confirmed by:
WDNR-1 -- Same direction Distress	VS-REQ-15.1 -- Log	The Vehicle System shall log received distress notifications to include the DNM.	* Perform Test Case WDNR-1 * Inspect Relay Vehicle OBU Logs and identify instance of DNM received from Distressed Vehicle	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
Notification relay to RSU			* Identification of receipt of DNMs in Relay Vehicle OBU confirms Vehicle System logs received distress notifications to include the DNM, thereby verifying the requirement is satisfied.	
WDNR-1 -- Same direction Distress Notification relay to RSU	VS-REQ-16.2 -- Driver-Generated Distress Notification	The Vehicle System shall have the ability to generate a distress notification when the vehicle operator selects the distress notification activation alternative in the HMI.	* Perform Test Case WDNR-1 * Inspect Distressed Vehicle OBU logs and confirm Distress Notification is activated 1 or more times. * Inspect Distressed Vehicle OBU Logs and identify instance of DNMs broadcast * Inspect Relay Vehicle OBU Logs and identify instance of DNM received from Distressed Vehicle * Receipt of DNMs by Relay Vehicle confirms Vehicle System has the ability to generate a distress notification when the vehicle operator selects the distress notification activation alternative in the HMI, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDNR-1 -- Same direction Distress Notification relay to RSU	VS-REQ-18 -- DN PSID	The Vehicle System shall use a unique high priority Provider Service Identifier (PSID) for the distress notification application as per IEEE 1609.12.	* Perform Test Case WDNR-1 * Inspect Relay Vehicle OBU logs and confirm receipt of Distress Notification. * Confirm use of unique high priority PSID * Use of unique high priority PSID verifies the Vehicle System uses a unique high priority Provider Service Identifier (PSID) for the distress notification application as per IEEE 1609.12. * (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	Requirement Verification Confirmed by:
WDNR-1 -- Same direction Distress Notification relay to RSU	VS-REQ-34.2 -- Generated Distress	The Vehicle System, in distress (described in Section 2.6 of the SyRS), shall broadcast distress notifications over DSRC, until the vehicle event code that triggered the distress notification is reset or power is lost (whichever comes first).	* Perform Test Case WDNR-1 * Inspect Distress Vehicle OBU logs and confirm Distress Notification is activated 1 or more times. * Inspect Distress Vehicle OBU Logs and identify 1 or more instances of DNMs broadcast. * Shut Off OBU and Restart. * Confirm OBU ceases broadcast of DNM. * Termination of broadcast confirms the Vehicle	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			System, in distress (as defined in Section 2.6.3), broadcasts distress notifications (over DSRC), until the vehicle event code that triggered the distress notification is reset or power is lost (whichever comes first), thereby verifying the requirement is satisfied. (Note: The trigger event code is reset by cycling power on the OBU.)	
WDNR-1 -- Same direction Distress Notification relay to RSU	ODE-REQ-3.4.2 -- Distribute to Data Warehouse-DNM	The Operational Data Environment shall distribute all collected and processed DNM information to the Data Warehouse, as described in Section 5.20 of the ICD.	* Perform test case WDNR-1 * Inspect DW logs * Confirm receipt of DNMs * Confirmation shows the Operational Data Environment distributes all collected and processed DNM information to the Data Warehouse, as described in Section 5.20 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDNR-1 -- Same direction Distress Notification relay to RSU	DNP-REQ-1 -- Distress Notification OBU DSRC Performance 1	Remote vehicles shall receive distress notification via DSRC between at least 2 and 300 meters from the distressed vehicle.	* Perform Test Case WDNR-1 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Relay Vehicle OBU Event Logs, determine location, speed, and heading path of Relay Vehicle when first Distress Notification Message received. * Compute Distance between Distressed and Relay Vehicle at time first Distress Notification Message was received by Relay Vehicle. * Confirm Relay Vehicles receive distress notification via DSRC between at least 2 and 300 meters from the distressed vehicle, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDNR-1 -- Same direction Distress Notification relay to RSU	DNP-REQ-11 -- Remote Vehicle Distress Notification Upload to ODE	When a remote Relay Vehicle receives an RSU WSA broadcast for the ODE server's IPv6 address, the OBU shall copy a log for the DNM to the ODE server.	* Perform Test Case WDNR-1 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Same Direction Relay Vehicle OBU Event Logs and confirm receipt of an RSU WSA broadcast for the ODE server's IPv6 address.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			* Inspect Same Direction Relay Vehicle OBU Event Logs and confirm copy of a log for the DNM to the ODE Server. * Inspect ODE logs and confirm copy of a log for the DNM to the ODE Server. * Confirm that when a remote Relay Vehicle receives an RSU WSA broadcast for the ODE server's IPv6 address, the OBU copies a log for the DNM to the ODE server, thereby verifying the requirement is satisfied.	
WDNR-1 -- Same direction Distress Notification relay to RSU	DNP-REQ-12 -- Remote Vehicle Distress Notification Upload Termination	When a remote Relay Vehicle OBU completes copying copies a log for the DNM to the ODE server, the Relay Vehicle shall stop further broadcasting the DNM and will stop copying it to RSUs to the ODE.	* Perform Test Case WDNR-1 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Same Direction Relay Vehicle OBU Event Logs, determine time, location, speed, and heading path of Same Direction Relay Vehicle when RSU WSA broadcast for the ODE server's IPv6 address was received and OBU copies a log for the DNM to the ODE server. * Inspect logs to confirm no further broadcast of Distress Notification Messages or OBU copies a log for the DNM log to the ODE. * Confirm that when a remote Relay Vehicle OBU completes copying copies a log for the DNM to the ODE server, the Relay Vehicle ceases further broadcasting the DNM and ceases copying it to RSUs to the ODE, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2VMCT-2 -- V2V exchange of DNMs (Integrated with WDNR-1)	VS-REQ-3 -- Receive Distress Information	The Vehicle System shall wirelessly receive a packet containing distress information from other connected vehicles over DSRC. Distress information is a high priority messages based on the received distress	* Perform Test Case WV2VMCT-2 * Inspect Distressed Vehicle OBU Logs and 1 or more instances of DN TIMs sent to Relay Vehicle * Inspect Relay Vehicle logs and identify corresponding instances of DN TIMs received from Distressed Vehicle	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		broadcast (defined in J3067 3.5.9.2.1), but has the content of the TIM (defined in J2735 5.16 Part III advisory ITIS data elements 6.1 from J2540-2 Accidents and Incidents).		
WV2VMCT-2 -- V2V exchange of DNMs (Integrated with WDNR-1)	DNP-REQ-2 -- Distress Notification OBU DSRC Performance 2	Remote vehicles shall receive distress notification from other remote "relay" vehicles via DSRC between at least 2 and 300 meters from the other remote vehicle.	* Perform Test Case WV2VMCT-2 * Inspect Relay Vehicle OBU Event Logs, determine time, location, speed, and heading path of Relay Vehicle when first Distress Notification Message received. * Inspect Distressed Vehicle OBU Event Logs, determine location and heading path of Distressed Vehicle at time that Relay Vehicle received first Distress Notification Message. * Compute Distance between Relay Vehicle and Distressed Vehicle at time first Distress Notification Message was received by Relay Vehicle. * Confirm Relay Vehicles receive distress notification from other remote "relay" vehicles via DSRC between at least 2 and 300 meters from the other Relay Vehicle, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-1 -- V2I and End-to-end communication of DNMs (Integrated with WDNR-1)	WCVS-REQ-1.3 -- Collect Distress Messages	The Wyoming CV System shall collect distress messages using the Traveler Information Message (as defined in section 5.16 of J2735) from the Vehicle System consistent with Section 3.5.8 (Traveler Information Requirements) of J3067	* Perform Test Case WV2IMCT-1(WDNR-1) * Inspect Relay Vehicle OBU Logs and confirm receipt of DNM from Distressed Vehicle * Inspect ODE Logs and identify corresponding instance of received DNM * Receipt of DNMs confirms Wyoming CV System collects distress messages using the Traveler Information Message (as defined in section 5.16 of J2735) from the Vehicle System consistent with Section 3.5.8 (Traveler Information Requirements) of J3067, thereby verifying the requirement is satisfied. * (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			developers verifies consistent implementation of standards formats and specifications.)	
WV2IMCT-1 -- V2I and End-to-end communication of DNMs (Integrated with WDNR-1)	WCVS-REQ-11.3 -- Store Distress Messages	The Wyoming CV System shall store processed distress messages using the Traveler Information Message (as defined in section 5.16 of J2735) received from the Vehicle System consistent with Section 3.5.8 (Traveler Information Requirements) of J3067. As the distress message will be previously validated, only core data will be stored (defined in sections 5.16, and 6.142 of J2735).	* Perform Test Case WV2IMCT-1(WDNR-1) * Inspect Relay Vehicle OBU Logs and confirm receipt of DNM from Distressed Vehicle * Inspect DW logs and verify receipt of identified DNM from OBU for storage. * Receipt of DNMs by DW confirms Wyoming CV System stores processed distress messages using the Traveler Information Message (as defined in section 5.16 of J2735) received from the Vehicle System consistent with Section 3.5.8 (Traveler Information Requirements) of J3067, thereby verifying the requirement is satisfied. * (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	Requirement Verification Confirmed by:
WV2IMCT-1 -- V2I and End-to-end communication of DNMs (Integrated with WDNR-1)	VS-REQ-38 -- SLD Information	The Vehicle System shall store information generated by the host vehicle on local storage. Information to be stored is detailed in Table 4-3 of the SyRS.	* Perform Test Case WV2IMCT-1(WDNR-1) * Confirm that the Vehicle System store information generated by the host vehicle on local storage. * Confirmation shows the Vehicle System store information generated by the host vehicle on local storage, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-1 -- V2I and End-to-end communication of DNMs (Integrated with WDNR-1)	VS-REQ-39 -- SLD Rolling Log	The Vehicle System shall maintain rolling logs for in vehicle generated CV data for 10 seconds. Table 4-4 of the SyRS lists one or more sources of the rolling logs that may be available in a vehicle Sub-System.	* Perform Test Case WV2IMCT-1(WDNR-1) * Confirm that the Vehicle System maintain rolling logs for in vehicle generated CV data for 10 seconds. * Confirmation shows the Vehicle System maintain rolling logs for in vehicle generated CV data for 10 seconds, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-1 -- V2I and End-to-end communication of	VS-REQ-40 -- SLD Log Format	The event log format shall contain UTC time stamped text or binary data.	* Perform Test Case WV2IMCT-1(WDNR-1) * Confirm that the event log format contain UTC time stamped text or binary data * Confirmation shows the event log format contain	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
DNMs (Integrated with WDNR-1)			UTC time stamped text or binary data, thereby verifying the requirement is satisfied.	
WV2IMCT-1 -- V2I and End-to-end communication of DNMs (Integrated with WDNR-1)	VS-REQ-41 -- SLD Log Data	The Vehicle System shall create event logs for all interactions with the Wyoming CV System or Vehicle System that is retained until it is sent to the Wyoming CV System or is older than seven (7) days. An interaction is defined as a received message from the Wyoming CV System or the Vehicle System. Each log should contain the information in Table 4-5 of the SyRS.	* Perform Test Case WV2IMCT-1(WDNR-1) * Confirm that the Vehicle System create event logs for all interactions with the Wyoming CV System or Vehicle System that is retained until it is sent to the Wyoming CV System or is older than seven (7) days. * Confirmation shows the Vehicle System create event logs for all interactions with the Wyoming CV System or Vehicle System that is retained until it is sent to the Wyoming CV System or is older than seven (7) days, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-1 -- V2I and End-to-end communication of DNMs (Integrated with WDNR-1)	ODE-REQ-3.5 -- Distribute to Data Broker	The Operational Data Environment shall distribute distress information to the Data Broker, as described in Section 5.21.1 of the ICD.	* Perform Test Case WV2IMCT-1(WDNR-1) * Inspect ODE Logs and identify 1 or more instances of DNMs received * Inspect DB logs and verify receipt of corresponding 1 or more DNMs * Confirmation shows the Operational Data Environment distributes distress information to the Data Broker, as described in Section 5.21.1 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-1 -- V2I and End-to-end communication of DNMs (Integrated with WDNR-1)	DB-REQ-6 -- Receive from ODE	The DB shall receive distress information from the ODE, as defined in Section 5.21.1 of the ICD.	* Perform Test Case WV2IMCT-1(WDNR-1) * Inspect ODE Logs and identify 1 or more instances of DN TIMs received * Inspect DB logs and verify receipt of corresponding DN TIMs * Confirmation shows the DB receive distress information from the ODE, as defined in Section 5211 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WV2IMCT-1 -- V2I and End-to-end communication of DNMs (Integrated with WDNR-1)	DNP-REQ-3 -- Distress Notification RSU DSRC Performance	ODE shall receive Distress Notification Messages (through RSU) from distressed vehicle or remote "relay" vehicles via DSRC from a distance between	* Perform Test Case WV2IMCT-1(WDNR-1) * Inspect Remote Vehicle OBU Event Logs, determine time, location, speed, and heading path of Remote Vehicle when OBU receives an RSU WSA broadcast for the ODE server’s IPv6 address, and the OBU copies a log for the DNM to the ODE	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		at least 2 and 300 meters between vehicles and RSU.	server. * Inspect ODE Logs, determine time when ODE received first Distress Notification Message. * Determine which RSU received the DNM and its location. * Compute Distance between Remote Vehicle and RSU at time first Distress Notification Message was received by Remote Vehicle 2. * Confirmation shows ODE receive Distress Notification Messages (through RSU) from distressed vehicle or remote "relay" vehicles via DSRC from a distance between at least 2 and 300 meters between vehicles and RSU, thereby verifying the requirement is satisfied.	
WDNR-2 -- Opposite direction Distress Notification relay to RSU and Following Vehicle	VS-REQ-17 -- DNM-Region	The Vehicle System shall ingest received DNMs to identify the applicable regions of use geographical path (Part II defined in J2735 section 6.142). Data ingest is defined as obtaining and importing data for use or storage.	* Perform Test Case WDNR-2 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Same Direction Following Vehicle OBU Event Logs, determine time, location, speed, and heading path of when first Distress Notification Message received. * Determine if Same Direction Following Vehicle is traveling in the same direction as the Distressed Vehicle. * Inspect Same Direction Following Vehicle HMI Logs and determine if the Distress Notification Cautions indicate if the distressed vehicle is in the same direction of travel as the receiving vehicle was displayed to the driver. * Confirm Distress Notification Cautions indicate if the distressed vehicle is in the same direction of travel verifies that the Vehicle System ingests received DNMs to identify the applicable regions of use geographical path (Part II defined in J2735 section 6.142), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WDNR-2 -- Opposite direction Distress Notification relay to RSU and Following Vehicle	VS-REQ-34.1 -- Received Distress	The Vehicle System shall broadcast distress notifications (over DSRC), received from remote vehicles, for five miles from the location where the distressed vehicle is located.	* Perform Test Case WDNR-2 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Opposing Direction Relay Vehicle OBU Event Logs, determine time, location, speed, and heading path of Opposing Direction Relay Vehicle when first Distress Notification Message was broadcast. * Inspect Opposing Direction Relay Vehicle OBU Event Logs, determine time, location, speed, and heading path of Opposing Direction Relay Vehicle when Distress Notification ceased to be broadcast. * Compute Distance between first and last Distress Notification broadcast. * Confirm the Vehicle System broadcasts distress notifications (over DSRC), received from Relay Vehicles, for approximately five miles from the location where the distressed vehicle is located, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDNR-2 -- Opposite direction Distress Notification relay to RSU and Following Vehicle	DNP-REQ-4 -- Distress Notification Driver Display Performance	Distress Notification Caution shall be issued to the driver of the receiving vehicle at least at a configurable distance from the distressed vehicle. Note: the configurable distance is to be determined empirically by system engineers during development and testing.	* Perform Test Case WDNR-2 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Same Direction Following Vehicle OBU Event Logs, determine time, location, speed, and heading path of when first Distress Notification Message received. * Inspect Same Direction Following Vehicle HMI Logs, and determine time when Distress Notification caution was first issued to driver. * Verify Distress Notification Caution was issued to the driver of the Same Direction Following Vehicle at least at a configurable distance from the distressed vehicle, thereby verifying the requirement is satisfied. (Note: the configurable distance is to be	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			determined empirically by system engineers during development and testing.)	
WDNR-2 -- Opposite direction Distress Notification relay to RSU and Following Vehicle	DNP-REQ-5 -- Distressed Vehicle Distance	Distress Notification Cautions shall indicate the approximate distance to the distressed vehicle.	* Perform Test Case WDNR-2 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Same Direction Following Vehicle OBU Event Logs, determine time, location, speed, and heading path of when first Distress Notification Message received. * Inspect Same Direction Following Vehicle HMI Logs, and determine time when Distress Notification caution was first issued to driver. * Compute Distance between Distressed and Same Direction Following Vehicle at time when Distress Notification caution was first issued to driver. * Inspect Same Direction Following Vehicle HMI Logs and verify approximate distance to Distressed Vehicle was displayed to the driver. * Confirm Distress Notification Cautions indicate the approximate distance to the distressed vehicle, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WDNR-2 -- Opposite direction Distress Notification relay to RSU and Following Vehicle	DNP-REQ-6 -- Distressed Vehicle Direction of Travel	Distress Notification Cautions shall indicate if the distressed vehicle is in the same direction of travel as the receiving vehicle.	* Perform Test Case WDNR-2 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Same Direction Following Vehicle OBU Event Logs, determine time, location, speed, and heading path of when first Distress Notification Message received. * Determine if Same Direction Following Vehicle is traveling in the same direction as the Distressed Vehicle. * Inspect Same Direction Following Vehicle HMI Logs and determine if the Distress Notification Cautions indicate if the distressed vehicle is in the same direction of travel as the receiving vehicle was displayed to the driver. * Confirm Distress Notification Cautions indicate if the distressed vehicle is in the same direction of travel as the receiving vehicle, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDNR-2 -- Opposite direction Distress Notification relay to RSU and Following Vehicle	DNP-REQ-7 -- Distressed Vehicle Roadway	Distress Notification Cautions shall be issued to drivers approaching the distressed vehicle on the same roadway.	* Perform Test Case WDNR-2 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Same Direction Following Vehicle OBU Event Logs, determine time, location, speed, and heading path of when first Distress Notification Message received. * determine if Same Direction Following Vehicle is traveling in the same direction as the Distressed Vehicle. * Inspect Same Direction Following Vehicle HMI Logs and determine if the Distress Notification Cautions indicate if the distressed vehicle is in the same direction of travel as the receiving vehicle was displayed to the driver. * Confirm Distress Notification Cautions issued to	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			drivers approaching the distressed vehicle on the same roadway, thereby verifying the requirement is satisfied.	
WDNR-2 -- Opposite direction Distress Notification relay to RSU and Following Vehicle	DNP-REQ-8 -- Distress Vehicle Passing	Distress Notification Cautions shall not be issued to drivers after passing the distressed vehicle.	* Perform Test Case WDNR-2 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Opposing Direction Relay Vehicle OBU Event Logs, determine time, location, speed, and heading path of Relay Vehicle when Relay Vehicle passed Distressed Vehicle. * Inspect Opposing Direction Relay Vehicle HMI Logs and verify time when Distress Notification ceased display. * Inspect Same Direction Following Vehicle OBU Event Logs, determine time, location, speed, and heading path of Relay Vehicle when Relay Vehicle passed Distressed Vehicle. * Inspect Same Direction Following Vehicle HMI Logs and verify time when Distress Notification ceased display. * Confirm Distress Notification Cautions were not issued to drivers after passing the distressed vehicle, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDNR-2 -- Opposite direction Distress Notification relay to RSU and Following Vehicle	DNP-REQ-9 -- Remote Vehicle Distress Notification Distance 1	Remote Vehicles receiving the broadcast DNM shall continue to broadcast it for a configurable distance and configurable time. Note: Initially this distance would be set to 5 miles.	* Perform Test Case WDNR-2 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Opposing Direction Relay Vehicle OBU Event Logs, determine time, location, speed, and heading path of Opposing Direction Relay Vehicle when first Distress Notification Message was broadcast. * Inspect Opposing Direction Relay Vehicle OBU Event Logs, determine time, location, speed, and heading path of Opposing Direction Relay Vehicle	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			when Distress Notification ceased to be broadcast. * Compute Distance between first and last Distress Notification broadcast. * Confirm Relay Vehicles receiving the broadcast DNM cease to broadcast it for a configurable distance and configurable time, thereby verifying the requirement is satisfied. (Note: Configurable Distance is initially set to 5 miles.)	
WDNR-2 -- Opposite direction Distress Notification relay to RSU and Following Vehicle	DNP-REQ-10 -- Remote Vehicle Distress Notification Distance 2	After broadcasting for the configurable distance or configurable time, a remote Relay Vehicle shall stop broadcasting the DNM and go silent until it receives an RSU WSA broadcast for the ODE server's IPv6 address.	* Perform Test Case WDNR-2 * Inspect Distressed Vehicle OBU Event Logs, determine location, and heading path of Distressed Vehicle. * Inspect Opposing Direction Relay Vehicle OBU Event Logs, determine time, location, speed, and heading path of Opposing Direction Relay Vehicle when Distress Notification ceased to be broadcast. * Inspect Opposing Direction Relay Vehicle OBU Event Logs, determine time, location, speed, and heading path of Opposing Direction Relay Vehicle when RSU WSA broadcast for the ODE server's IPv6 address was received. * Compute Distance between last Distress Notification broadcast and receipt of RSU WSA broadcast for the ODE server's IPv6. * Confirm that after broadcasting for the configurable distance or configurable time, a remote Relay Vehicle ceases broadcasting the DNM and goes silent until it receives an RSU WSA broadcast for the ODE server's IPv6 address, thereby verifying the requirement is satisfied. (Note: Configurable Distance is initially set to 5 miles.)	Requirement Verification Confirmed by:

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FHWA-JPO-17-472B.6

U.S. Department of Transportation

Connected Vehicle Pilot Deployment Program Phase 2

WYDOT CV Pilot – On-road Shakedown Test Procedure and Test Cases

www.its.dot.gov/index.htm
Final Report — July 30, 2018
FHWA-JPO-17-472B.7

U.S. Department of Transportation

Produced by DTFH6116H00027

U.S. Department of Transportation

Notice

Technical Report Documentation Page

<table>
<tr><td>1. Report No.
FHWA-JPO-17-472B.7</td><td>2. Government Accession No.</td><td colspan="2">3. Recipient's Catalog No.</td></tr>
<tr><td colspan="2" rowspan="2">4. Title and Subtitle
WYDOT CV Pilot - On-road Shakedown Test Procedure and Test Cases</td><td colspan="2">5. Report Date
7/30/2018</td></tr>
<tr><td colspan="2">6. Performing Organization Code</td></tr>
<tr><td colspan="2">7. Author(s)
Denny Stephens (Vital Assurance), Tony English (Trihydro), Nayel Ureña Serulle (ICF), Deepak Gopalakrishna (ICF), Vince Garcia (Wyoming DOT)</td><td colspan="2">8. Performing Organization Report No.
Task 2G: Operational Readiness Test and Demonstration Planning</td></tr>
<tr><td colspan="2" rowspan="2">9. Performing Organization Name and Address
Wyoming DOT, 5300 Bishop Boulevard, Cheyenne, WY 82009
ICF International, 1725 Eye St NW, Washington DC, 20006
Trihydro Corporation, 1252 Commerce Drive, Laramie, WY 82070
Vital Assurance, 175 S. Third St., Suite 200, Columbus, OH 43215</td><td colspan="2">10. Work Unit No. (TRAIS)</td></tr>
<tr><td colspan="2">11. Contract or Grant No.
DTFH6116H00027</td></tr>
<tr><td colspan="2" rowspan="2">12. Sponsoring Agency Name and Address
U.S Department of Transportation 1200 New Jersey Ave, SE Washington, DC 20590</td><td colspan="2">13. Type of Report and Period Covered
09/01/2016 to 7/30/2018</td></tr>
<tr><td colspan="2">14. Sponsoring Agency Code</td></tr>
<tr><td colspan="4">15. Supplementary Notes
Kate Hartman (COR), Sarah Tarpgaard (CO)</td></tr>
<tr><td colspan="4">16. Abstract
The Wyoming Department of Transportation's (WYDOT) Connected Vehicle (CV) Pilot Deployment Program is intended to develop a suite of applications that utilize vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communication technology to reduce the impact of adverse weather on truck travel in the I-80 corridor. These applications support a flexible range of services from advisories, roadside alerts, parking notifications and dynamic travel guidance. Information from these applications are made available directly to the equipped fleets or through data connections to fleet management centers (who will then communicate it to their trucks using their own systems). The pilot will be conducted in three Phases. Phase 1 includes the planning for the CV pilot including the concept of operations development. Phase 2 is the design, development, and testing phase. Phase 3 includes a real-world demonstration of the applications developed as part of this pilot.

This document presents the template for the On-road Shakedown Test Procedure and Test Cases of the Wyoming Department of Transportation (WYDOT) Connected Vehicle (CV) Pilot project as part of the United States Department of Transportation's (USDOT) CV program. These tests are part of the WYDOT CV Pilot Operational Test Plan - Attachment B.</td></tr>
<tr><td colspan="2">17. Key Words
Connected Vehicle Technology, I-80 Corridor, Road Weather, Truck Safety, System Architecture</td><td colspan="2">18. Distribution Statement
This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161</td></tr>
<tr><td>19. Security Classif. (of this report)
None</td><td>20. Security Classif. (of this page)
None</td><td>21. No. of Pages
30</td><td>22. Price
NA</td></tr>
</table>

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

Acknowledgements

The Operational Readiness Plan development team would like to thank USDOT and Noblis for their technical assistance throughout the development of this document.

Table of Contents

1 Introduction 1

1.1 Project Scope 1

1.2 Purpose of this Test 2

2 On-road Shakedown Test Procedure and Test Cases 3

2.1 Table WSHKR-SUM On-road Shakedown Test Case Summary 4

2.2 Table WSHKR-TP On-road Shakedown Test Procedure 6

2.3 Table WSHKR-CI On-road Shakedown System Component Configuration and Initialization 8

2.4 Table WSHKR-1-Description OBU Shakedown Test Case Description 13

2.5 Table WSHKR-1-Results OBU Shakedown Test Case Results 15

2.6 Table WSHKR-2-Description RSU and Backhaul Communications Shakedown Test Case Description 15

2.7 Table WSHKR-2-Results RSU and Backhaul Communications Shakedown Test Case Results 17

2.8 Table WSHKR-3-Description I-80 Satellite TIM coverage Shakedown Test Case Description 18

2.9 Table WSHKR-3-Results I-80 Satellite TIM coverage Shakedown Test Case Results 19

2.10 Table WSHKR-4-Description Verify I80 Geofence Map Test Case Description 20

2.11 Table WSHKR-4-Results Verify I80 Geofence Map Test Case Description Test Case Results 21

2.12 Table WSHKR-Requirements On-road Shakedown Post Test Requirements Verification Analysis 22

List of Tables

Table 2-1. WSHKR-SUM On-road Shakedown Test Case Summary 4
Table 2-2. WSHKR-TP On-road Shakedown Test Procedure 6
Table 2-3. WSHKR-CI On-road Shakedown System Component Configuration and Initialization. 8
Table 2-4. WSHKR-1-Description OBU Shakedown Test Case Description 13
Table 2-5. WSHKR-1-Results OBU Shakedown Test Case Results 15
Table 2-6. WSHKR-2-Description RSU and Backhaul Communications Shakedown Test Case Description 15
Table 2-7. WSHKR-2-Results RSU and Backhaul Communications Shakedown Test Case Results 17
Table 2-8. WSHKR-3-Description I-80 Satellite TIM coverage Shakedown Test Case Description 18
Table 2-9. WSHKR-3-Results I-80 Satellite TIM coverage Shakedown Test Case Results 19
Table 2-10. WSHKR-4-Description Verify I80 Geofence Map Test Case Description 20
Table 2-11. WSHKR-4-Results Verify I80 Geofence Map Test Case Description Test Case Results 21
Table 2-12. WSHKR-Requirements On-road Shakedown Post Test Requirements Verification Analysis 22

1 Introduction

1.1 Project Scope

Wyoming is one of the first wave of CV Pilot sites selected to showcase the value of and spur the adoption of CV technology in the United States. CV technology is a broad term to describe the applications and the systems that leverage dedicated short-range communications (DSRC) for vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I) and infrastructure-to-vehicle (I2V) communication to improve safety, mobility and productivity of the users of the nation's transportation system.

As one of the three selected pilots, WYDOT is focusing on improving safety and mobility by creating new ways to communicate road and travel information to commercial truck drivers and fleet managers along the 402 miles of Interstate 80 (I-80 henceforth) in the State. For the pilot project, WYDOT concluded Phase 1 (planning) in September 2016 and then initiated Phase 2 (deployment) which is scheduled to conclude in mid-2018. This will be followed by an 18-month demonstration period in the third phase.

Systems and applications developed in the pilot will enable drivers of connected vehicles to have improved awareness of potential hazards and of situations they cannot see. At a very high level, the pilot scope includes the following implementation elements:

- **Deploy about 75 roadside units (RSU)** that can receive and broadcast messages using DSRC along various sections on I-80.
- **Equip around 400 vehicles, a combination of fleet vehicles and commercial trucks, with on-board units (OBU).** Of the 400 vehicles, at least 150 are planned to be heavy trucks. All vehicles are expected to be regular users of I-80. Several types of OBUs are being procured as part of the pilot and differ based on their communication capabilities, ability to integrate with the in-vehicle network, and connectivity to ancillary devices and sensors. All OBUs will have the functionality to broadcast Basic Safety Messages (BSM) and will include a human-machine interface (HMI) to share alerts and advisories to drivers of these vehicles.
- **Develop several V2V, V2I, I2V applications** that will enable communication to drivers of alerts and advisories regarding various road conditions. These applications include support for in-vehicle dissemination of advisories for collision avoidance, speed management, detours, parking, and presence of work zones and maintenance and emergency vehicles downstream of their current location.
- **Enable overall improvements in WYDOT's traffic management and traveler information practices** by using data collected from connected vehicles. Targeted improvements include ingesting more location specific mobile road weather information system (RWIS) data, using Pikalert®[1] to provide for more accurate and road segment specific conditions to define better variable speed limits (VSLs), and improving road

[1] Pikalert is a trademark of the University Corporation for Atmospheric Research.

condition dissemination via 511, Dynamic Message Signs (DMS) and other WYDOT sources.

1.2 Purpose of this Test

This document presents the test results of the *On-road Shakedown Test Procedure and Test Cases* for the Wyoming Department of Transportation (WYDOT) Connected Vehicle (CV) Pilot project as part of the United States Department of Transportation's (USDOT) CV program. These tests are part of the WYDOT CV Pilot Operational Test Plan - Attachment B.

The purpose of this document is to describe the results of a sequence of end-to-end tests conducted to validate the successful operation of the system in terms of on-road shakedown.

2 On-road Shakedown Test Procedure and Test Cases

This chapter describes *Test Procedure ID WSHKR* – On-road Shakedown *Test Procedures and Test Cases*. Table WSHKR-1 is a high-level summary of the test cases, providing an orientation for the reader. Table WSHKR-2 details the Test Procedure itself. Table WSHKR-3 describes the configuration of each of the WYDOT CV Pilot System components for the Test Procedure and the Initialization to be performed for each prior to conducting the Test Cases. Table WSHKR-4 details each Test Case to be performed with this Test Procedure. Table WSHKR-5 identifies the requirements verified by each Test Case and the Post-Test Requirements Verification Methodology to be performed to achieve verification. Appendix A of the ORTP provides a list of all system requirements, the test case in which they are verified, and their individual requirements verification methodology.

2.1 Table WSHKR-SUM On-road Shakedown Test Case Summary

Table 2-1. WSHKR-SUM On-road Shakedown Test Case Summary

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID	Requirements Verified
WSHKR-1	OBU Shakedown	Perform baseline DSRC communication range test on all vehicles, followed by repetition periodically and after severe weather deployments (WYDOT Maintenance Vehicles) to verify OBU functionality and performance during shakedown test period. * Inspection and troubleshooting is recommended when failure or reduced performance is found, to identify and remediate problems prior to full deployment.	* Setup vehicle communication range test site on I-80 incorporating an OBU (in a simulated vehicle) and an RSU, each capturing vehicle BSMs. * Schedule each vehicle to pass test site independently and determine minimum V2V and V2I communication range for each. * Separation distance at which a configurable threshold percentage of BSMs sent are received and logged by test OBU and RSU is recorded as baseline for subsequent vehicle performance assessment.	A configurable threshold percentage of BSMs are received and processed by RSU when vehicle is at least 300 meters away. * A configurable threshold percentage of BSMs are received and processed by remote vehicle OBU when vehicle is at least 300 meters away. * Inspection and troubleshooting is recommended for any OBU failing this test or demonstrating significantly reduced performance from baseline to identify and remediate problems prior to full deployment.		Compiled in Table WSHKR-Requirements

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID	Requirements Verified
WSHKR-2	RSU and Backhaul Communications Shakedown	Perform baseline DSRC communication range test on all RSUs, followed by repetition periodically and after severe weather events to verify RSU functionality and performance during shakedown test period. * Inspection and troubleshooting is recommended when failure or reduced performance is found, to identify and remediate problems prior to full deployment.	* Host (WYDOT maintenance) vehicle approaches each RSU broadcasting BSMs, uploading log files and capturing TIMs via DSRC. * Separation distance at which a configurable threshold percentage of I2V TIM and V2I BSM and log file sent are received is recorded as baseline for subsequent RSU performance assessment.	* A configurable threshold percentage of I2V TIMs sent from the RSU to the OBU and a configurable threshold percentage of V2I BSMs sent from the OBU to the RSU at a range of at least 300 meters are received. All log files are received. * Inspection and troubleshooting is recommended for any RSU failing this test or demonstrating significantly reduced performance from baseline, to identify and remediate problems prior to full deployment.		Compiled in Table WSHKR-Requirements
WSHKR-3	I-80 Satellite TIM coverage	Verify and baseline the satellite-to-OBU TIM coverage across I-80.	* Test engineers identify at least 10 locations along I-80 remote from RSU coverage. * Host (WYDOT maintenance) vehicle visits each site, capturing TIMs via satellite	* A configurable threshold percentage of Satellite TIMs sent are received at each of the selected locations.		Compiled in Table WSHKR-Requirements

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID	Requirements Verified
			communications and recording the percentage of TIMs sent that are received.			
WSHKR-4	Verify I80 geofence map	Verify that map used for geofence generation accurately follows I-80 and will support accurate I2V SA message display.	* BSMs are logged from WYDOT Maintenance vehicles traveling I80.	* BSM location results are analyzed to verify that they fall on I80 geofence map. * Inspection and troubleshooting is recommended for map location in which BSMs fall more than one lane distance outside geofence map, to identify and remediate problems prior to full deployment.		Compiled in Table WSHKR-Requirements

2.2 Table WSHKR-TP On-road Shakedown Test Procedure

Table 2-2. WSHKR-TP On-road Shakedown Test Procedure

Test Procedure ID	WSHKR	Test Engineer Verification and Remarks
Test Procedure Name	On-road Shakedown Test Procedure	
Test Procedure Completion Date		
Priority	Required	

Test Procedure ID	WSHKR	Test Engineer Verification and Remarks
Objectives	• Perform baseline DSRC communication range test on all vehicles, followed by repetition periodically and after severe weather deployments (WYDOT Maintenance Vehicles) to verify OBU functionality and performance during shakedown test period. • Perform baseline DSRC communication range test on all RSUs, followed by repetition periodically and after severe weather events to verify RSU functionality and performance during shakedown test period • Verify and baseline the satellite-to-OBU TIM coverage across I-80. • Verify that map used for geofence generation accurately follows I-80 and will support accurate I2V SA message display.	
Relationship to Other Procedures	• Precondition is successful development and integration of the WYDOT CV Pilot System, as described in the SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment. • WSHKR Test Cases may be combined with other Test Cases at the discretion of the test engineer under the condition that that there is no interference, confusion or conflict in interpretation of test results.	
Discussion, Guidance, and Rationales	• Inspection and troubleshooting is recommended when failure or reduced performance is found, to identify and remediate problems prior to full deployment. • 300m is the design communication range for DSRC SAE J2735 messages. • WYDOT Maintenance Vehicle is used as remote vehicle for all test cases to verify FCW and DSRC performance around large vehicle bodies.	
Prior to Conducting Test	• Verify configuration of each system and test component complies with **Configuration for On-road Shakedown Test Procedure and Test Cases** described in Table WSHKR-CI. • Prepare each system and test component in accordance with **Initialization for On-road Shakedown Test Procedure and Test Cases** described in Table WSHKR-CI. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	

Test Procedure ID	WSHKR	Test Engineer Verification and Remarks
Test Cases Performed under This Procedure	For this procedure conduct the following Test Cases detailed later in this section. • WSHKR-1 • WSHKR-2 • WSHKR-3 • WSHKR-4	

2.3 Table WSHKR-CI On-road Shakedown System Component Configuration and Initialization

Table 2-3. WSHKR-CI On-road Shakedown System Component Configuration and Initialization

System Component	Applicable Test Procedures and Cases	Configuration for On-road Shakedown Test Procedure and Test Cases	Initialization for On-road Shakedown Test Procedure and Test Cases
Back office Component with Representative TIM	WSHKR-2 and WSHKR-3	“Representative” TIM is defined as an example TIM whose successful test result indicates conducting this test case with other I2V SA TIMs is also likely to be successful. This TIM is selected empirically, by developers and test engineers. This TIM message is used when it is not necessary or efficient to repeat all message types from each back-office component.	• Prepare applicable back office component inputs for Representative TIM • Formulate and document back office component inputs that will generate Representative I2V Message Communication TIM • Formulate and document back office component inputs (manual and computer input file) for distribution of Representative I2V Message Communication TIM through RSUs via DSRC and through Satellite.

System Component	Applicable Test Procedures and Cases	Configuration for On-road Shakedown Test Procedure and Test Cases	Initialization for On-road Shakedown Test Procedure and Test Cases
Roadway	All WSHKR Test Cases	• I-80 during normal operating conditions • Setup vehicle communication range test site on I-80 incorporating an OBU (in a simulated vehicle) and an RSU, each capturing vehicle BSMs. • Communication range test site installed on highway straightaway, to support straightforward measurement of vehicle to RSU distance. • Test vehicle speed should be safe highway travel speeds.	• Identify communication range test site locations and place traffic cones on both sides of roadway clearly visible to drivers. • Place cautionary signage and boundary markers in advance of communication range test site to warn test staff and visitors • On roadway, place any additional signage required by WYDOT Safety Manager
Data Broker (DB)	All WSHKR Test Cases	DB fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Verify DB configuration files are correct for this test set • Download/Copy DB configuration files to Test Case Folder for Test Record
Operational Data Environment (ODE)	All WSHKR Test Cases	ODE fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Verify ODE configuration files are correct for this test case • Download/Copy ODE configuration files to Test Case Folder for Test Record
Data Warehouse (DW)	All WSHKR Test Cases	DW fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Verify DW configuration files are correct for this test case • Download/Copy DW configuration files to Test Case Folder for Test Record
Security Credential Management System (SCMS)	All WSHKR Test Cases	SCMS fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from	• Verify SCMS configuration files are correct for this test case

System Component	Applicable Test Procedures and Cases	Configuration for On-road Shakedown Test Procedure and Test Cases	Initialization for On-road Shakedown Test Procedure and Test Cases
		development environment or production environment, as long as it is ready for production deployment. All test cases may be performed without SCMS support during development for verification of functionality and performance of other components. Final, "for the record" testing must be performed with SCMS fully integrated with WYDOT TMC per SDD and ICD, ready for production deployment.	• Download/Copy SCMS configuration files to Test Case Folder for Test Record
RSU(s)	One RSU for WSHKR-1 All RSUs for WSHKR-2 and 4	All RSUs fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Verify RSU configuration files are correct for this test case • Download/Copy RSU configuration files to Test Case Folder for Test Record
Satellite	WSHKR-3	Situation Data Warehouse and Satellite Service Provider (SSP) communications fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Delete (all) existing TIMs on SSP • Verify relevant configuration files are correct for this test case • Download/Copy relevant configuration files to Test Case Folder for Test Record
Data Logging	All WSHKR Test Cases	Data logging for each of the following components fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment: • OBU • RSU • ODE • Data broker	• Initialize Test Log Folder with Unique Test Identifier

System Component	Applicable Test Procedures and Cases	Configuration for On-road Shakedown Test Procedure and Test Cases	Initialization for On-road Shakedown Test Procedure and Test Cases
		• Data Warehouse	
External Storage Location for Each Test Set	All WSHKR Test Cases	Storage location external to the system for backup and archiving of log files and test records.	• Initialize Test Record Folder with Unique Test Identifier
All WYDOT Connected Vehicles operating during Shakedown Test Period	WSHKR-1	Schedule all connected vehicles to pass test site independently and determine minimum V2V and V2I communication range for each. Separation distance at which a configurable threshold percentage of BSMs sent are received and logged by test OBU and RSU is recorded as baseline for subsequent vehicle performance assessment.	•
WYDOT Maint Vehicle	Remote Vehicle for WSHKR-1 WSHKR-2, 3, and 4 WSHKR-2, 3, and 4 are expected to occur periodically over time as vehicles travel across Wyoming I-80 as part of their other WYDOT activities. It is expected that different vehicle will be used at different times and locations, based upon their availability and work assignments. While WYDOT Maint Vehicle are expected to be used for conducting these test cases because of their routine deployment on I-80, other vehicle may be used at the discretion of the Test Staff, if they can verify consistent comparisons and results.	Lear Roadstar OBU with antenna configuration planned for deployment and HMI fully developed, integrated with vehicle and CAN interface per SDD and ICD, ready for production deployment. May be tested with development environment or production environment, as long as it is ready for production deployment.	• Initialize log file folders for this Test Case with Unique Identifier • Verify OBU and HMI configuration files are correct for this test case • Download/Copy OBU and HMI configuration files to Test Case Folder for Test Record

System Component	Applicable Test Procedures and Cases	Configuration for On-road Shakedown Test Procedure and Test Cases	Initialization for On-road Shakedown Test Procedure and Test Cases
Operators of Back office Component with Representative TIM	WSHKR-2 and WSHKR-3	Back office System Operators trained in what to expect from I2V Applications and practiced in supporting Representative TIM I2V Message Communications.	• Train Back office System Operators to initiate TIM and distribute to RSU and satellite • Back office System Operators practice initiating TIM and distribution to RSU and satellite
Drivers	All WSHKR Test Cases	Drivers qualified and experienced in driving the assigned vehicles. Drivers trained in what to expect from V2I Applications and practiced in conducting driving scenarios safely and reliably with existing traffic.	• Conduct driver safety briefing • Review and practice test scenario, as required to ensure maneuvers can be conducted safely and reliably with existing traffic
Test Staff	All WSHKR Test Cases	Test staff trained in what to expect from V2I Applications and practiced in supporting driving scenarios safely and reliably with existing traffic.	• Conduct safety briefing and review danger zones • Verify that Test Staff wear safety vests • Review and practice test scenario, as required to ensure maneuvers can be conducted safely and reliably with existing traffic
Visitors and Non-Test Staff	All WSHKR Test Cases	Visitors and Non-Test Staff instructed in what to expect from V2I Applications and informed in observing driving scenarios safely and reliably with existing traffic.	• Review test scenario • Conduct safety briefing and review danger zones

2.4 Table WSHKR-1-Description OBU Shakedown Test Case Description

Table 2-4. WSHKR-1-Description OBU Shakedown Test Case Description

Test Case ID	WSHKR-1	Test Engineer Verification and Remarks
Test Case Name	OBU Shakedown	
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WSHKR-Requirements	
Objective	Perform baseline DSRC communication range test on all vehicles, followed by repetition periodically and after severe weather deployments (WYDOT Maintenance Vehicles) to verify OBU functionality and performance during shakedown test period.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for Distress Notification Test Procedure and Test Cases described in Table WSHKR-CI On-road Shakedown System Component Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for Distress Notification Test Procedure and Test Cases described in Table WSHKR-CI On-road Shakedown System Component Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	Data Warehouse	
Remote Vehicle OBU/ Vehicle	Lear Roadstar OBU set up at I-80 Communication Range Test Site	
RSU	Setup at I-80 Communication Range Test Site with communications backhaul	
Host Vehicle OBU/ Vehicle	All WYDOT Connected Vehicles operating during Shakedown Test Period	

Test Case ID	WSHKR-1	Test Engineer Verification and Remarks
Message Type	BSMs	
Host Vehicle Driving Scenario (TC Input)	Schedule all connected vehicles to pass test site independently and determine minimum V2V and V2I communication range for each. Perform baseline DSRC communication range test on all vehicles, followed by repetition periodically and after severe weather deployments.	
TC Output	I-80 Communication Range Test Site RSU and Remote Vehicle Logs. Separation distance at which a configurable threshold percentage of BSMs sent are received and logged by test OBU and RSU is recorded as baseline for subsequent vehicle performance assessment.	
Expected Result (Pass/Fail Criteria)	A configurable threshold percentage of BSMs are received and processed by RSU when vehicle is at least 300 meters away. A configurable threshold percentage of BSMs are received and processed by remote vehicle OBU when vehicle is at least 300 meters away. Inspection and troubleshooting is recommended for any OBU failing this test or demonstrating significantly reduced performance from baseline to identify and remediate problems prior to full deployment.	
Analysis and Verification Method		
Visual Observation Actual Result		
Log Analysis Actual Result	*Vehicle distance when BSMs received RSU. *Vehicle distance when BSMs received by OBU.	
Pass/Fail Assessment & Remarks		

2.5 Table WSHKR-1-Results OBU Shakedown Test Case Results

Table 2-5. WSHKR-1-Results OBU Shakedown Test Case Results

Test Case ID	WSHKR-1	Test Engineer Verification and Remarks
Test Case Name	OBU Shakedown	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

2.6 Table WSHKR-2-Description RSU and Backhaul Communications Shakedown Test Case Description

Table 2-6. WSHKR-2-Description RSU and Backhaul Communications Shakedown Test Case Description

Test Case ID	WSHKR-2	Test Engineer Verification and Remarks
Test Case Name	RSU and Backhaul Communications Shakedown	
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WSHKR-Requirements	

Test Case ID	WSHKR-2	Test Engineer Verification and Remarks
Objective	Perform baseline DSRC communication range test on all RSUs, followed by repetition periodically and after severe weather events to verify RSU functionality and performance during shakedown test period.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for Distress Notification Test Procedure and Test Cases described in Table WSHKR-CI On-road Shakedown System Component Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for Distress Notification Test Procedure and Test Cases described in Table WSHKR-CI On-road Shakedown System Component Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	Data Broker, Data Warehouse	
Host Vehicle OBU/ Vehicle	Lear Roadstar OBU operating on I-80	
RSU	All RSUs	
Message Type	BSMs, log files, TIMs	
Back Office Operators Scenario (TC Input 1)	Back Office System Operators initiate TIM messages and distribute to RSU and satellite.	
Host Vehicle Driving Scenario (TC Input 2)	Host (WYDOT maintenance) vehicle approaches each RSU broadcasting BSMs, uploading log files and capturing TIMs via DSRC.	
TC Output	Host Vehicle Logs. Separation distance at which a configurable threshold percentage of I2V TIM and V2I BSM and log file sent are received is recorded as baseline for subsequent RSU performance assessment.	

Test Case ID	WSHKR-2	Test Engineer Verification and Remarks
Expected Result (Pass/Fail Criteria)	A configurable threshold percentage of I2V TIMs sent from the RSU to the OBU and a configurable threshold percentage of V2I BSMs sent from the OBU to the RSU at a range of at least 300 meters are received. All log files are received. Inspection and troubleshooting is recommended for any RSU failing this test or demonstrating significantly reduced performance from baseline, to identify and remediate problems prior to full deployment.	
Detailed Execution Steps	*Dry runs of test procedure and test cases are to be conducted and detailed execution steps for each system component are to be prepared to support consistent implementation by test staff.*	

2.7 Table WSHKR-2-Results RSU and Backhaul Communications Shakedown Test Case Results

Table 2-7. WSHKR-2-Results RSU and Backhaul Communications Shakedown Test Case Results

Test Case ID	WSHKR-2	Test Engineer Verification and Remarks
Test Case Name	RSU and Backhaul Communications Shakedown	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

2.8 Table WSHKR-3-Description I-80 Satellite TIM coverage Shakedown Test Case Description

Table 2-8. WSHKR-3-Description I-80 Satellite TIM coverage Shakedown Test Case Description

Test Case ID	**WSHKR-3**	**Test Engineer Verification and Remarks**
Test Case Name	I-80 Satellite TIM coverage	
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WSHKR-Requirements	
Objective	Verify and baseline the satellite-to-OBU TIM coverage across I-80.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for Distress Notification Test Procedure and Test Cases described in Table WSHKR-CI On-road Shakedown System Component Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for Distress Notification Test Procedure and Test Cases described in Table WSHKR-CI On-road Shakedown System Component Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	Back office Component with Representative TIM, Data Warehouse	
Host Vehicle OBU/ Vehicle	Lear Roadstar OBU operating on I-80	
RSU	All RSUs	
Test Locations	Test engineers identify at least 10 locations along I-80 remote from RSU coverage for conducting Satellite communications tests.	

Test Case ID	WSHKR-3	Test Engineer Verification and Remarks
Message Type	TIMs	
Back Office Operators Scenario (TC Input 1)	Back Office System Operators initiate TIM messages and distribute to RSU and satellite.	
Host Vehicle Driving Scenario (TC Input)	Host (WYDOT maintenance) vehicle visits each site, capturing TIMs via satellite communications and recording the percentage of TIMs sent that are received.	
TC Output	Host Vehicle Logs. TIMs via satellite communications, recording the percentage of TIMs sent that are received.	
Expected Result (Pass/Fail Criteria)	A configurable threshold percentage of Satellite TIMs sent are received at each of the selected locations.	
Detailed Execution Steps	*Dry runs of test procedure and test cases are to be conducted and detailed execution steps for each system component are to be prepared to support consistent implementation by test staff.*	

2.9 Table WSHKR-3-Results I-80 Satellite TIM coverage Shakedown Test Case Results

Table 2-9. WSHKR-3-Results I-80 Satellite TIM coverage Shakedown Test Case Results

Test Case ID	WSHKR-3	Test Engineer Verification and Remarks
Test Case Name	I-80 Satellite TIM coverage	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*

Test Case ID	WSHKR-3	Test Engineer Verification and Remarks
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

2.10 Table WSHKR-4-Description Verify I80 Geofence Map Test Case Description

Table 2-10. WSHKR-4-Description Verify I80 Geofence Map Test Case Description

Test Case ID	WSHKR-4	Test Engineer Verification and Remarks
Test Case Name	Verify I80 geofence map	
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WSHKR-Requirements	
Objective	Verify that map used for geofence generation accurately follows I-80 and will support accurate I2V SA message display.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for Distress Notification Test Procedure and Test Cases described in Table WSHKR-CI On-road Shakedown System Component Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for Distress Notification Test Procedure and Test Cases described in Table WSHKR-CI On-road Shakedown System Component Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	Data Warehouse	

Test Case ID	WSHKR-4	Test Engineer Verification and Remarks
Host Vehicle OBU/ Vehicle	Lear Roadstar OBU operating on I-80	
Test Locations	Test engineers identify at least 10 locations along I-80 remote from RSU coverage for conducting Satellite communications tests.	
Message Type	BSMs	
Host Vehicle Driving Scenario (TC Input)	BSMs are logged from WYDOT Maintenance vehicles traveling I80.	
TC Output	Host Vehicle and Data Warehouse Logs.	
Expected Result (Pass/Fail Criteria)	BSM location results are analyzed to verify that they fall on I80 geofence map. Inspection and troubleshooting is recommended for map location in which BSMs fall more than one lane distance outside geofence map, to identify and remediate problems prior to full deployment.	
Detailed Execution Steps	*Dry runs of test procedure and test cases are to be conducted and detailed execution steps for each system component are to be prepared to support consistent implementation by test staff.*	

2.11 Table WSHKR-4-Results Verify I80 Geofence Map Test Case Description Test Case Results

Table 2-11. WSHKR-4-Results Verify I80 Geofence Map Test Case Description Test Case Results

Test Case ID	WSHKR-4	Test Engineer Verification and Remarks
Test Case Name	Verify I80 geofence map	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*

Test Case ID	WSHKR-4	Test Engineer Verification and Remarks
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

2.12 Table WSHKR-Requirements On-road Shakedown Post Test Requirements Verification Analysis

Table 2-12. WSHKR-Requirements On-road Shakedown Post Test Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WSHKR-1 -- OBU Shakedown	MCP-REQ-3 -- OBU Shakedown	The WYDOT CV Pilot System shall support periodic testing to verify functionality and DSRC range performance of WYDOT controlled Pilot vehicles.	* Perform Test Case WSHKR-1 * Confirm OBUs with performance less than 90% of baseline are checked for damage or unit failure. * Confirmation shows the WYDOT CV Pilot System support periodic testing to verify functionality and DSRC range performance of WYDOT controlled Pilot vehicles, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WSHKR-2 -- RSU and Backhaul Communications Shakedown	MCP-REQ-4 -- RSU and Backhaul Communications Shakedown 1	The WYDOT CV Pilot System shall support periodic testing to verify functionality and DSRC range performance of RSUs.	* Perform Test Case WSHKR-2 * Confirm RSUs with performance less than 90% of baseline are checked for damage or unit failure. * Confirmation shows the WYDOT CV Pilot System supports periodic testing to verify functionality and DSRC range performance of RSUs, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WSHKR-2 -- RSU and Backhaul	MCP-REQ-5 -- RSU and Backhaul	The WYDOT CV Pilot System shall support periodic testing to verify functionality and DSRC	* Perform Test Case WSHKR-2 * Confirm RSUs with performance less than 90% of baseline after storm events are checked for	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
Communications Shakedown	Communications Shakedown 2	range performance of RSUs after major storm events	damage or unit failure. * Confirmation shows the WYDOT CV Pilot System support periodic testing to verify functionality and DSRC range performance of RSUs after storm events, thereby verifying the requirement is satisfied.	
WSHKR-3 -- I-80 Satellite TIM coverage	I2VSAP-REQ-12 -- Satellite TIM Coverage	Vehicle Systems shall be capable of receiving I2V SA TIMs via satellite in vehicles traveling on I-80 across Wyoming.	* Perform Test Case WSHKR-3 * Inspect OBU logs * Confirm receipt of TIMs via Satellite. * Confirmation shows Vehicle Systems are capable of receiving I2V SA TIMs via satellite in vehicles traveling on I-80 across Wyoming, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WSHKR-4 -- Verify I80 geofence map	I2VSAP-REQ-11 -- Verify I-80 Map and Geofences	Vehicle Systems shall be capable of displaying Situational Awareness Message(s) in vehicles traveling in all travel lanes anywhere on I-80 across Wyoming.	* Perform Test Case WSHKR-4 * Confirm Message(s) display within 8 meters of beginning of specified geofence and cease display within 8 meters of end of specified geofence. * Confirmation shows Vehicle Systems are capable of displaying Situational Awareness Message(s) in vehicles traveling in all travel lanes anywhere on I-80 across Wyoming, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

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FHWA-JPO-17-472B.7

U.S. Department of Transportation

Connected Vehicle Pilot Deployment Program Phase 2

WYDOT CV Pilot – ORTP - Installation Robustness and Quality Control Test Procedure and Test Cases

www.its.dot.gov/index.htm

Final Report — July 30, 2018

FHWA-JPO-17-472B.8

U.S. Department of Transportation

Produced by DTFH6116H00027

U.S. Department of Transportation

Notice

Technical Report Documentation Page

1. Report No. FHWA-JPO-17-472B.8	**2. Government Accession No.**	**3. Recipient's Catalog No.**
4. Title and Subtitle WYDOT CV Pilot - Installation Robustness and Quality Control Test Procedure and Test Cases		**5. Report Date** 7/30/2018 **6. Performing Organization Code**
7. Author(s) Denny Stephens (Vital Assurance), Tony English (Trihydro), Nayel Ureña Serulle (ICF), Deepak Gopalakrishna (ICF), Vince Garcia (Wyoming DOT)		**8. Performing Organization Report No.** Task 2G: Operational Readiness Test and Demonstration Planning
9. Performing Organization Name and Address Wyoming DOT, 5300 Bishop Boulevard, Cheyenne, WY 82009 ICF International, 1725 Eye St NW, Washington DC, 20006 Trihydro Corporation, 1252 Commerce Drive, Laramie, WY 82070 Vital Assurance, 175 S. Third St., Suite 200, Columbus, OH 43215		**10. Work Unit No. (TRAIS)** **11. Contract or Grant No.** DTFH6116H00027
12. Sponsoring Agency Name and Address U.S Department of Transportation 1200 New Jersey Ave, SE Washington, DC 20590		**13. Type of Report and Period Covered** 09/01/2016 to 7/30/2018 **14. Sponsoring Agency Code**
15. Supplementary Notes Kate Hartman (COR), Sarah Tarpgaard (CO)		

16. Abstract

The Wyoming Department of Transportation's (WYDOT) Connected Vehicle (CV) Pilot Deployment Program is intended to develop a suite of applications that utilize vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communication technology to reduce the impact of adverse weather on truck travel in the I-80 corridor. These applications support a flexible range of services from advisories, roadside alerts, parking notifications and dynamic travel guidance. Information from these applications are made available directly to the equipped fleets or through data connections to fleet management centers (who will then communicate it to their trucks using their own systems). The pilot will be conducted in three Phases. Phase 1 includes the planning for the CV pilot including the concept of operations development. Phase 2 is the design, development, and testing phase. Phase 3 includes a real-world demonstration of the applications developed as part of this pilot.

This document presents the template for the *Installation Robustness and Quality Control Test Procedure and Test Cases* of the Wyoming Department of Transportation (WYDOT) Connected Vehicle (CV) Pilot project as part of the United States Department of Transportation's (USDOT) CV program. These tests are part of the WYDOT CV Pilot Operational Test Plan - Attachment B.

17. Key Words Connected Vehicle Technology, I-80 Corridor, Road Weather, Truck Safety, System Architecture	**18. Distribution Statement** This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161

19. Security Classif. (of this report) None	**20. Security Classif. (of this page)** None	**21. No. of Pages** 31	**22. Price** NA

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

Acknowledgements

The Operational Readiness Plan development team would like to thank USDOT and Noblis for their technical assistance throughout the development of this document.

Table of Contents

1 Introduction 1

1.1 Project Scope 1

1.2 Purpose of this Test 2

2 Installation Robustness and Quality Control Test Procedure and Test Cases 3

2.1 Table WINSTQ-SUM Installation Robustness and Quality Control Test Case Summary 4

2.2 Table WINSTQ-TP Installation Robustness and Quality Control Test Procedure 5

2.3 Table WINSTQ-CI Installation Robustness and Quality Control Test Configuration and Initialization 7

2.4 Table WINSTQ-1-Description Installation Robustness and Quality Control Test Case Description 13

2.5 Table WINSTQ-1-Results Installation Robustness and Quality Control 14

2.6 Table WINSTQ-2-Description Installation Robustness and Quality Control Test Case Description 15

2.7 Table WINSTQ-2-Results Installation Robustness and Quality Control 17

2.8 Table WINSTQ-3-Description Installation Robustness and Quality Control Test Case Description 18

2.9 Table WINSTQ-3-Results Installation Robustness and Quality Control 20

2.10 Table WINSTQ-4-Description Installation Robustness and Quality Control Test Case Description 21

2.11 Table WINSTQ-4-Results Installation Robustness and Quality Control 23

2.12 Table WINSTQ-Requirements Installation Robustness and Quality Control Post Test Requirements Verification Analysis 23

List of Tables

Table 2-1. WINSTQ-SUM Installation Robustness and Quality Control Test Case Summary 4
Table 2-2. WINSTQ-TP Installation Robustness and Quality Control Test Procedure 5
Table 2-3. WINSTQ-CI Installation Robustness and Quality Control Test Configuration and Initialization 7
Table 2-4. WINSTQ-1-Description Installation Robustness and Quality Control Test Case Description 13
Table 2-5. WINSTQ-1-Results Installation Robustness and Quality Control 14
Table 2-6. WINSTQ-2-Description Installation Robustness and Quality Control Test Case Description 15
Table 2-7. WINSTQ-2-Results Installation Robustness and Quality Control 17
Table 2-8. WINSTQ-3-Description Installation Robustness and Quality Control Test Case Description 18
Table 2-9. WINSTQ-3-Results Installation Robustness and Quality Control 20
Table 2-10. WINSTQ-4-Description Installation Robustness and Quality Control Test Case Description 21
Table 2-11. WINSTQ-4-Results Installation Robustness and Quality Control 23
Table 2-12. WINSTQ-Requirements Installation Robustness and Quality Control Post Test Requirements Verification Analysis 23

1 Introduction

1.1 Project Scope

Wyoming is one of the first wave of CV Pilot sites selected to showcase the value of and spur the adoption of CV technology in the United States. CV technology is a broad term to describe the applications and the systems that leverage dedicated short-range communications (DSRC) for vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I) and infrastructure-to-vehicle (I2V) communication to improve safety, mobility and productivity of the users of the nation's transportation system.

As one of the three selected pilots, WYDOT is focusing on improving safety and mobility by creating new ways to communicate road and travel information to commercial truck drivers and fleet managers along the 402 miles of Interstate 80 (I-80 henceforth) in the State. For the pilot project, WYDOT concluded Phase 1 (planning) in September 2016 and then initiated Phase 2 (deployment) which is scheduled to conclude in mid-2018. This will be followed by an 18-month demonstration period in the third phase.

Systems and applications developed in the pilot will enable drivers of connected vehicles to have improved awareness of potential hazards and of situations they cannot see. At a very high level, the pilot scope includes the following implementation elements:

- **Deploy about 75 roadside units (RSU)** that can receive and broadcast messages using DSRC along various sections on I-80.
- **Equip around 400 vehicles, a combination of fleet vehicles and commercial trucks, with on-board units (OBU).** Of the 400 vehicles, at least 150 are planned to be heavy trucks. All vehicles are expected to be regular users of I-80. Several types of OBUs are being procured as part of the pilot and differ based on their communication capabilities, ability to integrate with the in-vehicle network, and connectivity to ancillary devices and sensors. All OBUs will have the functionality to broadcast Basic Safety Messages (BSM) and will include a human-machine interface (HMI) to share alerts and advisories to drivers of these vehicles.
- **Develop several V2V, V2I, I2V applications** that will enable communication to drivers of alerts and advisories regarding various road conditions. These applications include support for in-vehicle dissemination of advisories for collision avoidance, speed management, detours, parking, and presence of work zones and maintenance and emergency vehicles downstream of their current location.
- **Enable overall improvements in WYDOT's traffic management and traveler information practices** by using data collected from connected vehicles. Targeted improvements include ingesting more location specific mobile road weather information system (RWIS) data, using Pikalert®[1] to provide for more accurate and road segment

[1] Pikalert is a trademark of the University Corporation for Atmospheric Research.

specific conditions to define better variable speed limits (VSLs), and improving road condition dissemination via 511, Dynamic Message Signs (DMS) and other WYDOT sources.

1.2 Purpose of this Test

This document presents the test results of the *Installation Robustness and Quality Control Test Procedure and Test Cases* for the Wyoming Department of Transportation (WYDOT) Connected Vehicle (CV) Pilot project as part of the United States Department of Transportation's (USDOT) CV program. These tests are part of the WYDOT CV Pilot Operational Test Plan - Attachment B.

The purpose of this document is to describe the results of a sequence of end-to-end tests conducted to validate the successful operation of the system in terms installation and quality control.

2 Installation Robustness and Quality Control Test Procedure and Test Cases

This chapter describes *Test Procedure ID WINSTQ -- Installation Robustness and Quality Control Test Procedure and Test Cases*. Table *WINSTQ* -SUM is a high-level summary of the test cases addressed in this test procedure, providing a summary and orientation for the reader. Table *WINSTQ* -TP details the Test Procedure itself. Table *WINSTQ* -CI describes the configuration of each of the WYDOT CV Pilot System components for the Test Procedure and the Initialization to be performed for each prior to conducting the Test Cases. Tables *WINSTQ*-1-Description through *WINSTQ*-4-Description provide the detailed description of Test Cases to be performed under this Test Procedure. Tables *WINSTQ*-1-Results through *WINSTQ*-4-Results capture the results of each repetition of each Test Case. Finally, Table *WINSTQ*-Requirements describes the requirement verification methodology and captures the Test Engineer's confirmation that each requirement is verified. Appendix A of the ORTP provides a list of all system requirements, the test case in which they are verified, and their individual requirements verification methodology.

2.1 Table WINSTQ-SUM Installation Robustness and Quality Control Test Case Summary

Table 2-1. WINSTQ-SUM Installation Robustness and Quality Control Test Case Summary

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID	Requirements Verified
WINSTQ-1	OBU Installation Robustness	Verify nominal OBU hardware installation robustness and ruggedness	* Install and remove OBU in vehicle 5 times.	* OBU shall pass the following two test cases after fifth installation * WV2VMCT-1 V2V exchange of BSMs * WV2IMCT-2 V2I & End-to-end communication of BSMs		Compiled in Table WINSTQ-Requirements
WINSTQ-2	RSU Installation Robustness	Verify nominal RSU hardware installation robustness and ruggedness	* Install and remove RSU on pole 3 times.	* RSU shall pass the following two test cases after third installation * WV2IMCT-2 V2I & End-to-end communication of BSMs * WI2VMCT-1 End-to-end & DSRC Delivery of I2V SA TIMs		Compiled in Table WINSTQ-Requirements
WINSTQ-3	OBU Installation Quality Control	Verify the functionality and performance of an OBU and antenna after installation in a vehicle	* Installation in a vehicle.	* OBU shall pass the following two test cases after installation * WV2VMCT-1 V2V exchange of BSMs * WV2IMCT-2 V2I & End-to-end communication of BSMs		Compiled in Table WINSTQ-Requirements

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID	Requirements Verified
WINSTQ-4	RSU Installation Quality Control	Verify the functionality and performance of an RSU and antenna after installation on a roadside structure.	* Installation on a roadside structure.	* RSU shall pass the following two test cases after installation * WV2IMCT-2 V2I & End-to-end communication of BSMs * WI2VMCT-1 End-to-end & DSRC Delivery of I2V SA TIMs		Compiled in Table WINSTQ-Requirements

2.2 Table WINSTQ-TP Installation Robustness and Quality Control Test Procedure

Table 2-2. WINSTQ-TP Installation Robustness and Quality Control Test Procedure

Test Procedure ID	WINSTQ	Test Engineer Verification and Remarks
Test Procedure Name	Installation Robustness and Quality Control Test Procedure	
Test Procedure Completion Date		
Priority	Required	
Objectives	• Verify nominal OBU hardware installation robustness and ruggedness • Verify nominal RSU hardware installation robustness and ruggedness • Verify the functionality and performance of an OBU and antenna after installation in a vehicle • Verify the functionality and performance of an RSU and antenna after installation on a	

Test Procedure ID	WINSTQ	Test Engineer Verification and Remarks
	roadside structure.	
Relationship to Other Procedures	• Precondition is successful development and integration of the WYDOT CV Pilot System, as described in the SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	
Discussion, Guidance, and Rationales	None at this time	
Test Cases Performed under This Procedure	Test Cases WINSTQ-1-OBU Installation Robustness and WINSTQ-2-RSU Installation Robustness are to be performed for an OBU and RSU from each vendor, representative of devises to be fielded in the WYDOT CV Pilot Vehicles. Test Case WINSTQ-3-OBU Installation Quality Control is to be performed on each OBU and antenna after installation in the fielded vehicle. This test case requires passing of Test Cases WV2VMCT-1 V2V exchange of BSMs and WV2IMCT-2 V2I & End-to-end communication of BSMs. Test Case WINSTQ-4-RSU Installation Quality Control is to be performed on each RSU and antenna after installation in the field. This test case requires passing of Test Cases WV2IMCT-2 V2I & End-to-end communication of BSMs and WI2VMCT-1 End-to-end & DSRC Delivery of I2V SA TIMs.	

2.3 Table WINSTQ-CI Installation Robustness and Quality Control Test Configuration and Initialization

Table 2-3. WINSTQ-CI Installation Robustness and Quality Control Test Configuration and Initialization

System Component	Applicable Test Procedures and Cases	Configuration for Installation Robustness and Quality Control Test Procedure and Test Cases	Initialization for Installation Robustness and Quality Control Test Procedure and Test Cases	Test Engineer Verification and Remarks
Back office Component with Representative TIM	All WINSTQ Test Cases	"Representative" TIM is defined as an example TIM whose successful test result indicates conducting this test case with other I2V SA TIMs is also likely to be successful. This TIM is selected empirically, by developers and test engineers. This TIM message is used when it is not necessary or efficient to repeat all message types from each back office component.	• Prepare applicable back office component inputs for Representative TIM • Formulate and document back office component inputs that will generate Representative I2V Message Communication TIM • Formulate and document back office component inputs (manual and computer input file) for distribution of Representative I2V Message Communication TIM through RSUs via DSRC.	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for Installation Robustness and Quality Control Test Procedure and Test Cases	Initialization for Installation Robustness and Quality Control Test Procedure and Test Cases	Test Engineer Verification and Remarks
Track or Roadway	All WINSTQ Test Cases	• Controlled environment "track", parking lot, or roadway wherein test can be performed safely, consistently, and without external interference. • RSU installed on straightaway, to support straightforward measurement of vehicle to RSU distance. • Test speed should be adjusted to be safe speeds for the test environment.	• Identify vehicle and RSU event locations and place traffic cones on both sides of roadway clearly visible to drivers. • Place cautionary signage and boundary markers in advance of event location to warn test staff and visitors • On roadway, place any additional signage required by WYDOT Safety Manager • Verify vehicle preparation and staging area is outside DSRC communication range from RSU and stopped vehicle location.	*Configuration Verified:* *Initialization Verified:*
Data Broker (DB)	All WINSTQ Test Cases	DB fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it	• Remove old log files • Verify DB configuration files are correct for this test set • Download/Copy DB configuration files to Test Case Folder for Test Record • Reinitialize, if practical	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for Installation Robustness and Quality Control Test Procedure and Test Cases	Initialization for Installation Robustness and Quality Control Test Procedure and Test Cases	Test Engineer Verification and Remarks
		is ready for production deployment.		
Operational Data Environment (ODE)	All WINSTQ Test Cases	ODE fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Remove old log files • Verify ODE configuration files are correct for this test case • Download/Copy ODE configuration files to Test Case Folder for Test Record • Reinitialize, if practical	*Configuration Verified:* *Initialization Verified:*
Data Warehouse (DW)	All WINSTQ Test Cases	DW fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Verify DW configuration files are correct for this test case • Download/Copy DW configuration files to Test Case Folder for Test Record	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for Installation Robustness and Quality Control Test Procedure and Test Cases	Initialization for Installation Robustness and Quality Control Test Procedure and Test Cases	Test Engineer Verification and Remarks
Security Credential Management System (SCMS)	All WINSTQ Test Cases	SCMS fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Verify SCMS configuration files are correct for this test case • Download/Copy SCMS configuration files to Test Case Folder for Test Record	*Configuration Verified:* *Initialization Verified:*
RSU(s)	All WINSTQ Test Cases	One RSU fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment. RSU installed on track straightaway, to support straightforward measurement of vehicle to RSU distance. RSU is located outside DSRC communication range from vehicle staging area.	• Verify RSU is located outside DSRC communication range from vehicle staging area. • Remove old log files • Verify RSU configuration files are correct for this test case • Download/Copy RSU configuration files to Test Case Folder for Test Record • Reboot RSU, if practical	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for Installation Robustness and Quality Control Test Procedure and Test Cases	Initialization for Installation Robustness and Quality Control Test Procedure and Test Cases	Test Engineer Verification and Remarks
Data Logging	All WINSTQ Test Cases	Data logging for each of the following components fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment: • OBU • RSU • ODE • Data broker • Data Warehouse	• Remove old log files after storage and archival • Initialize Test Log Folder with Unique Test Identifier	*Configuration Verified:* *Initialization Verified:*
External Storage Location for Each Test Set	All WINSTQ Test Cases	Storage location external to the system for backup and archiving of log files and test records.	• Initialize Test Record Folder with Unique Test Identifier	*Configuration Verified:* *Initialization Verified:*
WYDOT CV Pilot Vehicle	All WINSTQ Test Cases	OBU with antenna configuration planned for deployment and HMI fully developed, integrated with vehicle per SDD and ICD, ready for production deployment. May be tested with development environment or production environment, as long as it is ready for production deployment.	• Remove old log files • Initialize log file folders for this Test Case with Unique Identifier • Verify OBU and HMI configuration files are correct for this test case • Download/Copy OBU and HMI configuration files to Test Case Folder for Test Record	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for Installation Robustness and Quality Control Test Procedure and Test Cases	Initialization for Installation Robustness and Quality Control Test Procedure and Test Cases	Test Engineer Verification and Remarks
Drivers	All WINSTQ Test Cases	Drivers qualified and experienced in driving the assigned vehicles. Drivers trained in what to expect from V2I Applications and practiced in conducting driving scenarios safely and reliably with existing traffic.	• Conduct driver safety briefing • Review and practice test scenario, as required to ensure maneuvers can be conducted safely and reliably with existing traffic	*Configuration Verified:* *Initialization Verified:*
Test Staff	All WINSTQ Test Cases	Test staff trained in what to expect from V2I Applications and practiced in supporting driving scenarios safely and reliably with existing traffic.	• Conduct safety briefing and review danger zones • Verify that Test Staff wear safety vests • Review and practice test scenario, as required to ensure maneuvers can be conducted safely and reliably with existing traffic	*Configuration Verified:* *Initialization Verified:*
Visitors and Non-Test Staff	All WINSTQ Test Cases	Visitors and Non-Test Staff instructed in what to expect from V2I Applications and informed in observing driving scenarios safely and reliably with existing traffic.	• Review test scenario • Conduct safety briefing and review danger zones	*Configuration Verified:* *Initialization Verified:*

2.4 Table WINSTQ-1-Description Installation Robustness and Quality Control Test Case Description

Table 2-4. WINSTQ-1-Description Installation Robustness and Quality Control Test Case Description

Demonstration Test Case ID	**WINSTQ-1**	**Test Engineer Verification and Remarks**
Demonstration Test Case Name	**OBU Installation Robustness**	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WINSTQ-Requirements	
Objective	Verify nominal OBU hardware installation robustness and ruggedness.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for Installation Robustness and Quality Control Test Procedure and Test Cases described in Table WINSTQ-CI Installation Robustness and Quality Control Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for Installation Robustness and Quality Control Test Procedure and Test Cases described in Table WINSTQ-CI Installation Robustness and Quality Control Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
System Component	OBU	

Demonstration Test Case ID	WINSTQ-1	Test Engineer Verification and Remarks
TC Input	Install and remove OBU in vehicle 5 times. After fifth installation perform Test Procedure /Case WV2VMCT-1 -- V2V exchange of BSMs and Test Procedure/Case WV2IMCT-2 -- V2I & End-to-end communication of BSMs	
Test Components	Representative production sample from each OBU vendor	
TC Output	Results of Test Procedure /Case WV2VMCT-1 -- V2V exchange of BSMs and Test Procedure/Case WV2IMCT-2 -- V2I & End-to-end communication of BSMs	
Expected Result (Pass/Fail Criteria)	*OBU passes Test Procedure /Case WV2VMCT-1 -- V2V exchange of BSMs and Test Procedure/Case WV2IMCT-2 -- V2I & End-to-end communication of BSMs.	
Analysis and Verification Method	*Test staff visual inspection of OBUs and inspection and analysis of Test Procedure/Case results	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* • Install and remove OBU in vehicle 5 times.	

2.5 Table WINSTQ-1-Results Installation Robustness and Quality Control

Table 2-5. WINSTQ-1-Results Installation Robustness and Quality Control

Test Case ID	WINSTQ-1	Test Engineer Verification and Remarks
Test Case Name	**OBU Installation Robustness**	*Performed and Confirmed by:*

Test Case ID	WINSTQ-1	Test Engineer Verification and Remarks
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.6 Table WINSTQ-2-Description Installation Robustness and Quality Control Test Case Description

Table 2-6. WINSTQ-2-Description Installation Robustness and Quality Control Test Case Description

Demonstration Test Case ID	WINSTQ-2	Test Engineer Verification and Remarks
Demonstration Test Case Name	**RSU Installation Robustness**	

Demonstration Test Case ID	WINSTQ-2	Test Engineer Verification and Remarks
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WINSTQ-Requirements	
Objective	Verify nominal RSU hardware installation robustness and ruggedness.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for Installation Robustness and Quality Control Test Procedure and Test Cases described in Table WINSTQ-CI Installation Robustness and Quality Control Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for Installation Robustness and Quality Control Test Procedure and Test Cases described in Table WINSTQ-CI Installation Robustness and Quality Control Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
System Component	RSU	
TC Input	Install and remove RSU on roadside gantry 3 times. After third installation perform Test Procedure /Case WV2IMCT-2 -- V2I & End-to-end communication of BSMs and Test Procedure/Case WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs	
Test Components	Representative production sample from each RSU vendor	
TC Output	Results of Test Procedure /Case WV2IMCT-2 -- V2I & End-to-end communication of BSMs and Test Procedure/Case WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs	

Demonstration Test Case ID	WINSTQ-2	Test Engineer Verification and Remarks
Expected Result (Pass/Fail Criteria)	* RSU passes Test Procedure /Case WV2IMCT-2 -- V2I & End-to-end communication of BSMs and Test Procedure/Case WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs	
Analysis and Verification Method	*Test staff visual inspection of RSUs and inspection and analysis of Test Procedure/Case results.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* • Install and remove RSU on roadside gantry 3 times. • After third installation perform Test Procedure /Case WV2IMCT-2 -- V2I & End-to-end communication of BSMs and Test Procedure/Case WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs	

2.7 Table WINSTQ-2-Results Installation Robustness and Quality Control

Table 2-7. WINSTQ-2-Results Installation Robustness and Quality Control

Test Case ID	WINSTQ-2	Test Engineer Verification and Remarks
Test Case Name	**RSU Installation Robustness**	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*

Test Case ID	WINSTQ-2	Test Engineer Verification and Remarks
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.8 Table WINSTQ-3-Description Installation Robustness and Quality Control Test Case Description

Table 2-8. WINSTQ-3-Description Installation Robustness and Quality Control Test Case Description

Demonstration Test Case ID	WINSTQ-3	Test Engineer Verification and Remarks
Demonstration Test Case Name	OBU Installation Quality Control	
Test Case Completion Date		
Priority	Required	

Demonstration Test Case ID	**WINSTQ-3**	**Test Engineer Verification and Remarks**
Requirements Verified (Tracing)	Compiled in Table WINSTQ-Requirements	
Objective	Verify the functionality and performance of an OBU and antenna after installation in a vehicle.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for Installation Robustness and Quality Control Test Procedure and Test Cases described in Table WINSTQ-CI Installation Robustness and Quality Control Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for Installation Robustness and Quality Control Test Procedure and Test Cases described in Table WINSTQ-CI Installation Robustness and Quality Control Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
System Component	OBU	
TC Input	Install OBU in a vehicle per WYDOT CV Pilot OBU Installation Procedure. After installation perform Test Procedure /Case WV2VMCT-1 -- V2V exchange of BSMs and Test Procedure/Case WV2IMCT-2 -- V2I & End-to-end communication of BSMs	
Test Components	All OBUs following installation in WYDOT CV Pilot Vehicles	
TC Output	Results of Test Procedure /Case WV2VMCT-1 -- V2V exchange of BSMs and Test Procedure/Case WV2IMCT-2 -- V2I & End-to-end communication of BSMs	
Expected Result (Pass/Fail Criteria)	*OBU passes Test Procedure /Case WV2VMCT-1 -- V2V exchange of BSMs and Test Procedure/Case WV2IMCT-2 -- V2I & End-to-end communication of BSMs.	

Demonstration Test Case ID	WINSTQ-3	Test Engineer Verification and Remarks
Analysis and Verification Method	*Test staff visual inspection of OBUs and inspection and analysis of Test Procedure/Case results	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* • Install OBU in a vehicle per WYDOT CV Pilot OBU Installation Procedure. • After installation perform Test Procedure /Case WV2VMCT-1 -- V2V exchange of BSMs and Test Procedure/Case WV2IMCT-2 -- V2I & End-to-end communication of BSMs	

2.9 Table WINSTQ-3-Results Installation Robustness and Quality Control

Table 2-9. WINSTQ-3-Results Installation Robustness and Quality Control

Test Case ID	WINSTQ-3	Test Engineer Verification and Remarks
Test Case Name	OBU Installation Quality Control	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

2.10 Table WINSTQ-4-Description Installation Robustness and Quality Control Test Case Description

Table 2-10. WINSTQ-4-Description Installation Robustness and Quality Control Test Case Description

Demonstration Test Case ID	**WINSTQ-4**	**Test Engineer Verification and Remarks**
Demonstration Test Case Name	RSU Installation Quality Control Test Cases	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WINSTQ-Requirements	
Objective	Verify the functionality and performance of an RSU and antenna after installation on a roadside structure.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for Installation Robustness and Quality Control Test Procedure and Test Cases described in Table WINSTQ-CI Installation Robustness and Quality Control Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for Installation Robustness and Quality Control Test Procedure and Test Cases described in Table WINSTQ-CI Installation Robustness and Quality Control Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	

Demonstration Test Case ID	**WINSTQ-4**	**Test Engineer Verification and Remarks**
System Component	RSU	
TC Input	Install RSU according to WYDOT CV Pilot Installation Procedure. After installation perform Test Procedure /Case WV2IMCT-2 -- V2I & End-to-end communication of BSMs and Test Procedure/Case WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs	
Test Components	All RSUs	
TC Output	Results of Test Procedure /Case WV2IMCT-2 -- V2I & End-to-end communication of BSMs and Test Procedure/Case WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs	
Expected Result (Pass/Fail Criteria)	* RSU passes Test Procedure /Case WV2IMCT-2 -- V2I & End-to-end communication of BSMs and Test Procedure/Case WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs	
Analysis and Verification Method	*Test staff visual inspection of RSUs and inspection and analysis of Test Procedure/Case results.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* • Install RSU according to WYDOT CV Pilot Installation Procedure. • After installation perform Test Procedure /Case WV2IMCT-2 -- V2I & End-to-end communication of BSMs and Test Procedure/Case WI2VMCT-1 -- End-to-end & DSRC Delivery of I2V SA TIMs	

2.11 Table WINSTQ-4-Results Installation Robustness and Quality Control

Table 2-11. WINSTQ-4-Results Installation Robustness and Quality Control

Test Case ID	**WINSTQ-3**	**Test Engineer Verification and Remarks**
Test Case Name	**RSU Installation Quality Control**	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

2.12 Table WINSTQ-Requirements Installation Robustness and Quality Control Post Test Requirements Verification Analysis

Table 2-12. WINSTQ-Requirements Installation Robustness and Quality Control Post Test Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WINSTQ-1 -- OBU Installation Robustness	MCP-REQ-6 -- OBU Installation Robustness	WYDOT CV Pilot OBUs shall maintain functionality and DSRC communications range performance after up to five installations and removal.	* Perform Test Case WINSTQ-1 * Confirm OBU passes the following two test cases after fifth installation * WV2VMCT-1 V2V exchange of BSMs * WV2IMCT-2 V2I & End-to-end communication of BSMs * Confirmation shows WYDOT CV Pilot OBUs maintain functionality and DSRC communications	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			range performance after up to five installations and removal, thereby verifying the requirement is satisfied.	
WINSTQ-2 -- RSU Installation Robustness	MCP-REQ-7 -- RSU Installation Robustness	WYDOT CV Pilot RSUs shall maintain functionality and DSRC communications range performance after up to three installations and removal.	* Perform Test Case WINSTQ-2 * Confirm RSU passes the following two test cases after third installation * WV2IMCT-2 V2I & End-to-end communication of BSMs * WI2VMCT-1 End-to-end & DSRC Delivery of I2V SA TIMs * Confirmation shows WYDOT CV Pilot RSUs maintain functionality and DSRC communications range performance after up to three installations and removal, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WINSTQ-3 -- OBU Installation Quality Control	MCP-REQ-1 -- V2V Exchange of BSMs	Host vehicles shall receive BSM from remote vehicles via DSRC from between at least 2 and 300 meters distance.	* Perform Test Case WINSTQ-3 * Inspect Host Vehicle OBU Logs * Inspect Remote Vehicle OBU logs * Confirm a configurable threshold percentage of BSMs sent are received and logged by host and remote vehicle OBUs, when vehicles are at least 300 meters apart. * Confirm a configurable threshold percentage of BSMs continue to be received and logged until host vehicle stops. * Confirmation that a configurable threshold percentage of BSMs sent are received by host vehicle verifies Host vehicles receive BSM from remote vehicles via DSRC from between at least 2 and 300 meters distance.	Requirement Verification Confirmed by:
WINSTQ-4 -- RSU Installation Quality Control	MCP-REQ-2 -- V2I & End-to-end Communication of BSMs	RSUs shall receive BSM from Remote Vehicles via DSRC from between at least 2 and 300 meters distance.	* Perform Test Case WINSTQ-4 * Confirm BSMs are received and processed by RSU and ODE when vehicle is between at least 2 and 300 meters distance. * Confirmation shows RSUs receive BSM from Remote Vehicles via DSRC from between at least 2 and 300 meters distance, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

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FHWA-JPO-17-472B.8

U.S. Department of Transportation

Connected Vehicle Pilot Deployment Program Phase 2

WYDOT CV Pilot – ORTP - CV Pilot System Administration and Availability Test Cases

www.its.dot.gov/index.htm

Final

FHWA-JPO-17-472B.9

U.S. Department of Transportation

Produced by DTFH6116H00027
U.S. Department of Transportation

Notice

Technical Report Documentation Page

<table>
<tr><td>1. Report No.
FHWA-JPO-17-472B.9</td><td>2. Government Accession No.</td><td colspan="2">3. Recipient's Catalog No.</td></tr>
<tr><td colspan="2" rowspan="2">4. Title and Subtitle
WYDOT CV Pilot - CV Pilot System Administration and Availability Test Cases</td><td colspan="2">5. Report Date
7/30/2018</td></tr>
<tr><td colspan="2">6. Performing Organization Code</td></tr>
<tr><td colspan="2">7. Author(s)
Denny Stephens (Vital Assurance), Tony English (Trihydro), Nayel Ureña Serulle (ICF), Deepak Gopalakrishna (ICF), Vince Garcia (Wyoming DOT)</td><td colspan="2">8. Performing Organization Report No.
Task 2G: Operational Readiness Test and Demonstration Planning</td></tr>
<tr><td colspan="2" rowspan="2">9. Performing Organization Name and Address
Wyoming DOT, 5300 Bishop Boulevard, Cheyenne, WY 82009
ICF International, 1725 Eye St NW, Washington DC, 20006
Trihydro Corporation, 1252 Commerce Drive, Laramie, WY 82070
Vital Assurance, 175 S. Third St., Suite 200, Columbus, OH 43215</td><td colspan="2">10. Work Unit No. (TRAIS)</td></tr>
<tr><td colspan="2">11. Contract or Grant No.
DTFH6116H00027</td></tr>
<tr><td colspan="2" rowspan="2">12. Sponsoring Agency Name and Address
U.S Department of Transportation 1200 New Jersey Ave, SE Washington, DC 20590</td><td colspan="2">13. Type of Report and Period Covered
09/01/2016 to 7/30/2018</td></tr>
<tr><td colspan="2">14. Sponsoring Agency Code</td></tr>
<tr><td colspan="4">15. Supplementary Notes
Kate Hartman (COR), Sarah Tarpgaard (CO)</td></tr>
<tr><td colspan="4">16. Abstract
The Wyoming Department of Transportation's (WYDOT) Connected Vehicle (CV) Pilot Deployment Program is intended to develop a suite of applications that utilize vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communication technology to reduce the impact of adverse weather on truck travel in the I-80 corridor. These applications support a flexible range of services from advisories, roadside alerts, parking notifications and dynamic travel guidance. Information from these applications are made available directly to the equipped fleets or through data connections to fleet management centers (who will then communicate it to their trucks using their own systems). The pilot will be conducted in three Phases. Phase 1 includes the planning for the CV pilot including the concept of operations development. Phase 2 is the design, development, and testing phase. Phase 3 includes a real-world demonstration of the applications developed as part of this pilot.

This document presents the template for the CV Pilot System Administration and Availability Test Cases of the Wyoming Department of Transportation (WYDOT) Connected Vehicle (CV) Pilot project as part of the United States Department of Transportation's (USDOT) CV program. These tests are part of the WYDOT CV Pilot Operational Test Plan - Attachment B.</td></tr>
<tr><td colspan="2">17. Key Words
Connected Vehicle Technology, I-80 Corridor, Road Weather, Truck Safety, System Architecture</td><td colspan="2">18. Distribution Statement
This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161</td></tr>
<tr><td>19. Security Classif. (of this report)
None</td><td>20. Security Classif. (of this page)
None</td><td>21. No. of Pages
26</td><td>22. Price
NA</td></tr>
</table>

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

Acknowledgements

The Operational Readiness Plan development team would like to thank USDOT and Noblis for their technical assistance throughout the development of this document.

Table of Contents

1 Introduction 1

1.1 Project Scope 1

1.2 Purpose of this Test 2

2 CV Pilot System Administration and Availability Test Cases 3

2.1 Table WSYSAA-SUM System Administration and Availability Test Case Summary 4

2.2 Table WSYSAA-TP System Administration and Availability Test Procedure 5

2.3 Table WSYSAA-CI System Administration and Availability Test Configuration and Initialization 7

2.4 Table WSYSAA-1-Description WYDOT CV Pilot System Unavailable Notification Test Case Description 10

2.5 Table WSYSAA-1-Results WYDOT CV Pilot System Unavailable Notification 12

2.6 Table WSYSAA-2-Description System Administration Demonstration Test Case Description 13

2.7 Table WSYSAA-2-Results System Administration Demonstration 15

2.8 Table WSYSAA-Requirements System Administration and Availability Test Requirements Verification Analysis 16

List of Tables

Table 2-1. WSYSAA-SUM System Administration and Availability Test Case Summary............... 4
Table 2-2. WSYSAA-TP System Administration and Availability Test Procedure 5
Table 2-3. WSYSAA-CI System Administration and Availability Test Configuration and Initialization 7
Table 2-4. WSYSAA-1-Description WYDOT CV Pilot System Unavailable Notification Test Case 10
Table 2-5. WSYSAA-1-Results WYDOT CV Pilot System Unavailable Notification 12
Table 2-6. WSYSAA-2-Description System Administration Demonstration Test Case 13
Table 2-7. WSYSAA-2-Results System Administration Demonstration 15
Table 2-8. WSYSAA-Requirements System Administration and Availability Test Requirements Verification Analysis 16

1 Introduction

1.1 Project Scope

Wyoming is one of the first wave of CV Pilot sites selected to showcase the value of and spur the adoption of CV technology in the United States. CV technology is a broad term to describe the applications and the systems that leverage dedicated short-range communications (DSRC) for vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I) and infrastructure-to-vehicle (I2V) communication to improve safety, mobility and productivity of the users of the nation's transportation system.

As one of the three selected pilots, WYDOT is focusing on improving safety and mobility by creating new ways to communicate road and travel information to commercial truck drivers and fleet managers along the 402 miles of Interstate 80 (I-80 henceforth) in the State. For the pilot project, WYDOT concluded Phase 1 (planning) in September 2016 and then initiated Phase 2 (deployment) which is scheduled to conclude in mid-2018. This will be followed by an 18-month demonstration period in the third phase.

Systems and applications developed in the pilot will enable drivers of connected vehicles to have improved awareness of potential hazards and of situations they cannot see. At a very high level, the pilot scope includes the following implementation elements:

- **Deploy about 75 roadside units (RSU)** that can receive and broadcast messages using DSRC along various sections on I-80.
- **Equip around 400 vehicles, a combination of fleet vehicles and commercial trucks, with on-board units (OBU).** Of the 400 vehicles, at least 150 are planned to be heavy trucks. All vehicles are expected to be regular users of I-80. Several types of OBUs are being procured as part of the pilot and differ based on their communication capabilities, ability to integrate with the in-vehicle network, and connectivity to ancillary devices and sensors. All OBUs will have the functionality to broadcast Basic Safety Messages (BSM) and will include a human-machine interface (HMI) to share alerts and advisories to drivers of these vehicles.
- **Develop several V2V, V2I, I2V applications** that will enable communication to drivers of alerts and advisories regarding various road conditions. These applications include support for in-vehicle dissemination of advisories for collision avoidance, speed management, detours, parking, and presence of work zones and maintenance and emergency vehicles downstream of their current location.
- **Enable overall improvements in WYDOT's traffic management and traveler information practices** by using data collected from connected vehicles. Targeted improvements include ingesting more location specific mobile road weather information system (RWIS) data, using Pikalert®[1] to provide for more accurate and road segment specific conditions to define better variable speed limits (VSLs), and improving road

[1] Pikalert is a trademark of the University Corporation for Atmospheric Research.

condition dissemination via 511, Dynamic Message Signs (DMS) and other WYDOT sources.

1.2 Purpose of this Test

This document presents the test results of the *CV Pilot System Administration and Availability Test Cases* for the Wyoming Department of Transportation (WYDOT) Connected Vehicle (CV) Pilot project as part of the United States Department of Transportation's (USDOT) CV program. These tests are part of the WYDOT CV Pilot Operational Readiness Test Plan - Attachment B.

The purpose of this document is to describe the results of a sequence of end-to-end tests conducted to validate the successful operation of the system in terms of system administration and availability.

2 CV Pilot System Administration and Availability Test Cases

This chapter describes *Test Procedure ID WSYSAA -- CV Pilot System Administration and Availability Test Procedure and Test Cases*. Table *WSYSAA*-SUM is a high-level summary of the test cases addressed in this test procedure, providing a summary and orientation for the reader. Table *WSYSAA*-TP details the Test Procedure itself. Table *WSYSAA*-CI describes the configuration of each of the WYDOT CV Pilot System components for the Test Procedure and the Initialization to be performed for each prior to conducting the Test Cases. Tables *WSYSAA*-1-Description through *WSYSAA*-2-Description provide the detailed description of Test Cases to be performed under this Test Procedure. Tables *WSYSAA*-1-Results through *WSYSAA*-2-Results capture the results of each repetition of each Test Case. Finally, Table *WSYSAA*-Requirements describes the requirement verification methodology and captures the Test Engineer's confirmation that each requirement is verified. Appendix A of the ORTP provides a list of all system requirements, the test case in which they are verified, and their individual requirements verification methodology.

2.1 Table WSYSAA-SUM System Administration and Availability Test Case Summary

Table 2-1. WSYSAA-SUM System Administration and Availability Test Case Summary

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID	Requirements Verified
WSYSAA-1	WYDOT CV Pilot System Monitoring and Availability	Demonstrate Wyoming CV System availability monitoring and ITS Maintenance team notification.	* Disable or simulate unavailability of Wyoming CV System * Disable or simulate unavailability of Wyoming CV System monitored function. * Disable or simulate unavailability of Wyoming CV System subsystem. * Disable or simulate unavailability of Wyoming CV System external interface. * Simulate disk space under 10% availability	* Wyoming CV System sends alert to the WYDOT ITS Maintenance team within five minutes of a system becoming unavailable.		Compiled in Table WSYSAA-Requirements
WSYSAA-2	System Administration Demonstration Test Case	Demonstration System Administration functionality	* Demonstrate TMC administrator adding equipment to internal inventory list * Demonstrate TMC administrator editing equipment in internal inventory list * Demonstrate TMC administrator deleting equipment in internal	* Inspect the System Logs and verify * Adding equipment to internal inventory list * editing equipment in internal inventory list * deleting equipment in internal inventory list * testing the RSUs by allowing a series of Python testing scripts to		Compiled in Table WSYSAA-Requirements

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID	Requirements Verified
			inventory list * Demonstrate TMC administrator testing the RSUs by allowing a series of Python testing scripts to be run on an RSU and inspecting results of the test returned to the user. * Demonstrate Wyoming CV System provides the TMC administrator the geolocation of all RSUs. * Demonstrate Wyoming CV System provides the TMC administrator the ability to push out updates to the RSU firmware.	be run on an RSU. * the geolocation of all RSUs. * the ability to push out updates to the RSU firmware.		

2.2 Table WSYSAA-TP System Administration and Availability Test Procedure

Table 2-2. WSYSAA-TP System Administration and Availability Test Procedure

Test Procedure ID	WSYSAA	Test Engineer Verification and Remarks
Test Procedure	CV Pilot System Administration and Availability Test Procedure	

Test Procedure ID	WSYSAA	Test Engineer Verification and Remarks
Name		
Test Procedure Completion Date		
Priority	Required	
Objectives	• Demonstrate Wyoming CV System availability monitoring and ITS Maintenance team notification. • Demonstration System Administration functionality	
Relationship to Other Procedures	• Precondition is successful development and integration of the WYDOT CV Pilot System, as described in the SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	
Discussion, Guidance, and Rationales	None at this time	
Test Cases Performed under This Procedure	Test Cases WSYSAA-1 WYDOT CV Pilot System Unavailable Notification and WSYSAA-2 System Administration Demonstration Test Case are to be performed	

2.3 Table WSYSAA-CI System Administration and Availability Test Configuration and Initialization

Table 2-3. WSYSAA-CI System Administration and Availability Test Configuration and Initialization

System Component	Applicable Test Procedures and Cases	Configuration for System Administration and Availability Test Procedure and Test Cases	Initialization for System Administration and Availability Test Procedure and Test Cases	Test Engineer Verification and Remarks
Back office Component with Representative TIM	All WSYSAA Test Cases	“Representative” TIM is defined as an example TIM whose successful test result indicates conducting this test case with other I2V SA TIMs is also likely to be successful. This TIM is selected empirically, by developers and test engineers. This TIM message is used when it is not necessary or efficient to repeat all message types from each back office component.	• Prepare applicable back office component inputs for Representative TIM • Formulate and document back office component inputs that will generate Representative I2V Message Communication TIM • Formulate and document back office component inputs (manual and computer input file) for distribution of Representative I2V Message Communication TIM through RSUs via DSRC.	
Data Broker (DB)	All WSYSAA Test Cases	DB fully developed, integrated with WYDOT TMC per SDD and ICD,	• Remove old log files	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for System Administration and Availability Test Procedure and Test Cases	Initialization for System Administration and Availability Test Procedure and Test Cases	Test Engineer Verification and Remarks
		ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Verify DB configuration files are correct for this test set • Download/Copy DB configuration files to Test Case Folder for Test Record • Reinitialize, if practical	
Operational Data Environment (ODE)	All WSYSAA Test Cases	ODE fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Remove old log files • Verify ODE configuration files are correct for this test case • Download/Copy ODE configuration files to Test Case Folder for Test Record • Reinitialize, if practical	*Configuration Verified:* *Initialization Verified:*
Data Warehouse (DW)	All WSYSAA Test Cases	DW fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Verify DW configuration files are correct for this test case • Download/Copy DW configuration files to Test Case Folder for Test Record	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for System Administration and Availability Test Procedure and Test Cases	Initialization for System Administration and Availability Test Procedure and Test Cases	Test Engineer Verification and Remarks
Security Credential Management System (SCMS)	All WSYSAA Test Cases	SCMS fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Verify SCMS configuration files are correct for this test case • Download/Copy SCMS configuration files to Test Case Folder for Test Record	*Configuration Verified:* *Initialization Verified:*
Data Logging	All WSYSAA Test Cases	Data logging for each of the availability components.	• Remove old log files after storage and archival • Initialize Test Log Folder with Unique Test Identifier	*Configuration Verified:* *Initialization Verified:*
External Storage Location for Each Test Set	All WSYSAA Test Cases	Storage location external to the system for backup and archiving of log files and test records.	• Initialize Test Record Folder with Unique Test Identifier	*Configuration Verified:* *Initialization Verified:*
Test Staff	All WSYSAA Test Cases	Test staff trained in what to expect from V2I Applications and practiced in supporting driving scenarios safely and reliably with existing traffic.	• Conduct safety briefing and review danger zones • Verify that Test Staff wear safety vests • Review and practice test scenario, as required to ensure maneuvers can be conducted safely and reliably with existing traffic	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for System Administration and Availability Test Procedure and Test Cases	Initialization for System Administration and Availability Test Procedure and Test Cases	Test Engineer Verification and Remarks
Visitors and Non-Test Staff	All WSYSAA Test Cases	Visitors and Non-Test Staff instructed in what to expect from V2I Applications and informed in observing driving scenarios safely and reliably with existing traffic.	• Review test scenario • Conduct safety briefing and review danger zones	*Configuration Verified:* *Initialization Verified:*

2.4 Table WSYSAA-1-Description WYDOT CV Pilot System Unavailable Notification Test Case Description

Table 2-4. WSYSAA-1-Description WYDOT CV Pilot System Unavailable Notification Test Case

Test Case ID	WSYSAA-1	Test Engineer Verification and Remarks
Test Case Name	WYDOT CV Pilot System Unavailable Notification	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WSYSAA-Requirements	

Test Case ID	WSYSAA-1	Test Engineer Verification and Remarks
Objectives	• Demonstrate Wyoming CV System availability monitoring and ITS Maintenance team notification. • Demonstrate Wyoming CV System function monitoring and notification capability • Demonstrate Wyoming CV System Subsystem monitoring and notification capability • Demonstrate Wyoming CV System external interface monitoring and notification capability • Demonstrate Wyoming CV System data storage monitoring and notification capability	
Preconditions	• Verify configuration of each system and test component complies with Configuration for System Administration and Availability Test Procedure and Test Cases described in Table WSYSAA-CI System Administration and Availability Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for System Administration and Availability Test Procedure and Test Cases described in Table WSYSAA-CI System Administration and Availability Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
System Component	Wyoming CV System	
TC Input	• Disable or simulate unavailability of Wyoming CV System • Disable or simulate unavailability of Wyoming CV System monitored function. • Disable or simulate unavailability of Wyoming CV System subsystem. • Disable or simulate unavailability of Wyoming CV System external interface. • Simulate disk space under 10% availability	
TC Output	WYDOT ITS Maintenance team alert received	
Expected Result (Pass/Fail Criteria)	*Wyoming CV System sends alert to the WYDOT ITS Maintenance team within five minutes of a system becoming unavailable.	

Test Case ID	WSYSAA-1	Test Engineer Verification and Remarks
Analysis and Verification Method	*Test staff visual observation followed by inspection and analysis of Wyoming CV System event logs	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* • Disable or simulate unavailability of Wyoming CV System • Disable or simulate unavailability of Wyoming CV System monitored function. • Disable or simulate unavailability of Wyoming CV System subsystem. • Disable or simulate unavailability of Wyoming CV System external interface. • Simulate disk space under 10% availability	

2.5 Table WSYSAA-1-Results WYDOT CV Pilot System Unavailable Notification

Table 2-5. WSYSAA-1-Results WYDOT CV Pilot System Unavailable Notification

Test Case ID	WSYSAA-1	Test Engineer Verification and Remarks
Test Case Name	WYDOT CV Pilot System Unavailable Notification	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*

Test Case ID	WSYSAA-1	Test Engineer Verification and Remarks
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.6 Table WSYSAA-2-Description System Administration Demonstration Test Case Description

Table 2-6. WSYSAA-2-Description System Administration Demonstration Test Case

Test Case ID	WSYSAA-2	Test Engineer Verification and Remarks
Test Case Name	System Administration Demonstration Test Case	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WSYSAA-Requirements	
Objective	Demonstrate System Administration functionality.	

Test Case ID	WSYSAA-2	**Test Engineer Verification and Remarks**
Preconditions	• Verify configuration of each system and test component complies with Configuration for System Administration and Availability Test Procedure and Test Cases described in Table WSYSAA-CI System Administration and Availability Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for System Administration and Availability Test Procedure and Test Cases described in Table WSYSAA-CI System Administration and Availability Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
System Component	Wyoming CV System Administration.	
TC Input	- Demonstrate TMC administrator adding equipment to internal inventory list - Demonstrate TMC administrator editing equipment in internal inventory list - Demonstrate TMC administrator deleting equipment in internal inventory list - Demonstrate TMC administrator testing the RSUs by allowing a series of Python testing scripts to be run on an RSU and inspecting results of the test returned to the user. - Demonstrate Wyoming CV System provides the TMC administrator the geolocation of all RSUs. - Demonstrate Wyoming CV System provides the TMC administrator the ability to push out updates to the RSU firmware.	
TC Output	Wyoming CV System Administration Display and Logs.	
Expected Result (Pass/Fail Criteria)	* System Logs verify - Adding equipment to internal inventory list - editing equipment in internal inventory list - deleting equipment in internal inventory list - testing the RSUs by allowing a series of Python testing scripts to be run on an RSU. - the geolocation of all RSUs. - the ability to push out updates to the RSU firmware.	

Test Case ID	WSYSAA-2	Test Engineer Verification and Remarks
Analysis and Verification Method	*Test staff visual observation followed by inspection and analysis of Wyoming CV System event logs	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* - Demonstrate TMC administrator adding equipment to internal inventory list - Demonstrate TMC administrator editing equipment in internal inventory list - Demonstrate TMC administrator deleting equipment in internal inventory list - Demonstrate TMC administrator testing the RSUs by allowing a series of Python testing scripts to be run on an RSU and inspecting results of the test returned to the user. - Demonstrate Wyoming CV System provides the TMC administrator the geolocation of all RSUs. - Demonstrate Wyoming CV System provides the TMC administrator the ability to push out updates to the RSU firmware.	

2.7 Table WSYSAA-2-Results System Administration Demonstration

Table 2-7. WSYSAA-2-Results System Administration Demonstration

Test Case ID	WSYSAA-2	Test Engineer Verification and Remarks
Test Case Name	System Administration Demonstration	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*

Test Case ID	**WSYSAA-2**	**Test Engineer Verification and Remarks**
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.8 Table WSYSAA-Requirements System Administration and Availability Test Requirements Verification Analysis

Table 2-8. WSYSAA-Requirements System Administration and Availability Test Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WSYSAA-1 -- WYDOT CV Pilot System Monitoring and Availability	WCVS-REQ-16.1 -- Sub-System Availability	The Wyoming CV System shall monitor the Sub-systems for availability of ping services running. The WYDOT maintenance team will be sent a notification after a device, web service or running service is non-responsive for five minutes.	* Perform test Case WSYSAA-1 * Inspect Logs to determine time subsystems were disabled for testing * Inspect Logs to determine time ITS Maintenance Team was notified * Confirm that *Wyoming CV System monitors the Sub-systems for availability of ping services running. *WYDOT maintenance team is sent a notification after a device, web service or running service is non-responsive for five minutes. Thereby verifying the requirement is satisfied	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WSYSAA-1 -- WYDOT CV Pilot System Monitoring and Availability	WCVS-REQ-16.2 -- Sus-System Performance	The Wyoming CV System shall monitor the system's ability to transmit information in a timely manner. This will be done by monitoring message input queues age of oldest entry not processed. If the messages are not processed within five minutes the WYDOT maintenance team will be notified.	* Perform test Case WSYSAA-1 * Inspect Logs to determine system's ability to transmit information in a timely manner * Inspect Logs to determine time ITS Maintenance Team was notified * Confirm that *Wyoming CV System monitors the system's ability to transmit information in a timely manner. This will be done by monitoring message input queues age of oldest entry not processed. *If the messages are not processed within five minutes the WYDOT maintenance team is notified. Thereby verifying the requirement is satisfied	Requirement Verification Confirmed by:
WSYSAA-1 -- WYDOT CV Pilot System Monitoring and Availability	WCVS-REQ-16.3 -- Availability for Interfaces	The Wyoming CV System shall monitor the external interfaces for availability of ping services running. The WYDOT maintenance team will be sent a notification after a device, web service or running service is non-responsive for five minutes.	* Perform test Case WSYSAA-1 * Inspect Logs to confirm the system monitors the external interfaces for availability of ping services running * Inspect Logs to determine time ITS Maintenance Team was notified * Confirm that *Wyoming CV System monitors the external interfaces for availability of ping services running. *WYDOT maintenance team is sent a notification after a device, web service or running service is non-responsive for five minutes. Thereby verifying the requirement is satisfied	Requirement Verification Confirmed by:
WSYSAA-1 -- WYDOT CV Pilot System Monitoring and Availability	WCVS-REQ-16.4 -- Availability for Data Storage	The Wyoming CV System shall monitor available data storage of ping services running. The WYDOT maintenance team will be sent a notification after a device, web service or running service is non-responsive for five minutes. Notification will also be sent for disk space under 10% availability.	* Perform test Case WSYSAA-1 * Inspect Logs to confirm the monitors available data storage of ping services running * Inspect Logs to determine time ITS Maintenance Team was notified * Confirm that *Wyoming CV System monitors available data storage of ping services running. *WYDOT maintenance team is sent a notification after a device, web service or running service is non-responsive for five minutes. *Notification will also be sent for disk space	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			under 10% availability. Thereby verifying the requirement is satisfied	
WSYSAA-1 -- WYDOT CV Pilot System Monitoring and Availability	DW-REQ-1.4 -- Store System Monitoring Data	The Data Warehouse shall store all system monitoring data, as defined in WCVS-REQ-14.	* Perform Test Case WSYSAA-1. * Inspect DW and confirm storage of monitoring data defined in WCVS-REQ-14 by DW. * Confirmation shows Data Warehouse stores all system monitoring data, as defined in WCVS-REQ-14, thereby verifying the requirement is satisfied. (Note: Data written to the Data Warehouse is automatically archived per existing TMC best practices.)	Requirement Verification Confirmed by:
WSYSAA-2 -- System Administration Demonstration Test Case	WCVS-REQ-21 -- Manage CV Equipment	The Wyoming CV System shall provide the TMC administrator the ability to add/edit/delete equipment from the internal inventory list	* Perform Test Case WSYSAA-2 * Inspect the System Logs and confirm * Adding equipment to internal inventory list * Editing equipment in internal inventory list * Deleting equipment in internal inventory list. * Confirmation shows the Wyoming CV System provides the TMC administrator the ability to add/edit/delete equipment from the internal inventory list, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WSYSAA-2 -- System Administration Demonstration Test Case	WCVS-REQ-22 -- Test WCVS Equipment	The Wyoming CV System shall provide the TMC administrator the ability to test the RSUs by allowing a series of Python testing scripts to be run on an RSU and results of the test returned to the user.	* Perform Test Case WSYSAA-2 * Inspect the System Logs and confirm * Testing the RSUs by allowing a series of Python testing scripts to be run on an RSU. * Confirmation shows the Wyoming CV System provides the TMC administrator the ability to test the RSUs by allowing a series of Python testing scripts to be run on an RSU and results of the test returned to the user, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WSYSAA-2 -- System Administration Demonstration Test Case	WCVS-REQ-23 -- Track WCVS Equipment	The Wyoming CV System shall provide the TMC administrator the geolocation of RSUs.	* Perform Test Case WSYSAA-2 * Inspect the System Logs and confirm * The geolocation of all RSUs. * Confirmation shows the Wyoming CV System provide the TMC administrator the geolocation of	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			RSUs, thereby verifying the requirement is satisfied.	
WSYSAA-2 -- System Administration Demonstration Test Case	WCVS-REQ-24 -- Update WCVS Equipment	The Wyoming CV System shall provide the TMC administrator the ability to push out updates to the RSU firmware.	* Perform Test Case WSYSAA-2 * Inspect the System Logs and confirm * The ability to push out updates to the RSU firmware. * Confirmation shows the Wyoming CV System provide the TMC administrator the ability to push out updates to the RSU firmware, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

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FHWA-JPO-17-472B.9

U.S. Department of Transportation

Connected Vehicle Pilot Deployment Program Phase 2

WYDOT CV Pilot – ORTP - External Support Systems Test Cases

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Final Report — July 30, 2018

FHWA-JPO-17-472B.10

U.S. Department of Transportation

Produced by DTFH6116H00027
U.S. Department of Transportation

Notice

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA-JPO-17-472B.10		

4. Title and Subtitle WYDOT CV Pilot – ORTP - External Support Systems Test Cases	**5. Report Date** 7/30/2018 **6. Performing Organization Code**
7. Author(s) Denny Stephens (Vital Assurance), Tony English (Trihydro), Shane Zumpf (Trihydro), Nayel Ureña Serulle (ICF), Deepak Gopalakrishna (ICF), Vince Garcia (Wyoming DOT)	**8. Performing Organization Report No.** Task 2G: Operational Readiness, Test/Demonstration Planning
9. Performing Organization Name and Address Wyoming DOT, 5300 Bishop Boulevard, Cheyenne, WY 82009 ICF International, 1725 Eye St NW, Washington DC, 20006 Trihydro Corporation, 1252 Commerce Drive, Laramie, WY 82070 Vital Assurance, 175 S. Third St., Suite 200, Columbus, OH 43215	**10. Work Unit No. (TRAIS)** **11. Contract or Grant No.** DTFH6116H00027
12. Sponsoring Agency Name and Address U.S Department of Transportation 1200 New Jersey Ave, SE Washington, DC 20590	**13. Type of Report and Period Covered** 09/01/2016 to 6/30/2018 **14. Sponsoring Agency Code**

15. Supplementary Notes
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16. Abstract
The Wyoming Department of Transportation's (WYDOT) Connected Vehicle (CV) Pilot Deployment Program is intended to develop a suite of applications that utilize vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communication technology to reduce the impact of adverse weather on truck travel in the I-80 corridor. These applications support a flexible range of services from advisories, roadside alerts, parking notifications and dynamic travel guidance. Information from these applications are made available directly to the equipped fleets or through data connections to fleet management centers (who will then communicate it to their trucks using their own systems). The pilot will be conducted in three Phases. Phase 1 includes the planning for the CV pilot including the concept of operations development. Phase 2 is the design, development, and testing phase. Phase 3 includes a real-world demonstration of the applications developed as part of this pilot.

This document presents the template for the *External Support Systems Test Cases* for the Wyoming Department of Transportation (WYDOT) Connected Vehicle (CV) Pilot project as part of the United States Department of Transportation's (USDOT) CV program. These tests are part of the WYDOT CV Pilot Operational Test Plan - Attachment B.

17. Key Words	18. Distribution Statement
Connected Vehicle Technology, I-80 Corridor, Road Weather, Truck Safety, System Architecture	This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
None	None	37	NA

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

Acknowledgements

The Operational Readiness Plan development team would like to thank USDOT and Noblis for their technical assistance throughout the development of this document.

Table of Contents

1 Introduction 1

1.1 Project Scope 1

1.2 Purpose of this Test 2

2 External Support Systems Test Cases 3

2.1 Table WEXTSS-SUM External Support Systems Test Case Summary 4

2.2 Table WEXTSS-TP External Support Systems Test Procedure 6

2.3 Table WEXTSS-CI External Support Systems Test Configuration and Initialization 7

2.4 Table WEXTSS-511-Description Truck Parking Information Entry and Delivery Test Case Description 12

2.5 Table WEXTSS-511-Results Truck Parking Information Entry and Delivery Test Case Results 13

2.6 Table WEXTSS-CAM-Description Pikalert Camera Imagery Test Case Description ... 14

2.7 Table WEXTSS- CAM-Results Pikalert Camera Imagery Test Case Results 16

2.8 Table WEXTSS-SCMSCRL-Description WYDOT CV System and Vehicle System Misbehavior and CRL support Test Case Description 17

2.9 Table WEXTSS- SCMSCRL-Results WYDOT CV System Misbehavior and CRL Support Test Case Results 20

2.10 Table WEXTSS-OTA-Description OBU Over the Air Updates Test Case Description . 21

2.11 Table WEXTSS- OTA-Results OBU Over the Air Updates Test Case Results 22

2.12 Table WEXTSS-RSUFIRM-Description RSU Firmware Update Test Case Description23

2.13 Table WEXTSS- WEXTSS-RSUFIRM-Description RSU Firmware Update Test Case Results 25

2.14 Table WEXTSS-Requirements External Support Systems Post Test Requirements Verification Analysis 26

List of Tables

Table 2-1. WEXTSS-SUM External Support Systems Test Case Summary 4
Table 2-2. WEXTSS-TP External Support Systems Test Procedure 6
Table 2-3. WEXTSS-CI External Support Systems Test Configuration and Initialization 7
Table 2-4. WEXTSS-511-Description Truck Parking Information Entry and Delivery Test Case Description 12
Table 2-5. WEXTSS-511-Results Truck Parking Information Entry and Delivery Test Case Results 13
Table 2-6. WEXTSS-CAM-Description Pikalert Camera Imagery Test Case Description 14
Table 2-7. WEXTSS- CAM-Results Pikalert Camera Imagery Test Case Results 16
Table 2-8. WEXTSS-SCMSCRL-Description WYDOT CV System and Vehicle System Misbehavior and CRL support Test Case Description 17
Table 2-9. WEXTSS- SCMSCRL-Results WYDOT CV System Misbehavior and CRL Support Test Case Results 20
Table 2-10. WEXTSS-OTA-Description OBU Over the Air Updates Test Case Description 21
Table 2-11. WEXTSS- OTA-Results OBU Over the Air Updates Test Case Results 22
Table 2-12. WEXTSS-RSUFIRM-Description RSU Firmware Update Test Case Description 23
Table 2-13. WEXTSS- WEXTSS-RSUFIRM-Description RSU Firmware Update Test Case Results 25
Table 2-14. WEXTSS-Requirements External Support Systems Post Test Requirements Verification Analysis 26

1 Introduction

1.1 Project Scope

Wyoming is one of the first wave of CV Pilot sites selected to showcase the value of and spur the adoption of CV technology in the United States. CV technology is a broad term to describe the applications and the systems that leverage dedicated short-range communications (DSRC) for vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I) and infrastructure-to-vehicle (I2V) communication to improve safety, mobility and productivity of the users of the nation's transportation system.

As one of the three selected pilots, WYDOT is focusing on improving safety and mobility by creating new ways to communicate road and travel information to commercial truck drivers and fleet managers along the 402 miles of Interstate 80 (I-80 henceforth) in the State. For the pilot project, WYDOT concluded Phase 1 (planning) in September 2016 and then initiated Phase 2 (deployment) which is scheduled to conclude in mid-2018. This will be followed by an 18-month demonstration period in the third phase.

Systems and applications developed in the pilot will enable drivers of connected vehicles to have improved awareness of potential hazards and of situations they cannot see. At a very high level, the pilot scope includes the following implementation elements:

- **Deploy about 75 roadside units (RSU)** that can receive and broadcast messages using DSRC along various sections on I-80.
- **Equip around 400 vehicles, a combination of fleet vehicles and commercial trucks, with on-board units (OBU).** Of the 400 vehicles, at least 150 are planned to be heavy trucks. All vehicles are expected to be regular users of I-80. Several types of OBUs are being procured as part of the pilot and differ based on their communication capabilities, ability to integrate with the in-vehicle network, and connectivity to ancillary devices and sensors. All OBUs will have the functionality to broadcast Basic Safety Messages (BSM) and will include a human-machine interface (HMI) to share alerts and advisories to drivers of these vehicles.
- **Develop several V2V, V2I, I2V applications** that will enable communication to drivers of alerts and advisories regarding various road conditions. These applications include support for in-vehicle dissemination of advisories for collision avoidance, speed management, detours, parking, and presence of work zones and maintenance and emergency vehicles downstream of their current location.
- **Enable overall improvements in WYDOT's traffic management and traveler information practices** by using data collected from connected vehicles. Targeted improvements include ingesting more location specific mobile road weather information system (RWIS) data, using Pikalert®[1] to provide for more accurate and road segment specific conditions to define better variable speed limits (VSLs), and improving road

[1] Pikalert is a trademark of the University Corporation for Atmospheric Research.

condition dissemination via 511, Dynamic Message Signs (DMS) and other WYDOT sources.

1.2 Purpose of this Test

This document presents the *External Support Systems Test Cases* for the Wyoming Department of Transportation (WYDOT) Connected Vehicle (CV) Pilot project as part of the United States Department of Transportation's (USDOT) CV program. These test cases are part of the WYDOT CV Pilot Operational Test Plan - Attachment B.

The purpose of this document is to describe the sequence of end-to-end tests to be conducted to validate the successful operation of the system in terms of external support.

2 External Support Systems Test Cases

This chapter describes Test Procedure ID WEXTSS -- External Support Systems Test Procedures and Test Cases. Table WEXTSS-SUM is a high-level summary of the test cases addressed in this test procedure, providing a summary and orientation for the reader. Table WEXTSS-TP details the Test Procedure itself. Table WEXTSS-CI describes the configuration of each of the WYDOT CV Pilot System components for the Test Procedure and the Initialization to be performed for each prior to conducting the Test Cases. Tables WEXTSS-511-Description through WEXTSS- RSUFIRM-Description provide the detailed description of Test Cases to be performed under this Test Procedure. Tables WEXTSS-511-Results through WEXTSS-RSUFIRM-Results capture the results of each repetition of each Test Case. Finally, Table WEXTSS-Requirements describes the requirement verification methodology and capture the Test Engineer's confirmation that each requirement is verified. Appendix A of the ORPT provides a list of all system requirements, the test case in which they are verified, and their individual requirements verification methodology.

2.1 Table WEXTSS-SUM External Support Systems Test Case Summary

Table 2-1. WEXTSS-SUM External Support Systems Test Case Summary

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID	Requirements Verified
WEXTSS-511	Truck Parking Information Entry and Delivery	Verify the accurate capture and dissemination of truck parking information via the WYDOT 511 App.	* Driver in host vehicle located at a truck parking area enters truck parking status.	* Driver in remote vehicle located upstream of parking area receives correct truck parking status within 15 minutes of entry by host vehicle driver.		Compiled in Table WEXTSS-Requirements
WEXTSS-CAM	Pikalert Camera Imagery	Demonstrate Pikalert receives camera imagery from the TMC File Transfer Protocol (FTP) server	* Demonstrate Pikalert Web Interface.	* Pikalert Web Interface displays camera imagery.		Compiled in Table WEXTSS-Requirements
WEXTSS-SCMSCRL	WYDOT CV System Misbehavior and CRL support	Verify Wyoming CV System misbehavior reporting and CRL support. (*Note Misbehavior Report and CRL not currently supported by SCMS)	* Remote Vehicle system simulates misbehavior sufficient to be placed on CRL. * Wyoming CV System detects misbehavior and sends report to the USDOT SCMS * Host Vehicle detects misbehavior and sends report to the USDOT SCMS * Wyoming CV System downloads CRL from USDOT SCMS	* Wyoming CV System detects misbehavior by Remote Vehicle * Wyoming CV System sends misbehavior reports to the USDOT SCMS within 24 hours after detection * Wyoming CV System downloads the CRL from the USDOT SCMS * Wyoming CV System rejects messages received from Remote Vehicle on the current		Compiled in Table WEXTSS-Requirements

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID	Requirements Verified
			* Host Vehicle downloads CRL from USDOT SCMS * Wyoming CV System rejects message from Remote Vehicle on CRL * Host Vehicle rejects message from Remote Vehicle on CRL	CRL. * Host Vehicle detects misbehavior by Remote Vehicle * Host Vehicle detects sends misbehavior reports to the USDOT SCMS * Host Vehicle detects downloads the CRL from the USDOT SCMS * Host Vehicle detects rejects messages received from Remote Vehicle on the current CRL.		
WEXTSS-OTA	OBU over the air updates	Verify OBU Over the Air Update	* Perform an OBU over the air update.	* Vehicle System receives and successfully performs update. * OTA requirements are satisfied.		Compiled in Table WEXTSS-Requirements
WEXTSS-RSUFIRM	RSU Firmware update	Verify RSU firmware update initiated by the TMC administrator.	* Perform an RSU firmware update initiated by the TMC administrator.	* RSU receives and successfully performs update. * Firmware update requirements are satisfied.		Compiled in Table WEXTSS-Requirements

2.2 Table WEXTSS-TP External Support Systems Test Procedure

Table 2-2. WEXTSS-TP External Support Systems Test Procedure

Test Procedure ID	**WEXTSS**	**Test Engineer Verification and Remarks**
Test Procedure Name	External Support Systems Test Procedure	
Test Procedure Completion Date		
Priority	Required	
Objectives	• Confirm WYDOT CV Systems integration with external support systems, including ○ Verify the accurate capture and dissemination of truck parking information via the WYDOT 511 App. ○ Demonstrate Pikalert receives camera imagery from the TMC File Transfer Protocol (FTP) server ○ Verify Wyoming CV System and Vehicle misbehavior reporting and CRL support. ○ Verify OBU Over the Air Update ○ Verify RSU firmware update initiated by the TMC administrator.	
Relationship to Other Procedures	• Precondition is successful development and integration of the WYDOT CV Pilot System, as described in the SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	
Discussion, Guidance, and Rationales		

Test Procedure ID	WEXTSS	Test Engineer Verification and Remarks
Test Cases Performed under This Procedure	The following Test Cases are to be performed under this test procedure: • WEXTSS-511 - Truck Parking Information Entry and Delivery • WEXTSS-CAM - Pikalert Camera Imagery • WEXTSS-SCMSCRL - WYDOT CV System and Vehicle System Misbehavior and CRL support • WEXTSS-OTA - OBU over the air updates • WEXTSS-RSUFIRM - RSU Firmware update	

2.3 Table WEXTSS-CI External Support Systems Test Configuration and Initialization

Table 2-3. WEXTSS-CI External Support Systems Test Configuration and Initialization

System Component	Applicable Test Procedures and Cases	Configuration for External Support Systems Test Procedure and Test Cases	Initialization for External Support Systems Test Procedure and Test Cases	Test Engineer Verification and Remarks
WYDOT 511 System	WEXTSS-511	511 System fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Remove old log files • Verify system configuration files are correct for this test set • Download/Copy 511 system configuration files to Test Case Folder for Test Record • Reinitialize, if practical	*Configuration Verified:* *Initialization Verified:*
Data Broker (DB)	All WEXTSS Test Cases	DB fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production	• Remove old log files • Verify DB configuration files are correct for this test set	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for External Support Systems Test Procedure and Test Cases	Initialization for External Support Systems Test Procedure and Test Cases	Test Engineer Verification and Remarks
		deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Download/Copy DB configuration files to Test Case Folder for Test Record • Reinitialize, if practical	
Operational Data Environment (ODE)	All WEXTSS Test Cases	ODE fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Remove old log files • Verify ODE configuration files are correct for this test case • Download/Copy ODE configuration files to Test Case Folder for Test Record • Reinitialize, if practical	*Configuration Verified:* *Initialization Verified:*
Data Warehouse (DW)	All WEXTSS Test Cases	DW fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Verify DW configuration files are correct for this test case • Download/Copy DW configuration files to Test Case Folder for Test Record	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for External Support Systems Test Procedure and Test Cases	Initialization for External Support Systems Test Procedure and Test Cases	Test Engineer Verification and Remarks
Security Credential Management System (SCMS)	All WEXTSS Test Cases	SCMS fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Verify SCMS configuration files are correct for this test case • Download/Copy SCMS configuration files to Test Case Folder for Test Record	*Configuration Verified:* *Initialization Verified:*
RSU(s)	WEXTSS-RSUFIRM	One RSU fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	• Remove old log files • Verify RSU configuration files are correct for this test case • Download/Copy RSU configuration files to Test Case Folder for Test Record • Reboot RSU, if practical	*Configuration Verified:* *Initialization Verified:*
Lear Roadstar OBU	WEXTSS-SCMSCRL WEXTSS-OTA	Lear Roadstar OBU with antenna configuration planned for deployment and HMI fully developed, integrated with vehicle and CAN interface per SDD and ICD, ready for production deployment. May be tested with development environment	• Remove old log files • Initialize log file folders for this Test Case with Unique Identifier • Verify OBU and HMI configuration files are correct for this test case • Download/Copy OBU and HMI configuration	

System Component	Applicable Test Procedures and Cases	Configuration for External Support Systems Test Procedure and Test Cases	Initialization for External Support Systems Test Procedure and Test Cases	Test Engineer Verification and Remarks
		or production environment, as long as it is ready for production deployment.	files to Test Case Folder for Test Record	
SiriusXM OBU	WEXTSS-SCMSCRL WEXTSS-OTA	SiriusXM OBU with antenna configuration planned for deployment and HMI fully developed, integrated with vehicle and CAN interface per SDD and ICD, ready for production deployment. May be tested with development environment or production environment, as long as it is ready for production deployment.	• Remove old log files • Initialize log file folders for this Test Case with Unique Identifier • Verify OBU and HMI configuration files are correct for this test case • Download/Copy OBU and HMI configuration files to Test Case Folder for Test Record	
Data Logging	All WEXTSS Test Cases	Data logging for each of the availability components.	• Remove old log files after storage and archival • Initialize Test Log Folder with Unique Test Identifier	*Configuration Verified:* *Initialization Verified:*
External Storage Location for Each Test Set	All WEXTSS Test Cases	Storage location external to the system for backup and archiving of log files and test records.	• Initialize Test Record Folder with Unique Test Identifier	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for External Support Systems Test Procedure and Test Cases	Initialization for External Support Systems Test Procedure and Test Cases	Test Engineer Verification and Remarks
Test Staff	All WEXTSS Test Cases	Test staff trained in what to expect from applications and practiced in supporting driving scenarios safely and reliably with existing traffic.	• Conduct safety briefing and review danger zones • Verify that Test Staff wear safety vests • Review and practice test scenario, as required to ensure maneuvers can be conducted safely and reliably with existing traffic	*Configuration Verified:* *Initialization Verified:*
Visitors and Non-Test Staff	All WEXTSS Test Cases	Visitors and Non-Test Staff instructed in what to expect from applications and informed in observing driving scenarios safely and reliably with existing traffic.	• Review test scenario • Conduct safety briefing and review danger zones	*Configuration Verified:* *Initialization Verified:*

2.4 Table WEXTSS-511-Description Truck Parking Information Entry and Delivery Test Case Description

Table 2-4. WEXTSS-511-Description Truck Parking Information Entry and Delivery Test Case Description

Test Case ID	WEXTSS-511	**Test Engineer Verification and Remarks**
Test Case Name	Truck Parking Information Entry and Delivery	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WEXTSS-Requirements	
Objective	Verify the accurate capture and dissemination of truck parking information via the WYDOT 511 App.	
Preconditions	• Successful update of WYDOT 511 Application to include truck parking information. • Compliments WI2VSAT-1-511 -- Message Display in Travel Lanes – 511 • Verify configuration of each system and test component complies with Configuration for System Administration and Availability Test Procedure and Test Cases described in Table WSYSAA-CI System Administration and Availability Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for System Administration and Availability Test Procedure and Test Cases described in Table WSYSAA-CI System Administration and Availability Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	WYDOT 511 System	

Test Case ID	WEXTSS-511	Test Engineer Verification and Remarks
TIM	NA – Smart Phone Application Test Case	
Host Vehicle OBU/ Vehicle	NA – Smart Phone Application Test Case	
Host Vehicle Driving Scenario (TC Input 2)	Driver in host vehicle located at a truck parking area enters truck parking status in Smart Phone WYDOT 511 Application.	
Driver Advisory/ Warning Displayed (TC Output)	Driver in remote vehicle located upstream of parking area receives correct truck parking status.	
Expected Result (Pass/Fail Criteria)	* Driver in remote vehicle located upstream of parking area receives correct truck parking status within 15 minutes of entry by host vehicle driver.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* Driver in host vehicle located at a truck parking area enters truck parking status in Smart Phone WYDOT 511 Application.	

2.5 Table WEXTSS-511-Results Truck Parking Information Entry and Delivery Test Case Results

Table 2-5. WEXTSS-511-Results Truck Parking Information Entry and Delivery Test Case Results

Test Case ID	WEXTSS-511	Test Engineer Verification and Remarks
Test Case Name	Truck Parking Information Entry and Delivery	*Performed and Confirmed by:*

Test Case ID	WEXTSS-511	Test Engineer Verification and Remarks
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.6 Table WEXTSS-CAM-Description Pikalert Camera Imagery Test Case Description

Table 2-6. WEXTSS-CAM-Description Pikalert Camera Imagery Test Case Description

Test Case ID	WEXTSS-CAM	Test Engineer Verification and Remarks
Test Case Name	Pikalert Camera Imagery	
Test Case Completion Date		

Test Case ID	WEXTSS-CAM	Test Engineer Verification and Remarks
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WEXTSS-Requirements	
Objective	Demonstrate Pikalert receives camera imagery from the TMC File Transfer Protocol (FTP) server.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for System Administration and Availability Test Procedure and Test Cases described in Table WSYSAA-CI System Administration and Availability Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for System Administration and Availability Test Procedure and Test Cases described in Table WSYSAA-CI System Administration and Availability Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	Pikalert – Web Interface	
Input Scenario (TC Input)	Demonstrate Pikalert Web Interface.	
Information Displayed (TC Output)	Pikalert Web Interface displays camera imagery.	
Expected Result (Pass/Fail Criteria)	* Pikalert Web Interface displays camera imagery.	
Detailed Execution Steps	* *The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.*	

Test Case ID	WEXTSS-CAM	Test Engineer Verification and Remarks
	* Demonstrate Pikalert Web Interface	

2.7 Table WEXTSS- CAM-Results Pikalert Camera Imagery Test Case Results

Table 2-7. WEXTSS- CAM-Results Pikalert Camera Imagery Test Case Results

Test Case ID	WEXTSS-CAM	Test Engineer Verification and Remarks
Test Case Name	Pikalert Camera Imagery	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.8 Table WEXTSS-SCMSCRL-Description WYDOT CV System and Vehicle System Misbehavior and CRL support Test Case Description

Table 2-8. WEXTSS-SCMSCRL-Description WYDOT CV System and Vehicle System Misbehavior and CRL support Test Case Description

Test Case ID	**WEXTSS-SCMSCRL**	**Test Engineer Verification and Remarks**
Test Case Name	WYDOT CV System and Vehicle System Misbehavior and CRL support	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WEXTSS-Requirements	
Objective	Verify Wyoming CV System and vehicle misbehavior reporting and CRL support.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for System Administration and Availability Test Procedure and Test Cases described in Table WSYSAA-CI System Administration and Availability Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for System Administration and Availability Test Procedure and Test Cases described in Table WSYSAA-CI System Administration and Availability Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	USDOT SCMS	

Test Case ID	**WEXTSS-SCMSCRL**	**Test Engineer Verification and Remarks**
TIM	CRL	
Host Vehicle OBU/ Vehicle	• Lear Roadstar OBU • SiriusXM OBU	
Remote Vehicle OBU/ Vehicle	Any OBU	
Remote Vehicle Scenario (Test Case Input 1)	• Remote Vehicle system simulates misbehavior sufficient to be placed on CRL. • Remote vehicle enters track/roadway, passes RSU broadcasting BSMs, then approaches and stops at designated test location. • After Host Vehicle rejects message from Remote Vehicle, Remote Vehicle passes RSU again, uploading BSMs.	
Host Vehicle Driving Scenario (TC Input 2)	• Host vehicle enters track/roadway from outside communication range. Host Vehicle approaches stopped remote vehicle at 35 mph. After receiving FCW Advisory (Level 1) and FCW Imminent Alert (Level 2), driver stops or veers to clear adjacent lane and proceeds past stopped vehicle. • Host Vehicle detects misbehavior and sends report to the USDOT SCMS • Host Vehicle downloads CRL from USDOT SCMS • Host vehicle enters track/roadway from outside communication range. Host Vehicle approaches stopped remote vehicle at 35 mph. • Host Vehicle rejects message from Remote Vehicle on CRL and does not issue FCW Advisory (Level 1) or FCW Imminent Alert (Level 2).	
Wyoming CV System/SCMS	• Wyoming CV System detects Remote Vehicle misbehavior during first RSU encounter and sends report to the USDOT SCMS • Wyoming CV System downloads CRL from USDOT SCMS • During second Remote Vehicle encounter, Wyoming CV System rejects message from Remote Vehicle on CRL.	
Driver Advisory/ Warning Displayed (TC Output)	SCMS log notification.	

Test Case ID	**WEXTSS-SCMSCRL**	**Test Engineer Verification and Remarks**
Expected Result (Pass/Fail Criteria)	• Wyoming CV System detects misbehavior by Remote Vehicle • Wyoming CV System sends misbehavior reports to the USDOT SCMS within 24 hours after detection • Wyoming CV System downloads the CRL from the USDOT SCMS • Wyoming CV System rejects messages received from Remote Vehicle on the current CRL. • Host Vehicle detects misbehavior by Remote Vehicle • Host Vehicle detects sends misbehavior reports to the USDOT SCMS • Host Vehicle detects downloads the CRL from the USDOT SCMS • Host Vehicle detects rejects messages received from Remote Vehicle on the current CRL.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* • Remote Vehicle system simulates misbehavior sufficient to be placed on CRL. • Wyoming CV System detects misbehavior and sends report to the USDOT SCMS • Host Vehicle detects misbehavior and sends report to the USDOT SCMS • Wyoming CV System downloads CRL from USDOT SCMS • Host Vehicle downloads CRL from USDOT SCMS • Wyoming CV System rejects message from Remote Vehicle on CRL • Host Vehicle rejects message from Remote Vehicle on CRL	

2.9 Table WEXTSS- SCMSCRL-Results WYDOT CV System Misbehavior and CRL Support Test Case Results

Table 2-9. WEXTSS- SCMSCRL-Results WYDOT CV System Misbehavior and CRL Support Test Case Results

Test Case ID	WEXTSS-	Test Engineer Verification and Remarks
Test Case Name	WEXTSS-SCMSCRL	*Performed and Confirmed by:*
Test Case Completion Date	WYDOT CV System and Vehicle System Misbehavior and CRL support	*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.10 Table WEXTSS-OTA-Description OBU Over the Air Updates Test Case Description

Table 2-10. WEXTSS-OTA-Description OBU Over the Air Updates Test Case Description

Test Case ID	WEXTSS-OTA	Test Engineer Verification and Remarks
Test Case Name	OBU Over the Air Updates	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WEXTSS-Requirements	
Objective	Verify OBU Over the Air Update.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for System Administration and Availability Test Procedure and Test Cases described in Table WSYSAA-CI System Administration and Availability Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for System Administration and Availability Test Procedure and Test Cases described in Table WSYSAA-CI System Administration and Availability Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	FTP upload to ODE	
TIM/Data Files	CRL	

Test Case ID	WEXTSS-OTA	Test Engineer Verification and Remarks
Host Vehicle OBU/ Vehicle	Lear Roadstar OBU	
TC Input	Perform an OBU over the air update according to vendor instructions.	
TC Output	Vehicle System receives and successfully performs update.	
Expected Result (Pass/Fail Criteria)	Vehicle System receives and successfully performs update.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* • Perform an OBU over the air update according to vendor instructions.	

2.11 Table WEXTSS- OTA-Results OBU Over the Air Updates Test Case Results

Table 2-11. WEXTSS- OTA-Results OBU Over the Air Updates Test Case Results

Test Case ID	WEXTSS-	Test Engineer Verification and Remarks
Test Case Name	WEXTSS-OTA	*Performed and Confirmed by:*
Test Case Completion Date	OBU Over the Air Updates	*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*

Test Case ID	WEXTSS-	Test Engineer Verification and Remarks
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.12 Table WEXTSS-RSUFIRM-Description RSU Firmware Update Test Case Description

Table 2-12. WEXTSS-RSUFIRM-Description RSU Firmware Update Test Case Description

Test Case ID	WEXTSS-RSUFIRM	Test Engineer Verification and Remarks
Test Case Name	RSU Firmware update.	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WEXTSS-Requirements	

Test Case ID	WEXTSS-RSUFIRM	Test Engineer Verification and Remarks
Objective	Verify RSU firmware update initiated by the TMC administrator.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for System Administration and Availability Test Procedure and Test Cases described in Table WSYSAA-CI System Administration and Availability Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for System Administration and Availability Test Procedure and Test Cases described in Table WSYSAA-CI System Administration and Availability Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	FTP upload to ODE.	
TIM/Data Files	RSU Firmware	
Host Vehicle OBU/ Vehicle	NA	
TC Input	Perform an RSU firmware update initiated by the TMC administrator.	
TC Output	RSU receives and successfully performs update.	
Expected Result (Pass/Fail Criteria)	RSU receives and successfully performs update.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* • Perform an RSU firmware update initiated by the TMC administrator.	

2.13 Table WEXTSS- WEXTSS-RSUFIRM-Description RSU Firmware Update Test Case Results

Table 2-13. WEXTSS- WEXTSS-RSUFIRM-Description RSU Firmware Update Test Case Results

Test Case ID	**WEXTSS-RSUFIRM**	**Test Engineer Verification and Remarks**
Test Case Name	RSU Firmware update.	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Repetition 2 Results		*Performed and Confirmed by:*
Test Case Repetition 3 Results		*Performed and Confirmed by:*
Test Case Repetition 4 Results		*Performed and Confirmed by:*
Test Case Repetition 5 Results*		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

*If 4 out of 5 Test Case Repetition Results meet the pass/fail criteria, additional lines are to be added to the table to report the results of Test Case Repetitions 6 through 10.

2.14 Table WEXTSS-Requirements External Support Systems Post Test Requirements Verification Analysis

Table 2-14. WEXTSS-Requirements External Support Systems Post Test Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WEXTSS-511 -- Truck Parking Information Entry and Delivery	511-REQ-1.1 -- Availability	The Wyoming CV System shall categorize parking availability for the facility of interest as follows: i) Full – No parking availability, ii) Spaces available, or iii) Only a few spaces available.	* Perform Test Case WEXTSS-511 * Inspect DB Logs * Locate 1 or more instances of receipt of Parking Status Updates from the WYDOT 511 App (via WYDOT 511 System) * Confirm parking status updates show Full or Available * Confirmation shows the Wyoming CV System categorizes parking availability for the facility of interest as follows: i) Full – No parking availability or ii) Available – Parking is available at this location, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WEXTSS-511 -- Truck Parking Information Entry and Delivery	511-REQ-1.2 -- Default	The Wyoming CV System shall set parking availability default to available if not provided.	* Perform Test Case WEXTSS-511 * Inspect DB Logs * Locate 1 or more instances of receipt of Parking Status Updates from the WYDOT 511 App (via WYDOT 511 System) * For case where driver does not enter parking availability, confirm parking status	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			updates show "Available". * Confirmation shows The Wyoming CV System sets parking availability default to available if not provided, thereby verifying the requirement is satisfied.	
WEXTSS-511 -- Truck Parking Information Entry and Delivery	511-REQ-1.3 -- Time	The Wyoming CV System shall timestamp parking availability reports.	* Perform Test Case WEXTSS-511 * Inspect DB Logs * Locate 1 or more instances of receipt of Parking Status Updates from the WYDOT 511 App (via WYDOT 511 System) * Confirm each instance is timestamped. * Confirmation shows the Wyoming CV System timestamps parking availability reports, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WEXTSS-511 -- Truck Parking Information Entry and Delivery	511-REQ-1.4 -- Location	The Wyoming CV System shall associate parking availability with a parking facility on I-80.	* Perform Test Case WEXTSS-511 * Inspect DB Logs * Locate 1 or more instances of receipt of Parking Status Updates from the WYDOT 511 App (via WYDOT 511 System) * Confirm each instance is associated with a parking facility on I-80. * Confirmation shows the Wyoming CV System associates parking availability with a parking facility on I-80,	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			thereby verifying the requirement is satisfied.	
WEXTSS-511 -- Truck Parking Information Entry and Delivery	511-REQ-1.5 -- Protocol	The Wyoming CV System shall receive information, based on HTTP protocol, from the 511App.	* Perform Test Case WEXTSS-511 * Inspect DB Logs * Locate 1 or more instances of receipt of Parking Status Updates from the WYDOT 511 App (via WYDOT 511 System) * Inspect 511 logs and verify HTTP Protocol * Confirmation shows the Wyoming CV System receives information, based on HTTP protocol, from the 511App, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WEXTSS-511 -- Truck Parking Information Entry and Delivery	511-REQ-1.6 -- Schema	The Wyoming CV System shall receive information based on the parking schema defined by WYDOT (WYDOT Truck Parking Map – as of 07/2016).	* Perform Test Case WEXTSS-511 * Inspect DB Logs * Locate 1 or more instances of receipt of Parking Status Updates from the WYDOT 511 App (via WYDOT 511 System) * Inspect WYDOT Truck Parking Map and confirm information received is based upon parking schema defined by WYDOT Truck Parking Map. * Confirmation shows the Wyoming CV System receives information based on the parking schema defined by WYDOT (WYDOT Truck Parking Map – as of	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			07/2016), thereby verifying the requirement is satisfied.	
WEXTSS-511 -- Truck Parking Information Entry and Delivery	511-REQ-2 -- Timeframe	The Wyoming CV System shall receive Parking availability data from the WYDOT 511 application within thirty minutes of generation.	* Perform Test Case WEXTSS-511 * Inspect DB Logs * Locate 1 or more instances of receipt of Parking Status Updates from the WYDOT 511 App (via WYDOT 511 System) * Verify each instance is timestamped when sent. * Verify each instance is timestamped when received by DB. * Confirm parking availability data is received within 30 minutes of generation. * Confirmation shows the Wyoming CV System receives Parking availability data from the WYDOT 511 application within thirty minutes of generation, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WEXTSS-CAM -- Pikalert Camera Imagery	PA-REQ-2.2 -- TMC Data	The Pikalert System shall receive camera imagery from the TMC File Transfer Protocol (FTP) server as described in Section 5.26.1 of the ICD.	* Perform Test Case WEXTSS-CAM. * Inspect Pikalert logs * Confirm retrieval of camera images from TMC and DB via FTP. * Confirmation shows the Pikalert System receives camera imagery from the TMC File Transfer Protocol (FTP) server as described in Section 5.26.1 of the ICD,	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			thereby verifying the requirement is satisfied.	
WEXTSS-SCMSCRL -- WYDOT CV System and Vehicle System Misbehavior and CRL support	SCMS-REQ-1.2 -- SCMS Wyoming CV System Misbehavior Reporting	The Wyoming CV System shall send misbehavior reports after they are published to the USDOT SCMS within 24 hours.	* Perform Test Case WEXTSS-SCMSCRL * Inspect Wyoming CV System SCMS Logs * Confirm Wyoming CV System detects misbehavior by Remote Vehicle * Confirm Wyoming CV System sends misbehavior reports to the USDOT SCMS within 24 hours after detection, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WEXTSS-SCMSCRL -- WYDOT CV System and Vehicle System Misbehavior and CRL support	SCMS-REQ-1.3 -- SCMS Wyoming CV System Certificates Revocation List (CRL)	The Wyoming CV System shall download the CRL from the USDOT SCMS.	* Perform Test Case WEXTSS-SCMSCRL * Inspect Wyoming CV System SCMS Logs * Confirm Wyoming CV System downloads the CRL from the USDOT SCMS, thereby verifying the requirement is satisfied	Requirement Verification Confirmed by:
WEXTSS-SCMSCRL -- WYDOT CV System and Vehicle System Misbehavior and CRL support	SCMS-REQ-1.4 -- SCMS Wyoming CV System Rejection	The Wyoming CV System shall reject messages received from any vehicles on the current CRL.	* Perform Test Case WEXTSS-SCMSCRL * Inspect Wyoming CV System SCMS Logs * Confirm Wyoming CV System rejects messages received from Remote Vehicle on the current CRL, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WEXTSS-SCMSCRL -- WYDOT CV System and Vehicle System Misbehavior and CRL support	SCMS-REQ-2.2 -- SCMS Vehicle System Misbehavior Reporting	The Vehicle System shall send misbehavior reports after they are defined to the USDOT SCMS	* Perform Test Case WEXTSS-SCMSCRL * Inspect Vehicle System SCMS Logs * Confirm Vehicle System	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			detects misbehavior by Remote Vehicle * Confirm Vehicle System sends misbehavior reports to the USDOT SCMS, thereby verifying the requirement is satisfied.	
WEXTSS-SCMSCRL -- WYDOT CV System and Vehicle System Misbehavior and CRL support	SCMS-REQ-2.3 -- SCMS Vehicle System Certificates Revocation List (CRL)	The Vehicle System shall download and utilize the CRL from the USDOT SCMS.	* Perform Test Case WEXTSS-SCMSCRL * Inspect Vehicle System SCMS Logs * Confirm Vehicle System downloads the CRL from the USDOT SCMS, thereby verifying the requirement is satisfied	Requirement Verification Confirmed by:
WEXTSS-SCMSCRL -- WYDOT CV System and Vehicle System Misbehavior and CRL support	SCMS-REQ-2.4 -- SCMS Vehicle System Rejection	The Vehicle System shall reject messages received from any vehicles on the current CRL	* Perform Test Case WEXTSS-SCMSCRL * Inspect Vehicle System SCMS Logs * Confirm Vehicle System rejects messages received from Remote Vehicle on the current CRL, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WEXTSS-OTA -- OBU over the air updates	VS-REQ-48 -- VSM Updates	The Vehicle System shall support Over-the-Air (OTA) software updates from the Wyoming CV System based on WAVE Service Announcements (WSA).	* Perform Test Case WEXTSS-OTA * Inspect OBU logs and verify that system received and successfully performed update. * Confirmation shows the Vehicle System supports Over-the-Air (OTA) software updates from the Wyoming CV System based on WAVE Service Announcements	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			(WSA), thereby verifying the requirement is satisfied.	
WEXTSS-OTA -- OBU over the air updates	ODE-REQ-6 -- OBU Update	The Operational Data Environment shall send OTA firmware updates to the OBU.	* Perform Test Case WEXTSS-OTA * Inspect OBU logs and verify that system received and successfully performed update. * Confirmation shows the Operational Data Environment sends OTA firmware updates to the OBU, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WEXTSS-RSUFIRM -- RSU Firmware update	RSU-REQ-12 -- Receive Update	The Roadside Units shall receive firmware updates from the TMC administrator.	* Perform Test Case WEXTSS-RSUFIRM * Inspect RSU logs and verify that RSU received and successfully performed update. * Confirmation shows the Roadside Units receive firmware updates from the TMC administrator, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

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FHWA-JPO-17-472B.10

U.S. Department of Transportation

Connected Vehicle Pilot Deployment Program Phase 2

WYDOT CV Pilot – ORTP - CV Pilot System Components Documentation Test Cases

www.its.dot.gov/index.htm

Final

FHWA-JPO-17-472B.11

U.S. Department of Transportation

Produced by DTFH6116H00027

U.S. Department of Transportation

Notice

Technical Report Documentation Page

<table>
<tr><td>1. Report No.
FHWA-JPO-17-472B.11</td><td>2. Government Accession No.</td><td colspan="2">3. Recipient's Catalog No.</td></tr>
<tr><td colspan="2" rowspan="2">4. Title and Subtitle
WYDOT CV Pilot – ORTP - CV Pilot System Components Documentation Test Cases</td><td colspan="2">5. Report Date
7/30/2018</td></tr>
<tr><td colspan="2">6. Performing Organization Code</td></tr>
<tr><td colspan="2">7. Author(s)
Denny Stephens (Vital Assurance), Tony English (Trihydro), Nayel Ureña Serulle (ICF), Deepak Gopalakrishna (ICF), Vince Garcia (Wyoming DOT)</td><td colspan="2">8. Performing Organization Report No.
Task 2G: Operational Readiness Test and Demonstration Planning</td></tr>
<tr><td colspan="2" rowspan="2">9. Performing Organization Name and Address
Wyoming DOT, 5300 Bishop Boulevard, Cheyenne, WY 82009
ICF International, 1725 Eye St NW, Washington DC, 20006
Trihydro Corporation, 1252 Commerce Drive, Laramie, WY 82070
Vital Assurance, 175 S. Third St., Suite 200, Columbus, OH 43215</td><td colspan="2">10. Work Unit No. (TRAIS)</td></tr>
<tr><td colspan="2">11. Contract or Grant No.
DTFH6116H00027</td></tr>
<tr><td colspan="2" rowspan="2">12. Sponsoring Agency Name and Address
U.S Department of Transportation 1200 New Jersey Ave, SE
Washington, DC 20590</td><td colspan="2">13. Type of Report and Period Covered
09/01/2016 to 6/30/2018</td></tr>
<tr><td colspan="2">14. Sponsoring Agency Code</td></tr>
<tr><td colspan="4">15. Supplementary Notes
Kate Hartman (COR), Sarah Tarpgaard (CO)</td></tr>
<tr><td colspan="4">16. Abstract
The Wyoming Department of Transportation's (WYDOT) Connected Vehicle (CV) Pilot Deployment Program is intended to develop a suite of applications that utilize vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communication technology to reduce the impact of adverse weather on truck travel in the I-80 corridor. These applications support a flexible range of services from advisories, roadside alerts, parking notifications and dynamic travel guidance. Information from these applications are made available directly to the equipped fleets or through data connections to fleet management centers (who will then communicate it to their trucks using their own systems). The pilot will be conducted in three Phases. Phase 1 includes the planning for the CV pilot including the concept of operations development. Phase 2 is the design, development, and testing phase. Phase 3 includes a real-world demonstration of the applications developed as part of this pilot.

This document presents the templates for CV Pilot System Components Documentation Test Cases of the Wyoming Department of Transportation (WYDOT) Connected Vehicle (CV) Pilot project as part of the United States Department of Transportation's (USDOT) CV program. These tests are part of the WYDOT CV Pilot Operational Test Plan - Attachment B.</td></tr>
<tr><td colspan="2">17. Key Words
Connected Vehicle Technology, I-80 Corridor, Road Weather, Truck Safety, System Architecture</td><td colspan="2">18. Distribution Statement
This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161</td></tr>
<tr><td>19. Security Classif. (of this report)
None</td><td>20. Security Classif. (of this page)
None</td><td>21. No. of Pages
55</td><td>22. Price
NA</td></tr>
</table>

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

Acknowledgements

The Operational Readiness Plan development team would like to thank USDOT and Noblis for their technical assistance throughout the development of this document.

Table of Contents

1 Introduction 1

1.1 Project Scope 1

1.2 Purpose of this Test 2

2 CV Pilot System Components Documentation Test Cases 3

2.1 Table WSYSDOC-SUM System Components Documentation Test Case Summary 4

2.2 Table WSYSDOC-TP System Components Documentation Test Procedure 5

2.3 Table WSYSDOC-CI System Components Documentation Test Configuration and Initialization 6

2.4 Table WOBUDOC-1-Description Inspection of OBU Certification and Test Documents Test Case Description 8

2.5 Table WOBUDOC-1-Results Inspection of OBU Certification and Test Documents Test Case Results 10

2.6 Table WOBUDOC-2-Description Inspection of Environmental Sensor Certification and Test Documents Test Case Description 10

2.7 Table WOBUDOC-2-Results Inspection of Environmental Sensor Certification and Test Documents Test Case Results 12

2.8 Table WRSUDOC-1-Description Inspection of RSU Certification and Test Documents Test Case Descriptions 13

2.9 Table WRSUDOC-1-Results Inspection of RSU Certification and Test Documents Test Case Results 14

2.10 Table WODEDOC-1-Description Inspection of ODE Certification and Test Documents Test Case Description 15

2.11 Table WODEDOC-1-Results Inspection of ODE Certification and Test Documents Test Case Results 17

2.12 Table WDWDOC-1-Description Inspection of OBU Certification and Test Documents Test Case Description 18

2.13 Table WDWDOC-1-Results Inspection of DW Certification and Test Documents Test Case Results 19

2.14 Table WSYSDOC-Requirements System Components Documentation Post Test Requirements Verification Analysis 20

List of Tables

Table 2-1. WSYSDOC-SUM System Components Documentation Test Case Summary.............. 4
Table 2-2. WSYSDOC-TP System Components Documentation Test Procedure 5
Table 2-3. WSYSDOC-CI System Components Documentation Test Configuration and Initialization 6
Table 2-4. WOBUDOC-1-Description Inspection of OBU Certification and Test Documents Test Case Description 8
Table 2-5. WOBUDOC-1-Results Inspection of OBU Certification and Test Documents Test Case Results 10
Table 2-6. WOBUDOC-2-Description Inspection of Environmental Sensor Certification and Test Documents Test Case Description 10
Table 2-7. WOBUDOC-2-Results Inspection of Environmental Sensor Certification and Test Documents Test Case Results 12
Table 2-8. WRSUDOC-1-Description Inspection of RSU Certification and Test Documents Test Case Descriptions 13
Table 2-9. WRSUDOC-1-Results Inspection of RSU Certification and Test Documents Test Case Results 14
Table 2-10. WODEDOC-1-Description Inspection of ODE Certification and Test Documents Test Case Description 15
Table 2-11. WODEDOC-1-Results Inspection of ODE Certification and Test Documents Test Case Results 17
Table 2-12. WDWDOC-1-Description Inspection of OBU Certification and Test Documents Test Case Description 18
Table 2-13. WDWDOC-1-Results Inspection of DW Certification and Test Documents Test Case Results 19
Table 2-14. WSYSDOC-Requirements System Components Documentation Post Test Requirements Verification Analysis 20

1 Introduction

1.1 Project Scope

Wyoming is one of the first wave of CV Pilot sites selected to showcase the value of and spur the adoption of CV technology in the United States. CV technology is a broad term to describe the applications and the systems that leverage dedicated short-range communications (DSRC) for vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I) and infrastructure-to-vehicle (I2V) communication to improve safety, mobility and productivity of the users of the nation's transportation system.

As one of the three selected pilots, WYDOT is focusing on improving safety and mobility by creating new ways to communicate road and travel information to commercial truck drivers and fleet managers along the 402 miles of Interstate 80 (I-80 henceforth) in the State. For the pilot project, WYDOT concluded Phase 1 (planning) in September 2016 and then initiated Phase 2 (deployment) which is scheduled to conclude in mid-2018. This will be followed by an 18-month demonstration period in the third phase.

Systems and applications developed in the pilot will enable drivers of connected vehicles to have improved awareness of potential hazards and of situations they cannot see. At a very high level, the pilot scope includes the following implementation elements:

- **Deploy about 75 roadside units (RSU)** that can receive and broadcast messages using DSRC along various sections on I-80.
- **Equip around 400 vehicles, a combination of fleet vehicles and commercial trucks, with on-board units (OBU).** Of the 400 vehicles, at least 150 are planned to be heavy trucks. All vehicles are expected to be regular users of I-80. Several types of OBUs are being procured as part of the pilot and differ based on their communication capabilities, ability to integrate with the in-vehicle network, and connectivity to ancillary devices and sensors. All OBUs will have the functionality to broadcast Basic Safety Messages (BSM) and will include a human-machine interface (HMI) to share alerts and advisories to drivers of these vehicles.
- **Develop several V2V, V2I, I2V applications** that will enable communication to drivers of alerts and advisories regarding various road conditions. These applications include support for in-vehicle dissemination of advisories for collision avoidance, speed management, detours, parking, and presence of work zones and maintenance and emergency vehicles downstream of their current location.
- **Enable overall improvements in WYDOT's traffic management and traveler information practices** by using data collected from connected vehicles. Targeted improvements include ingesting more location specific mobile road weather information system (RWIS) data, using Pikalert®[1] to provide for more accurate and road segment specific conditions to define better variable speed limits (VSLs), and improving road

[1] Pikalert is a trademark of the University Corporation for Atmospheric Research.

condition dissemination via 511, Dynamic Message Signs (DMS) and other WYDOT sources.

1.2 Purpose of this Test

This document presents the test results of the *CV Pilot System Components Documentation Test Cases* for the Wyoming Department of Transportation (WYDOT) Connected Vehicle (CV) Pilot project as part of the United States Department of Transportation's (USDOT) CV program. These tests are part of the WYDOT CV Pilot Operational Test Plan - Attachment B.

The purpose of this document is to describe the results of a sequence of end-to-end tests conducted to validate the successful operation of the system in terms of system components documentation.

2 CV Pilot System Components Documentation Test Cases

This chapter describes Test Procedure ID WSYSDOC -- CV Pilot System Components Documentation Test Procedures and Test Cases. Table WSYSDOC-SUM is a high-level summary of the test cases addressed in this test procedure, providing a summary and orientation for the reader. Table WSYSDOC-TP details the Test Procedure itself. Table WSYSDOC-CI describes the configuration of each of the WYDOT CV Pilot System components for the Test Procedure and the Initialization to be performed for each prior to conducting the Test Cases. Tables WSYSDOC-OBU-Description through WSYSDOC-DW-Description provide the detailed description of Test Cases to be performed under this Test Procedure. Tables WSYSDOC-OBU-Results through WSYSDOC-DW-Results capture the results of each repetition of each Test Case. Finally, Table WSYSDOC-Requirements describes the requirement verification methodology and capture the Test Engineer's confirmation that each requirement is verified. Appendix A of the ORTP provides a list of all system requirements, the test case in which they are verified, and their individual requirements verification methodology.

2.1 Table WSYSDOC-SUM System Components Documentation Test Case Summary

Table 2-1. WSYSDOC-SUM System Components Documentation Test Case Summary

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID	Requirements Verified
WOBUDOC-1	Inspection of OBU Certification and Test Documents	Verify OBU and HMI requirements are satisfied by vendor certification and test documentation.	None.	* OBU requirements are satisfied.		Compiled in Table WSYSDOC-Requirements
WOBUDOC-2	Inspection of Environmental Sensor Certification and Test Documents	Verify Environmental Sensor requirements are satisfied by vendor certification and test documentation.	None.	* Environmental Sensor requirements are satisfied.		Compiled in Table WSYSDOC-Requirements
WRSUDOC-1	Inspection of RSU Certification and Test Documents	Verify RSU requirements are satisfied by vendor certification and test documentation.	None.	* RSU requirements are satisfied.		Compiled in Table WSYSDOC-Requirements
WODEDOC-1	Inspection of ODE Design and Test Documents	Verify ODE requirements are satisfied by developer design and test documentation.	None.	* ODE requirements are satisfied.		Compiled in Table WSYSDOC-Requirements
WDWDOC-1	Inspection of DW Design and Test Documents	Verify DW requirements are satisfied by developer design	None.	* DW requirements are satisfied.		Compiled in Table WSYSDOC-Requirements

Test Case ID	Test Case Title	Test Case Objective	Test Case Input (Driving Scenario)	Test Case Expected Result (Pass/Fail Criterion)	Integrated Test Case ID	Requirements Verified
		and test documentation.				

2.2 Table WSYSDOC-TP System Components Documentation Test Procedure

Table 2-2. WSYSDOC-TP System Components Documentation Test Procedure

Test Procedure ID	WSYSDOC	Test Engineer Verification and Remarks
Test Procedure Name	System Components Documentation Test Procedure	
Test Procedure Completion Date		
Priority	Required	
Objectives	• Verify OBU and HMI requirements are satisfied by vendor certification and test documentation. • Verify Environmental Sensor requirements are satisfied by vendor certification and test documentation. • Verify RSU requirements are satisfied by vendor certification and test documentation. • Verify ODE requirements are satisfied by developer design and test documentation. • Verify DW requirements are satisfied by developer design and test documentation.	
Relationship to Other Procedures	• Precondition is successful development and integration of the WYDOT CV Pilot System, as described in the SDD and ICD, ready for production deployment. May be tested from development environment or production environment, as long as it is ready for production deployment.	

Test Procedure ID	WSYSDOC	Test Engineer Verification and Remarks
Discussion, Guidance, and Rationales		
Test Cases Performed under This Procedure	For this procedure conduct the following Test Cases detailed later in this section. • WOBUDOC-1 - Inspection of OBU Certification and Test Documents • WOBUDOC-2 - Inspection of Environmental Sensor Certification and Test Documents • WRSUDOC-1 - Inspection of RSU Certification and Test Documents • WODEDOC-1 - Inspection of ODE Design and Test Documents • WDWDOC-1 - Inspection of DW Design and Test Documents	

2.3 Table WSYSDOC-CI System Components Documentation Test Configuration and Initialization

Table 2-3. WSYSDOC-CI System Components Documentation Test Configuration and Initialization

System Component	Applicable Test Procedures and Cases	Configuration for I2V Situational Awareness Test Procedure and Test Cases	Initialization for I2V Situational Awareness Test Procedure and Test Cases	Test Engineer Verification and Remarks
Lear Roadstar OBU	WOBUDOC-1	Comprehensive documentation and certification results for OBU, fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment.	Comprehensive documentation and certification results for OBU, fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment.	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for I2V Situational Awareness Test Procedure and Test Cases	Initialization for I2V Situational Awareness Test Procedure and Test Cases	Test Engineer Verification and Remarks
SiriusXM	WOBUDOC-1	Comprehensive documentation and certification results for OBU, fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment.	Comprehensive documentation and certification results for OBU, fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment.	*Configuration Verified:* *Initialization Verified:*
Environmental Sensors	WOBUDOC-2	Comprehensive documentation and certification results for Environmental Sensor, fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment.	Comprehensive documentation and certification results for Environmental Sensor, fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment.	*Configuration Verified:* *Initialization Verified:*
RSU	WRSUDOC-1	Comprehensive documentation and certification results for RSU, fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment.	Comprehensive documentation and certification results for RSU, fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment.	*Configuration Verified:* *Initialization Verified:*
Operational Data Environment (ODE)	WODEDOC-1	Comprehensive documentation and certification results for ODE, fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment.	Comprehensive documentation and certification results for ODE, fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment.	*Configuration Verified:* *Initialization Verified:*

System Component	Applicable Test Procedures and Cases	Configuration for I2V Situational Awareness Test Procedure and Test Cases	Initialization for I2V Situational Awareness Test Procedure and Test Cases	Test Engineer Verification and Remarks
Data Warehouse (DW)	WDWDOC-1	Comprehensive documentation and certification results for DW, fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment.	Comprehensive documentation and certification results for DW, fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment.	*Configuration Verified:* *Initialization Verified:*

2.4 Table WOBUDOC-1-Description Inspection of OBU Certification and Test Documents Test Case Description

Table 2-4. WOBUDOC-1-Description Inspection of OBU Certification and Test Documents Test Case Description

Test Case ID	**WOBUDOC-1**	**Test Engineer Verification and Remarks**
Test Case Name	Inspection of OBU Certification and Test Documents	
Test Case Completion Date		
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WSYSDOC-Requirements	
Objective	Verify OBU and HMI requirements are satisfied by vendor certification and test documentation.	

Test Case ID	WOBUDOC-1	Test Engineer Verification and Remarks
Preconditions	• Verify configuration of each system and test component complies with Configuration for System Administration and Availability Test Procedure and Test Cases described in Table WSYSAA-CI System Administration and Availability Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for System Administration and Availability Test Procedure and Test Cases described in Table WSYSAA-CI System Administration and Availability Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
System Component	OBU	
TC Input	Inspection and analysis of vendor/developer component certification, test documents, and requirements verification.	
TC Output	Requirements verification results.	
Expected Result (Pass/Fail Criteria)	Specified OBU requirements are verified.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* Inspect and analyze of vendor/developer component certification, test documents, and requirements verification. Confirm specified OBU requirements are verified.	

2.5 Table WOBUDOC-1-Results Inspection of OBU Certification and Test Documents Test Case Results

Table 2-5. WOBUDOC-1-Results Inspection of OBU Certification and Test Documents Test Case Results

Test Case ID	WOBUDOC-1	Test Engineer Verification and Remarks
Test Case Name	Inspection of OBU Certification and Test Documents	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

2.6 Table WOBUDOC-2-Description Inspection of Environmental Sensor Certification and Test Documents Test Case Description

Table 2-6. WOBUDOC-2-Description Inspection of Environmental Sensor Certification and Test Documents Test Case Description

Test Case ID	WOBUDOC-2	Test Engineer Verification and Remarks
Test Case Name	Inspection of Environmental Sensor Certification and Test Documents	
Priority	Required	

Test Case ID	WOBUDOC-2	Test Engineer Verification and Remarks
Requirements Verified (Tracing)	Compiled in Table WSYSDOC-Requirements	
Objective	Verify Environmental Sensor requirements are satisfied by vendor certification and test documentation.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for System Administration and Availability Test Procedure and Test Cases described in Table WSYSAA-CI System Administration and Availability Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for System Administration and Availability Test Procedure and Test Cases described in Table WSYSAA-CI System Administration and Availability Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
System Component	Environmental Sensors	
TC Input	Inspection and analysis of vendor/developer component certification, test documents, and requirements verification.	
TC Output	Requirements verification results.	
Expected Result (Pass/Fail Criteria)	Specified Environmental requirements are verified.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.*	

Test Case ID	WOBUDOC-2	Test Engineer Verification and Remarks
	Inspect and analyze of vendor/developer component certification, test documents, and requirements verification. Confirm specified Environmental Sensor requirements are verified.	

2.7 Table WOBUDOC-2-Results Inspection of Environmental Sensor Certification and Test Documents Test Case Results

Table 2-7. WOBUDOC-2-Results Inspection of Environmental Sensor Certification and Test Documents Test Case Results

Test Case ID	WOBUDOC-1	Test Engineer Verification and Remarks
Test Case Name	Inspection of Environmental Sensor Certification and Test Documents	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

2.8 Table WRSUDOC-1-Description Inspection of RSU Certification and Test Documents Test Case Descriptions

Table 2-8. WRSUDOC-1-Description Inspection of RSU Certification and Test Documents Test Case Descriptions

Test Case ID	WRSUDOC-1	Test Engineer Verification and Remarks
Test Case Name	Inspection of RSU Certification and Test Documents.	
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WSYSDOC-Requirements	
Objective	Verify RSU requirements are satisfied by vendor certification and test documentation.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for System Administration and Availability Test Procedure and Test Cases described in Table WSYSAA-CI System Administration and Availability Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for System Administration and Availability Test Procedure and Test Cases described in Table WSYSAA-CI System Administration and Availability Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
System Component	RSUs	
TC Input	Inspection and analysis of vendor/developer component certification, test documents, and requirements verification.	

Test Case ID	WRSUDOC-1	Test Engineer Verification and Remarks
TC Output	Requirements verification results.	
Expected Result (Pass/Fail Criteria)	Specified OBU requirements are verified.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* Inspect and analyze of vendor/developer component certification, test documents, and requirements verification. Confirm specified RSU requirements are verified.	

2.9 Table WRSUDOC-1-Results Inspection of RSU Certification and Test Documents Test Case Results

Table 2-9. WRSUDOC-1-Results Inspection of RSU Certification and Test Documents Test Case Results

Test Case ID	WRSUDOC-1	Test Engineer Verification and Remarks
Test Case Name	Inspection of RSU Certification and Test Documents	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*

Test Case ID	WRSUDOC-1	Test Engineer Verification and Remarks
Pass/Fail Assessment		*Performed and Confirmed by:*

2.10 Table WODEDOC-1-Description Inspection of ODE Certification and Test Documents Test Case Description

Table 2-10. WODEDOC-1-Description Inspection of ODE Certification and Test Documents Test Case Description

Test Case ID	WODEDOC-1	Test Engineer Verification and Remarks
Test Case Name	Inspection of ODE Design and Test Documents.	
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WSYSDOC-Requirements	
Objective	Verify ODE requirements are satisfied by developer design and test documentation.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for System Administration and Availability Test Procedure and Test Cases described in Table WSYSAA-CI System Administration and Availability Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for System Administration and Availability Test Procedure and Test Cases described in Table WSYSAA-CI System Administration and Availability Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	

Test Case ID	WODEDOC-1	Test Engineer Verification and Remarks
System Component	ODE	
TC Input	Inspection and analysis of vendor/developer component certification, test documents, and requirements verification.	
TC Output	Requirements verification results.	
Expected Result (Pass/Fail Criteria)	Specified ODE requirements are verified.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* Inspect and analyze of vendor/developer component certification, test documents, and requirements verification. Confirm specified ODE requirements are verified.	

2.11 Table WODEDOC-1-Results Inspection of ODE Certification and Test Documents Test Case Results

Table 2-11. WODEDOC-1-Results Inspection of ODE Certification and Test Documents Test Case Results

Test Case ID	**WODEDOC-1**	**Test Engineer Verification and Remarks**
Test Case Name	Inspection of ODE Certification and Test Documents	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*
Pass/Fail Assessment		*Performed and Confirmed by:*

2.12 Table WDWDOC-1-Description Inspection of OBU Certification and Test Documents Test Case Description

Table 2-12. WDWDOC-1-Description Inspection of OBU Certification and Test Documents Test Case Description

Test Case ID	WDWDOC-1	Test Engineer Verification and Remarks
Test Case Name	Inspection of DW Design and Test Documents.	
Priority	Required	
Requirements Verified (Tracing)	Compiled in Table WSYSDOC-Requirements	
Objective	Verify DW requirements are satisfied by developer design and test documentation.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for System Administration and Availability Test Procedure and Test Cases described in Table WSYSAA-CI System Administration and Availability Test Configuration and Initialization. • Prepare each system and test component in accordance with Initialization for System Administration and Availability Test Procedure and Test Cases described in Table WSYSAA-CI System Administration and Availability Test Configuration and Initialization. • Conduct dry runs of test procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
System Component	DW	
TC Input	Inspection and analysis of vendor/developer component certification, test documents, and requirements verification.	

Test Case ID	WDWDOC-1	Test Engineer Verification and Remarks
TC Output	Requirements verification results.	
Expected Result (Pass/Fail Criteria)	Specified DW requirements are verified.	
Detailed Execution Steps	*The following generic test steps are to be replaced by detailed execution steps developed by test staff during dry runs.* Inspect and analyze of vendor/developer component certification, test documents, and requirements verification. Confirm specified DW requirements are verified.	

2.13 Table WDWDOC-1-Results Inspection of DW Certification and Test Documents Test Case Results

Table 2-13. WDWDOC-1-Results Inspection of DW Certification and Test Documents Test Case Results

Test Case ID	WDWDOC-1	Test Engineer Verification and Remarks
Test Case Name	Inspection of DW Certification and Test Documents	*Performed and Confirmed by:*
Test Case Completion Date		*Performed and Confirmed by:*
Test Case Repetition 1 Results		*Performed and Confirmed by:*
Test Case Analysis Tables		*Performed and Confirmed by:*

Test Case ID	WDWDOC-1	Test Engineer Verification and Remarks
Pass/Fail Assessment		*Performed and Confirmed by:*

2.14 Table WSYSDOC-Requirements System Components Documentation Post Test Requirements Verification Analysis

Table 2-14. WSYSDOC-Requirements System Components Documentation Post Test Requirements Verification Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-32.1 -- HMI-Location	The location where the devices will be mounted/installed shall be selected so that they do not obstruct the line of sight of the driver nor distract the driver from the primary task of driving.	* Perform Test Case WOBUDOC-1 * Confirm the location where the devices will be mounted/installed is selected so that they do not obstruct the line of sight of the driver nor distract the driver from the primary task of driving. * Confirmation shows the location where the devices will be mounted/installed be selected so that they do not obstruct the line of sight of the driver nor distract the driver from the primary task of driving, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-32.2 -- HMI-Distraction	The HMI shall minimize the ‘eyes off the road’ time when presenting information for an application	* Perform Test Case WOBUDOC-1 * Confirm the HMI minimizes the ‘eyes off the road’ time when presenting information for an application * Confirmation shows the HMI minimize the ‘eyes off the road’ time when presenting information for an application, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-32.3 -- HMI-Readability	The HMI shall provide messages that can be read from the driver’s normal seating position	* Perform Test Case WOBUDOC-1 * Confirm the HMI provide messages that can be read from the driver’s normal seating position. * Confirmation shows the HMI provide messages that can be read from the driver’s normal seating	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			position, thereby verifying the requirement is satisfied.	
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-32.4.1 -- Visual Consistency	The HMI shall maintain a consistent structure across applications with respect to presenting information to drivers and inputs to the system.	* Perform Test Case WOBUDOC-1 * Confirm the HMI maintain a consistent structure across applications with respect to presenting information to drivers and inputs to the system. * Confirmation shows the HMI maintain a consistent structure across applications with respect to presenting information to drivers and inputs to the system, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-32.4.2 -- Audio Signals	Auditory signals shall be loud enough to overcome masking sounds from road noise, the cab environment, and other equipment.	* Perform Test Case WOBUDOC-1 * Confirm the auditory signals be loud enough to overcome masking sounds from road noise, the cab environment, and other equipment. * Confirmation shows auditory signals be loud enough to overcome masking sounds from road noise, the cab environment, and other equipment, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-32.5 -- Customizations	HMI characteristics shall be customizable to reflect driver preferences. Preferences that shall be customizable are: • Volume • Brightness • Contrast text size • Display contrast • Mounting eye position	* Perform Test Case WOBUDOC-1 * Confirm HMI characteristics are customizable to reflect driver preferences. * Confirmation shows HMI characteristics be customizable to reflect driver preferences, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-32.6.1 -- Power Status	The HMI shall notify the driver of the power status of device with the screen graphics (e.g., off, powering up and online).	* Perform Test Case WOBUDOC-1 * Confirm the HMI notifies the driver of the power status of device with the screen graphics (e.g., off, powering up and online). * Confirmation shows the HMI notifies the driver of the power status of device with the screen graphics (e.g., off, powering up and online), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-32.6.2 -- System Settings	The HMI shall allow the driver to see the system settings of the device with screen graphics. (e.g., version, brightness, volume font size).	* Perform Test Case WOBUDOC-1 * Confirm The HMI allows the driver to see the system settings of the device with screen graphics. (e.g., version, brightness, volume font size). * Confirmation shows the HMI allow the driver to see the system settings of the device with screen graphics (e.g., version, brightness, volume font size), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-32.6.3 -- Application Availability	The HMI shall allow the driver to see application availability with screen graphics (e.g., failed, operating, disabled).	* Perform Test Case WOBUDOC-1 * Confirm the HMI allows the driver to see application availability with screen graphics (e.g., failed, operating, disabled).* Perform Test Case WOBUDOC-1 * Confirmation shows the HMI allows the driver to see application availability with screen graphics (e.g., failed, operating, disabled), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-32.6.4 -- Pending Update Status	The HMI shall allow the driver see pending updates for the device with screen graphics (e.g., applications, firmware, operating system).	* Perform Test Case WOBUDOC-1 * Confirm the HMI allows the driver see pending updates for the device with screen graphics (e.g., applications, firmware, operating system).* Perform Test Case WOBUDOC-1 * Confirmation shows the HMI allows the driver see pending updates for the device with screen graphics (e.g., applications, firmware, operating system), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-32.7 -- Distress Notification	The HMI shall include a distress button to allow a driver to notify the Vehicle System that the driver has initiated a distress condition. This button enables the distress notification application as defined in section 2.6.3 of the SyRS.	* Perform Test Case WOBUDOC-1 * Confirm the HMI includes a distress button to allow a driver to notify the Vehicle System that the driver has initiated a distress condition. * Confirmation shows the HMI includes a distress button to allow a driver to notify the Vehicle System that the driver has initiated a distress condition	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU	VS-REQ-35 -- BCVI General	The Vehicle System shall use the general broadcast requirements defined in	* Perform Test Case WOBUDOC-1 * Confirm the Vehicle System uses the general broadcast requirements defined in Appendix A4	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
Certification and Test Documents	Broadcast Requirements	Appendix A.4 Broadcast Traveler Information of the SyRS.	Broadcast Traveler Information of the SyRS. * Confirmation shows the Vehicle System use the general broadcast requirements defined in Appendix A4 Broadcast Traveler Information of the SyRS, thereby verifying the requirement is satisfied.	
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-42 -- VSM SCMS	The Vehicle System shall use the USDOT SCMS Certificates in accordance with the security and privacy requirements in Section 6.5 of J2945/1	* Perform Test Case WOBUDOC-1 * Confirm Vehicle System use the USDOT SCMS Certificates in accordance with the security and privacy requirements in Section 6.5 of J2945/1. * Confirmation shows the Vehicle System use the USDOT SCMS Certificates in accordance with the security and privacy requirements in Section 65 of J2945/1, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-43 -- VSM SCMS Encryption	The Vehicle System shall use the USDOT SCMS Certificates to sign and encrypt messages transmitted. The approved encryption algorithms are defined in IEEE 1609.2 and explained in USDOT SCMS CAMP Wiki Cryptography.	* Perform Test Case WOBUDOC-1 * Confirm Vehicle System uses the USDOT SCMS Certificates to sign and encrypt messages transmitted. * Confirmation shows the Vehicle System use the USDOT SCMS Certificates to sign and encrypt messages transmitted, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-44 -- VSM SCMS Sign	The Vehicle System shall use the USDOT SCMS Certificates to sign, but not encrypt, all broadcasted messages.	* Perform Test Case WOBUDOC-1 * Confirm Vehicle System uses the USDOT SCMS Certificates to sign, but not encrypt, all broadcasted messages. * Confirmation shows the Vehicle System use the USDOT SCMS Certificates to sign, but not encrypt, all broadcasted messages, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-45 -- VSM SCMS Encryption-Log	The Vehicle System shall use the USDOT SCMS Certificates to encrypt log files stored locally using the Public Key Encryption defined in USDOT SCMS CAMP Wiki Cryptography. Password	* Perform Test Case WOBUDOC-1 * Confirm Vehicle System uses the USDOT SCMS Certificates to encrypt log files stored locally using the Public Key Encryption defined in USDOT SCMS CAMP Wiki Cryptography or confirm password protection is used to protect log files. * Confirmation shows the Vehicle System use the	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		protection is also allowable protection for log files.	USDOT SCMS Certificates to encrypt log files stored locally using the Public Key Encryption defined in USDOT SCMS CAMP Wiki Cryptography or that password protection is used to protect log files, thereby verifying the requirement is satisfied.	
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-46 -- VSM SCMS Sign-Log	The Vehicle System shall use the USDOT SCMS Certificates to sign log files stored locally. Password protection is also allowable for in place of signing log files.	* Perform Test Case WOBUDOC-1 * Confirm Vehicle System uses the USDOT SCMS Certificates to sign log files stored locally or confirm password protection is used to protect log files. * Confirmation shows the Vehicle System use the USDOT SCMS Certificates to sign log files stored locally or password protection is used to protect log files, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-47 -- VSM App Availability Log	The Vehicle System shall log local application availability to the local event logs by vehicle type.	* Perform Test Case WOBUDOC-1 * Confirm the Vehicle System logs local application availability to the local event logs by vehicle type. * Confirmation shows the Vehicle System log local application availability to the local event logs by vehicle type, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	VS-REQ-51 -- VS Equipment	All Vehicle System equipment shall conform to the characteristics described in Appendix A of the CAP.	* Perform Test Case WOBUDOC-1 * Confirm OBU conforms to the characteristics described in Appendix A of the CAP. * Confirmation shows all Vehicle System equipment conforms to the characteristics described in Appendix A of the CAP, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	MV-REQ-9 -- General	All vehicle system requirements identified in Section 4.2 of the SyRS shall apply to this Sub-system.	* Perform Test Case WOBUDOC-1 * Confirm all vehicle system requirements identified in Section 42 of the SyRS are confirmed for this Sub-system * Confirmation shows all vehicle system requirements identified in Section 42 of the SyRS	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			apply to this Sub-system, thereby verifying the requirement is satisfied.	
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	HP-REQ-1 -- General	All vehicle system requirements identified in Section 4.2 of the SyRS shall apply to this Sub-system except: • VS-REQ-4.2 Collect Dimension Data • VS-REQ-5 External Environment Sensor Data • VS-REQ-5.1 External Environment Sensor Data Configuration • VS-REQ-5.2 External Environment Sensor Data Management • VS-REQ-36.1 Transmit Environmental Data	* Perform Test Case WOBUDOC-1 * Confirm all vehicle system requirements identified in Section 42 of the SyRS apply to this Sub-system except: • VS-REQ-4.2 Collect Dimension Data • VS-REQ-5 External Environment Sensor Data • VS-REQ-5.1 External Environment Sensor Data Configuration • VS-REQ-5.2 External Environment Sensor Data Management • VS-REQ-36.1 Transmit Environmental Data * Confirmation shows all vehicle system requirements identified in Section 42 of the SyRS apply to this Sub-system except: • VS-REQ-4.2 Collect Dimension Data • VS-REQ-5 External Environment Sensor Data • VS-REQ-5.1 External Environment Sensor Data Configuration • VS-REQ-5.2 External Environment Sensor Data Management • VS-REQ-36.1 Transmit Environmental Data, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	IT-REQ-6 -- General	All vehicle system requirements identified in Section 4.2 of the SyRS shall apply to this Sub-system except: • VS-REQ-5 External Environment Sensor Data • VS-REQ-5.1 External Environment Sensor Data Configuration • VS-REQ-5.2 External Environment Sensor Data Management • VS-REQ-36.1 Transmit Environmental Data	* Perform Test Case WOBUDOC-1 * Confirm all vehicle system requirements identified in Section 42 of the SyRS apply to this Sub-system except: • VS-REQ-5 External Environment Sensor Data • VS-REQ-5.1 External Environment Sensor Data Configuration • VS-REQ-5.2 External Environment Sensor Data Management • VS-REQ-36.1 Transmit Environmental Data * Confirmation shows all vehicle system requirements identified in Section 42 of the SyRS apply to this Sub-system except: • VS-REQ-5 External Environment Sensor Data	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			• VS-REQ-5.1 External Environment Sensor Data Configuration • VS-REQ-5.2 External Environment Sensor Data Management • VS-REQ-36.1 Transmit Environmental Data, thereby verifying the requirement is satisfied.	
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	RFV-REQ-5 -- General	All vehicle system requirements identified in Section 4.2 of the SyRS shall apply to this Sub-system except the following requirements pertaining to distress notifications and updates: • VS-REQ-3 Receive Distress Information • VS-REQ-4.1 Collect Vehicle Status Data • VS-REQ-5 External Environment Sensor Data • VS-REQ-5.1 External Environment Sensor Data Configuration • VS-REQ-5.2 External Environment Sensor Data Management • VS-REQ-15 Distress Notification ID • VS-REQ-15.1 Log • VS-REQ-16 Create Distress Notification • VS-REQ-16.1 System-Generated Distress Notification • VS-REQ-16.2 Driver-Generated Distress Notification • VS-REQ-17 DNM-Region • VS-REQ-18 DN PSID • VS-REQ-27 IVAA DN • VS-REQ-32.5 Customizations	* Perform Test Case WOBUDOC-1 * Confirm all vehicle system requirements identified in Section 42 of the SyRS apply to this Sub-system except the following requirements pertaining to distress notifications and updates: • VS-REQ-3 Receive Distress Information • VS-REQ-4.1 Collect Vehicle Status Data • VS-REQ-5 External Environment Sensor Data • VS-REQ-5.1 External Environment Sensor Data Configuration • VS-REQ-5.2 External Environment Sensor Data Management • VS-REQ-15 Distress Notification ID • VS-REQ-15.1 Log • VS-REQ-16 Create Distress Notification • VS-REQ-16.1 System-Generated Distress Notification • VS-REQ-16.2 Driver-Generated Distress Notification • VS-REQ-17 DNM-Region • VS-REQ-18 DN PSID • VS-REQ-27 IVAA DN • VS-REQ-32.5 Customizations • VS-REQ-32.7 Distress Notification • VS-REQ-34 BCVI Distress • VS-REQ-34.1 Received Distress • VS-REQ-34.2 Generated Distress • VS-REQ-35 BCVI General Broadcast Requirements • VS-REQ-36.1 Transmit Environmental Data * Confirmation shows all vehicle system requirements identified in Section 42 of the SyRS	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		• VS-REQ-32.7 Distress Notification • VS-REQ-34 BCVI Distress • VS-REQ-34.1 Received Distress • VS-REQ-34.2 Generated Distress • VS-REQ-35 BCVI General Broadcast Requirements • VS-REQ-36.1 Transmit Environmental Data	apply to this Sub-system except the following requirements pertaining to distress notifications and updates: • VS-REQ-3 Receive Distress Information • VS-REQ-4.1 Collect Vehicle Status Data • VS-REQ-5 External Environment Sensor Data • VS-REQ-5.1 External Environment Sensor Data Configuration • VS-REQ-5.2 External Environment Sensor Data Management • VS-REQ-15 Distress Notification ID • VS-REQ-15.1 Log • VS-REQ-16 Create Distress Notification • VS-REQ-16.1 System-Generated Distress Notification • VS-REQ-16.2 Driver-Generated Distress Notification • VS-REQ-17 DNM-Region • VS-REQ-18 DN PSID • VS-REQ-27 IVAA DN • VS-REQ-32.5 Customizations • VS-REQ-32.7 Distress Notification • VS-REQ-34 BCVI Distress • VS-REQ-34.1 Received Distress • VS-REQ-34.2 Generated Distress • VS-REQ-35 BCVI General Broadcast Requirements • VS-REQ-36.1 Transmit Environmental Data, thereby verifying the requirement is satisfied.	
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	ARQ-REQ-1 -- Architectural Requirements - Connected Device Dialogs	(Source: J3067, 3.4.3) – A connected device shall be able to establish a private wireless connection with another specific connected device that mutually agrees.	* Perform Test Case WOBUDOC-1 * Confirm (Source: J3067, 343) – A connected device is able to establish a private wireless connection with another specific connected device that mutually agrees * Confirmation shows (Source: J3067, 343) – A connected device be able to establish a private wireless connection with another specific	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			connected device that mutually agrees, thereby verifying the requirement is satisfied.	
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	CSC-REQ-1 -- OBU SCMS Use	All OBUs used in the Wyoming Pilot shall be certified from a US DOT authorized testing facility based on the SCMS current version CAMP Wiki: Requirements and Specifications.	* Perform Test Case WOBUDOC-1 * Confirm All OBUs used in the Wyoming Pilot be certified from a US DOT authorized testing facility based on the SCMS current version CAMP Wiki: Requirements and Specifications * Confirmation shows All OBUs used in the Wyoming Pilot be certified from a US DOT authorized testing facility based on the SCMS current version CAMP Wiki: Requirements and Specifications, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	CSC-REQ-2 -- OBU Certification	All OBUs used in the Wyoming Pilot shall be certified from a USDOT authorized testing facility based on J2945/1.	* Perform Test Case WOBUDOC-1 * Confirm All OBUs used in the Wyoming Pilot be certified from a USDOT authorized testing facility based on J2945/1 At a minimum, the following applications interfaces and requirements from J2945/1 will be included in the certification testing * Confirmation shows All OBUs used in the Wyoming Pilot be certified from a USDOT authorized testing facility based on J2945/1 At a minimum, the following applications interfaces and requirements from J2945/1 will be included in the certification testing, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.1 -- Broadcast Traveler Information	(Source: J3067, 3.5.8.1). A connected device shall broadcast a packet containing traveler information to connected devices. Each packet may contain one or more individual traveler information messages.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.1) a connected device broadcast a packet containing traveler information to connected devices. Each packet may contain one or more individual traveler information messages, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.2.1 -- Broadcast Traveler Information - Packet Identifier	(Source: J3067, 3.5.8.2.1). A connected device shall include a packet identifier for the traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.2.1) a connected device include a packet identifier for the traveler information packet broadcasted to	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			connected devices, thereby verifying the requirement is satisfied.	
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.2.2 -- Broadcast Traveler Information - Message Identifier Requirements	(Source: J3067, 3.5.8.2.2). For each traveler information message in a traveler information packet, a connected device needs to identify each message transmitted as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.2.2) For each traveler information message in a traveler information packet, a connected device needs to identify each message transmitted as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.2.2.1 -- Broadcast Traveler Advisories - Message Identifier	(Source: J3067, 3.5.8.2.2.1). For traveler advisories, a connected device shall include a message identifier for each traveler advisory message as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.2.2.1) For traveler advisories, a connected device include a message identifier for each traveler advisory message as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.1 -- Broadcast Traveler Information - Validity Duration	(Source: J3067, 3.5.8.3.4). For each traveler information message in a traveler information packet, a connected device shall include the duration from the start time that the traveler message is valid for as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.4) For each traveler information message in a traveler information packet, a connected device include the duration from the start time that the traveler message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.2 -- Broadcast Traveler Information – Importance	(Source: J3067, 3.5.8.3.5). For each traveler information message in a traveler information packet, a connected device shall include the importance of the message relative to other traveler information messages being broadcasted as part of a traveler	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.5) For each traveler information message in a traveler information packet, a connected device include the importance of the message relative to other traveler information messages being broadcasted as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		information packet broadcasted to connected devices.		
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3 -- Broadcast Traveler Information - Presentation Requirements	(Source: J3067, 3.5.8.3.6). Agencies may need to present traveler information messages only to specific travelers, such as travelers within specific geographic (spatial) regions or a direction of travel.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6) agencies may need to present traveler information messages only to specific travelers, such as travelers within specific geographic (spatial) regions or a direction of travel, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.1 -- Broadcast Traveler Information - Default Anchor Point Position	(Source: J3067, 3.5.8.3.6.1). For each traveler information message in a traveler information packet, a connected device shall include the geographic location (latitude, longitude, elevation) of the default anchor point for which valid regions are determined as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.1) For each traveler information message in a traveler information packet, a connected device include the geographic location (latitude, longitude, elevation) of the default anchor point for which valid regions are determined as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.2 -- Broadcast Traveler Information - Heading Slice	(Source: J3067, 3.5.8.3.6.2). For each traveler information message in a traveler information packet, a connected device shall include the direction of motion (of the connected device) that the message is valid for as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.2) For each traveler information message in a traveler information packet, a connected device include the direction of motion (of the connected device) that the message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.3 -- Broadcast Traveler Information - Circular Valid Region Requirements	(Source: J3067, 3.5.8.3.6.3). A spatial region for which a traveler information message is valid for may be a circular region around an anchor point. The connected device should be located within the circular region for the traveler	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.3) a spatial region for which a traveler information message is valid for may be a circular region around an anchor point. the connected device should be located within the circular region for the traveler information message to be presented to	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		information message to be presented to the traveler.	the traveler, thereby verifying the requirement is satisfied.	
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.3.1 -- Broadcast Traveler Information - Circular Region – Radius	(Source: J3067, 3.5.8.3.6.3.1). For each traveler information message in a traveler information packet, a connected device shall include the radius for the circular region defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.3.1) For each traveler information message in a traveler information packet, a connected device include the radius for the circular region defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.3.2 -- Broadcast Traveler Information - Circular Region - Anchor Point	(Source: J3067, 3.5.8.3.6.3.2). For each traveler information message in a traveler information packet, a connected device shall include the geographic location (latitude, longitude, elevation) of the anchor point for the circular region of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.3.2) For each traveler information message in a traveler information packet, a connected device include the geographic location (latitude, longitude, elevation) of the anchor point for the circular region of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.4 -- Broadcast Traveler Information - Polygon Valid Region Requirements	(Source: J3067, 3.5.8.3.6.4). A spatial region for which a traveler information message is valid for may be a polygon, which may represent the jurisdictional boundaries of a specific transportation agency or a work zone. The connected device should be located within this polygon region for the traveler information message to be presented to the traveler.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.4) a spatial region for which a traveler information message is valid for may be a polygon, which may represent the jurisdictional boundaries of a specific transportation agency or a work zone. the connected device should be located within this polygon region for the traveler information message to be presented to the traveler, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.4.1 -- Broadcast Traveler Information - Polygon Region – Offsets	(Source: J3067, 3.5.8.3.6.4.1). For each traveler information message in a traveler information packet, a connected device shall include the area of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.4.1) For each traveler information message in a traveler information packet, a connected device include the area of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.4.2 -- Broadcast Traveler Information - Polygon Region - Anchor Point	(Source: J3067, 3.5.8.3.6.4.2). For each traveler information message in a traveler information packet, a connected device shall include the geographic location (latitude, longitude, elevation) of the anchor point for the area of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.4.2) For each traveler information message in a traveler information packet, a connected device include the geographic location (latitude, longitude, elevation) of the anchor point for the area of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.5 -- Broadcast Traveler Information - Valid Shape Point Set Region Requirements	(Source: J3067, 3.5.8.3.6.5). A spatial region for which a traveler information message is valid for may be a shape point set, which allows a spline-like representation of a geographic area such as a road segment. A connected device should be located within the shape point set region for the traveler information message to be presented to the traveler.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5) a spatial region for which a traveler information message is valid for may be a shape point set, which allows a spline-like representation of a geographic area such as a road segment. a connected device should be located within the shape point set region for the traveler information message to be presented to the traveler, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU	BC-REQ-1.3.3.5.1 -- Broadcast Traveler	(Source: J3067, 3.5.8.3.6.5.1). For each traveler information message in a traveler	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.1) For each traveler information message in a traveler	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
Certification and Test Documents	Information - Shape Point Set - Default Direction	information packet, a connected device shall include the default direction of travel along the shape point set as part of a traveler information packet broadcasted to connected devices.	information packet, a connected device include the default direction of travel along the shape point set as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.5.2 -- Broadcast Traveler Information - Shape Point Set - Default Width	(Source: J3067, 3.5.8.3.6.5.2). For each traveler information message in a traveler information packet, a connected device shall include the default width of the shape point set as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.2) For each traveler information message in a traveler information packet, a connected device include the default width of the shape point set as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.5.3 -- Broadcast Traveler Information - Shape Point Set – Offsets	(Source: J3067, 3.5.8.3.6.5.3). For each traveler information message in a traveler information packet, a connected device shall include the shape point set defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.3) For each traveler information message in a traveler information packet, a connected device include the shape point set defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.5.4 -- Broadcast Traveler Information - Shape Point Set – Direction	(Source: J3067, 3.5.8.3.6.5.4). For each shape point set in a traveler information message, a connected device shall include the allowed direction of travel along the shape point set as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.4) For each shape point set in a traveler information message, a connected device include the allowed direction of travel along the shape point set as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU	BC-REQ-1.3.3.5.5 -- Broadcast Traveler	(Source: J3067, 3.5.8.3.6.5.5). For a shape point set in a traveler information message, a	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.5) For a shape point set in a traveler information message,	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
Certification and Test Documents	Information - Shape Point Set – Width	connected device shall include the width for the shape point set as part of a traveler information packet broadcasted to connected devices.	a connected device include the width for the shape point set as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.5.6 -- Broadcast Traveler Information - Shape Point Set - Node Width	(Source: J3067, 3.5.8.3.6.5.6). For a shape point offset in a traveler information message, a connected device shall include the width of the geographic area at that node as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.6) For a shape point offset in a traveler information message, a connected device include the width of the geographic area at that node as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.3.5.7 -- Broadcast Traveler Information - Shape Point Set - Anchor Point	(Source: J3067, 3.5.8.3.6.5.7). For each shape point set in a traveler information message, a connected device shall include the geographic location (latitude, longitude, elevation) of the anchor point for the shape point set defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.7) For each shape point set in a traveler information message, a connected device include the geographic location (latitude, longitude, elevation) of the anchor point for the shape point set defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.4 -- Broadcast Traveler Advisories – Content	(Source: J3067, 3.5.8.3.7). For traveler advisory message in a traveler information packet, a connected device shall include the contents of the travel advisory information as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.7) For traveler advisory message in a traveler information packet, a connected device include the contents of the travel advisory information as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.5 -- Broadcast Road Sign – Content	(Source: J3067, 3.5.8.3.8). For each road sign message in a traveler information packet, a connected device shall include	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.8) For each road sign message in a traveler information packet, a connected device include the road sign	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		the road sign information as part of a traveler information packet broadcasted to connected devices	information as part of a traveler information packet broadcasted to connected device, thereby verifying the requirement is satisfied.	
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.6 -- Broadcast Traveler Information - Uniform Resource Locator	(Source: J3067, 3.5.8.3.9). For each traveler information message in a traveler information packet, an OBU shall include a uniform resource locator (URL) for the traveler information message as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.9) For each traveler information message in a traveler information packet, an OBU include a uniform resource locator (URL) for the traveler information message as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-1 -- Inspection of OBU Certification and Test Documents	BC-REQ-1.3.7 -- Broadcast Traveler Information - Valid Vehicle Type	(Source: J3067, 3.5.8.3.10). For each traveler information message, a connected device shall include the vehicle types that the traveler advisory or road sign is valid for as part of a traveler information message broadcasted to connected vehicles.	* Perform Test Case WOBUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.10) For each traveler information message, a connected device include the vehicle types that the traveler advisory or road sign is valid for as part of a traveler information message broadcasted to connected vehicles, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WOBUDOC-2 -- Inspection of Environmental Sensor Certification and Test Documents	MV-REQ-1.1 -- Environmental Sensor Equipment	Environmental Sensor equipment shall conform to the characteristics described in Appendix A of the CAP	* Perform Test Case WOBUDOC-2 * Confirm Environmental Sensor equipment conforms to the characteristics described in Appendix A of the CAP. * Confirmation shows Environmental Sensor equipment conforms to the characteristics described in Appendix A of the CAP, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	RSU-REQ-3 -- SCMS	The Roadside Units shall interface with the USDOT SCMS, as defined in SCMS-REQ-1.	* Perform Test Case WRSUDOC-1 * Confirm RSU interfaces with the USDOT SCMS, as defined in SCMS-REQ-1 (Section 3.1.1). * Confirmation shows the Roadside Units interface with the USDOT SCMS, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	RSU-REQ-4 -- LTS	The Roadside Units shall interface with the USDOT LTS, as defined in LTS-REQ-1.	* Perform Test Case WRSUDOC-1 * Confirm RSU interfaces with the USDOT LTS, as defined in LTS-REQ-1 (Section 3.2). * Confirmation shows the Roadside Units interface with the USDOT LTS, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	RSU-REQ-13 -- RSU Equipment	Roadside Unit equipment shall conform to the characteristics described in Appendix A of the CAP.	* Perform Test Case WRSUDOC-1 * Confirm RSU conforms to the characteristics described in Appendix A of the CAP. * Confirmation shows Roadside Unit equipment conforms to the characteristics described in Appendix A of the CAP, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	CSC-REQ-3 -- RSU SCMS Use	All RSUs used in the Wyoming Pilot shall be certified from a US DOT authorized testing facility based on the SCMS current version CAMP Wiki: Requirements and Specifications.	* Perform Test Case WRSUDOC-1 * Confirm that all RSUs used in the Wyoming Pilot are certified from a US DOT authorized testing facility based on the SCMS current version CaMP Wiki: Requirements and Specifications, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	CSC-REQ-4 -- RSU Certification	All RSUs used in the Wyoming Pilot shall be certified from a US DOT authorized testing facility based on J2945/1.	* Perform Test Case WRSUDOC-1 * Confirm that all RSUs used in the Wyoming Pilot are certified from a US DOT authorized testing facility based on J2945/1. the following interfaces and requirements from J2945/1, at a minimum, will are included in the certification testing, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	CSC-REQ-5 -- RSU Specification	All RSUs used in the Wyoming Pilot shall be compliant with the following interfaces and requirements from DSRC Roadside Unit (RSU) Specifications Document v4.1. • Minimum Requirements o 3.4 Functional Requirements § USDOT_RSU-Req_513-	* Perform Test Case WRSUDOC-1 * Confirm that all RSUs used in the Wyoming Pilot are compliant with the following interfaces and requirements from DSRC Roadside Unit (RSU) Specifications Document v4.1, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		v003 System Time: GPS primary o 3.4.8 Security § USDOT_RSU-Req_442-v002 Data Protection: NTP Secondary Time o 3.7.1.2 IEEE 1609.2 § USDOT_RSU-Req_579-v001 Secure Storage: HSM		
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.1 -- Broadcast Traveler Information	(Source: J3067, 3.5.8.1). A connected device shall broadcast a packet containing traveler information to connected devices. Each packet may contain one or more individual traveler information messages.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.1) a connected device broadcast a packet containing traveler information to connected devices. Each packet may contain one or more individual traveler information messages, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.2.1 -- Broadcast Traveler Information - Packet Identifier	(Source: J3067, 3.5.8.2.1). A connected device shall include a packet identifier for the traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.2.1) a connected device include a packet identifier for the traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.2.2 -- Broadcast Traveler Information - Message Identifier Requirements	(Source: J3067, 3.5.8.2.2). For each traveler information message in a traveler information packet, a connected device needs to identify each message transmitted as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.2.2) For each traveler information message in a traveler information packet, a connected device needs to identify each message transmitted as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.2.2.1 -- Broadcast Traveler Advisories - Message Identifier	(Source: J3067, 3.5.8.2.2.1). For traveler advisories, a connected device shall include a message identifier for each traveler advisory message as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.2.2.1) For traveler advisories, a connected device include a message identifier for each traveler advisory message as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.2.2.2 -- Broadcast Road Sign - Message Identifier	(Source: J3067, 3.5.8.2.2.2). For road sign messages, the message identifier is determined by its geographic location and its viewing angle. Thus, for each road sign message, a connected device shall include the geographic location (latitude, longitude, elevation), based on the WGS-84 coordinate system, and the viewing angle of the road sign as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.2.2.2) For road sign messages, the message identifier is determined by its geographic location and its viewing angle. Thus, for each road sign message, a connected device include the geographic location (latitude, longitude, elevation), based on the WGS-84 coordinate system, and the viewing angle of the road sign as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.1 -- Broadcast Traveler Information - Validity Duration	(Source: J3067, 3.5.8.3.4). For each traveler information message in a traveler information packet, a connected device shall include the duration from the start time that the traveler message is valid for as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.4) For each traveler information message in a traveler information packet, a connected device include the duration from the start time that the traveler message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.2 -- Broadcast Traveler Information – Importance	(Source: J3067, 3.5.8.3.5). For each traveler information message in a traveler information packet, a connected device shall include the importance of the message relative to other traveler information messages being broadcasted as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.5) For each traveler information message in a traveler information packet, a connected device include the importance of the message relative to other traveler information messages being broadcasted as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU	BC-REQ-3.3.3 -- Broadcast Traveler	(Source: J3067, 3.5.8.3.6). Agencies may need to present traveler information messages	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6) agencies may need to present traveler information	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
Certification and Test Documents	Information - Presentation Requirements	only to specific travelers, such as travelers within specific geographic (spatial) regions or a direction of travel.	messages only to specific travelers, such as travelers within specific geographic (spatial) regions or a direction of travel, thereby verifying the requirement is satisfied.	
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.1 - - Broadcast Traveler Information - Default Anchor Point Position	(Source: J3067, 3.5.8.3.6.1). For each traveler information message in a traveler information packet, a connected device shall include the geographic location (latitude, longitude, elevation) of the default anchor point for which valid regions are determined as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.1) For each traveler information message in a traveler information packet, a connected device include the geographic location (latitude, longitude, elevation) of the default anchor point for which valid regions are determined as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.2 -- Broadcast Traveler Information - Heading Slice	(Source: J3067, 3.5.8.3.6.2). For each traveler information message in a traveler information packet, a connected device shall include the direction of motion (of the connected device) that the message is valid for as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.2) For each traveler information message in a traveler information packet, a connected device include the direction of motion (of the connected device) that the message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.3 -- Broadcast Traveler Information - Circular Valid Region Requirements	(Source: J3067, 3.5.8.3.6.3). A spatial region for which a traveler information message is valid for may be a circular region around an anchor point. The connected device should be located within the circular region for the traveler information message to be presented to the traveler.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.3) a spatial region for which a traveler information message is valid for may are a circular region around an anchor point. the connected device should are located within the circular region for the traveler information message to are presented to the traveler, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU	BC-REQ-3.3.3.3.1 -- Broadcast Traveler	(Source: J3067, 3.5.8.3.6.3.1). For each traveler information message in a traveler	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.3.1) For each traveler information message in a traveler	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
Certification and Test Documents	Information - Circular Region – Radius	information packet, a connected device shall include the radius for the circular region defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.	information packet, a connected device include the radius for the circular region defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.3.2 -- Broadcast Traveler Information - Circular Region - Anchor Point	(Source: J3067, 3.5.8.3.6.3.2). For each traveler information message in a traveler information packet, a connected device shall include the geographic location (latitude, longitude, elevation) of the anchor point for the circular region of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.3.2) For each traveler information message in a traveler information packet, a connected device include the geographic location (latitude, longitude, elevation) of the anchor point for the circular region of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.4 -- Broadcast Traveler Information - Polygon Valid Region Requirements	(Source: J3067, 3.5.8.3.6.4). A spatial region for which a traveler information message is valid for may be a polygon, which may represent the jurisdictional boundaries of a specific transportation agency or a work zone. The connected device should be located within this polygon region for the traveler information message to be presented to the traveler.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.4) a spatial region for which a traveler information message is valid for may are a polygon, which may represent the jurisdictional boundaries of a specific transportation agency or a work zone. the connected device should are located within this polygon region for the traveler information message to are presented to the traveler, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.4.1 -- Broadcast Traveler Information -	(Source: J3067, 3.5.8.3.6.4.1). For each traveler information message in a traveler information packet, a connected device shall include the area of	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.4.1) For each traveler information message in a traveler information packet, a connected device include the area of travel defining where the traveler	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
	Polygon Region – Offsets	travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.	information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.4.2 -- Broadcast Traveler Information - Polygon Region - Anchor Point	(Source: J3067, 3.5.8.3.6.4.2). For each traveler information message in a traveler information packet, a connected device shall include the geographic location (latitude, longitude, elevation) of the anchor point for the area of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.4.2) For each traveler information message in a traveler information packet, a connected device include the geographic location (latitude, longitude, elevation) of the anchor point for the area of travel defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.5 -- Broadcast Traveler Information - Valid Shape Point Set Region Requirements	(Source: J3067, 3.5.8.3.6.5). A spatial region for which a traveler information message is valid for may be a shape point set, which allows a spline-like representation of a geographic area such as a road segment. A connected device should be located within the shape point set region for the traveler information message to be presented to the traveler.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5) a spatial region for which a traveler information message is valid for may are a shape point set, which allows a spline-like representation of a geographic area such as a road segment. a connected device should are located within the shape point set region for the traveler information message to are presented to the traveler, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.5.1 -- Broadcast Traveler Information - Shape Point Set - Default Direction	(Source: J3067, 3.5.8.3.6.5.1). For each traveler information message in a traveler information packet, a connected device shall include the default direction of travel along the shape point set as part of a traveler information packet	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.1) For each traveler information message in a traveler information packet, a connected device include the default direction of travel along the shape point set as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		broadcasted to connected devices.		
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.5.2 -- Broadcast Traveler Information - Shape Point Set - Default Width	(Source: J3067, 3.5.8.3.6.5.2). For each traveler information message in a traveler information packet, a connected device shall include the default width of the shape point set as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.2) For each traveler information message in a traveler information packet, a connected device include the default width of the shape point set as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.5.3 -- Broadcast Traveler Information - Shape Point Set – Offsets	(Source: J3067, 3.5.8.3.6.5.3). For each traveler information message in a traveler information packet, a connected device shall include the shape point set defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.3) For each traveler information message in a traveler information packet, a connected device include the shape point set defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.5.4 -- Broadcast Traveler Information - Shape Point Set – Direction	(Source: J3067, 3.5.8.3.6.5.4). For each shape point set in a traveler information message, a connected device shall include the allowed direction of travel along the shape point set as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.4) For each shape point set in a traveler information message, a connected device include the allowed direction of travel along the shape point set as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.5.5 -- Broadcast Traveler Information - Shape Point Set – Width	(Source: J3067, 3.5.8.3.6.5.5). For a shape point set in a traveler information message, a connected device shall include the width for the shape point set as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.5) For a shape point set in a traveler information message, a connected device include the width for the shape point set as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.5.6 -- Broadcast Traveler Information - Shape Point Set - Node Width	(Source: J3067, 3.5.8.3.6.5.6). For a shape point offset in a traveler information message, a connected device shall include the width of the geographic area at that node as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.6) For a shape point offset in a traveler information message, a connected device include the width of the geographic area at that node as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.3.5.7 -- Broadcast Traveler Information - Shape Point Set - Anchor Point	(Source: J3067, 3.5.8.3.6.5.7). For each shape point set in a traveler information message, a connected device shall include the geographic location (latitude, longitude, elevation) of the anchor point for the shape point set defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.6.5.7) For each shape point set in a traveler information message, a connected device include the geographic location (latitude, longitude, elevation) of the anchor point for the shape point set defining where the traveler information message is valid for as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.4 -- Broadcast Traveler Advisories – Content	(Source: J3067, 3.5.8.3.7). For traveler advisory message in a traveler information packet, a connected device shall include the contents of the travel advisory information as part of a traveler information packet broadcasted to connected devices.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.7) For traveler advisory message in a traveler information packet, a connected device include the contents of the travel advisory information as part of a traveler information packet broadcasted to connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.5 -- Broadcast Road Sign – Content	(Source: J3067, 3.5.8.3.8). For each road sign message in a traveler information packet, a connected device shall include the road sign information as part of a traveler information packet broadcasted to connected devices	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.8) For each road sign message in a traveler information packet, a connected device include the road sign information as part of a traveler information packet broadcasted to connected device, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	BC-REQ-3.3.6 -- Broadcast Traveler Information	(Source: J3067, 3.5.8.3.10). For each traveler information message, a connected device shall include the vehicle types that the traveler advisory or road sign is valid for as part of a traveler information message broadcasted to connected vehicles.	* Perform Test Case WRSUDOC-1 * Confirm that (Source: J3067, 3.5.8.3.10) For each traveler information message, a connected device include the vehicle types that the traveler advisory or road sign is valid for as part of a traveler information message broadcasted to connected vehicles, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	MNG-REQ-1.6.1 -- Maximum Transmission Rate - Broadcast Traveler Information	(Source: J3067, G.2.11.1). An RSU shall broadcast a traveler information message to connected devices no more than once per second.	* Perform Test Case WRSUDOC-1 * Confirm (Source: J3067, G2111) an RSU broadcasts a traveler information message to connected devices no more than once per second * Confirmation shows (Source: J3067, G2111) an RSU broadcasts a traveler information message to connected devices no more than once per second, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WRSUDOC-1 -- Inspection of RSU Certification and Test Documents	MNG-REQ-1.6.2 -- Default Transmission Rate - Broadcast Traveler Information	(Source: J3067, G.2.11.2). If the specification does not indicate a default transmission rate, the suggested default transmission rate for an RSU to broadcast a traveler information message to connected devices once per second. If there is no need for an RSU to broadcast a message, then it recommended that no messages be transmitted from the RSU to minimize traffic, i.e., congestion. Otherwise, it is recommended that an RSU transmit a broadcast message frequently enough to ensure that the connected device for which the message is intended, traveling at the expected percentile speed would be within	* Perform Test Case WRSUDOC-1 * Confirm (Source: J3067, G.2.11.2). If the specification does not indicate a default transmission rate, the suggested default transmission rate for an RSU to broadcast a traveler information message to connected devices once per second. If there is no need for an RSU to broadcast a message, then it recommended that no messages be transmitted from the RSU to minimize traffic, i.e., congestion. Otherwise, it is recommended that an RSU transmit a broadcast message frequently enough to ensure that the connected device for which the message is intended, traveling at the expected percentile speed would be within the transmission zone for at least three or four broadcasts. * Confirmation shows (Source: J3067, G2112) If the specification does not indicate a default transmission rate, the suggested default transmission rate for an RSU to broadcast a traveler information message to connected devices	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		the transmission zone for at least three or four broadcasts.	once per second If there is no need for an RSU to broadcast a message, then it recommended that no messages be transmitted from the RSU to minimize traffic, i.e., congestion Otherwise, it is recommended that an RSU transmit a broadcast message frequently enough to ensure that the connected device for which the message is intended, traveling at the expected percentile speed would be within the transmission zone for at least three or four broadcasts, thereby verifying the requirement is satisfied.	
WODEDOC-1 -- Inspection of ODE Design and Test Documents	ODE-REQ-2 -- Data Processing	The Operational Data Environment shall provide the VISA-related functions of CV Data as defined in Section 3.1.4.1 of the SDD.	WODEDOC-1 Verified by inspection of ODE certification and test documents. * Obtain ODE Certification and test documents from Vendor. * Verify ODE provide VISA-related functions of CV Data as defined in Section 3.1.4.1 of the SDD. * Verify requirement is satisfied.	Requirement Verification Confirmed by:
WODEDOC-1 -- Inspection of ODE Design and Test Documents	ODE-REQ-4 -- SCMS	The Operational Data Environment shall interface with the USDOT SCMS, as defined in SCMS-REQ-1.	* Perform Test Case WODEDOC-1 * Confirm ODE interfaces with the USDOT SCMS, as defined in SCMS-REQ-1 (Section 3.1.1). * Confirmation shows the Operational Data Environment interface with the USDOT SCMS, as defined in SCMS-REQ-1, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WODEDOC-1 -- Inspection of ODE Design and Test Documents	ODE-REQ-5 -- LTS	The Operational Data Environment shall interface with the USDOT LTS, as defined in LTS-REQ-1.	* Perform Test Case WODEDOC-1 * Confirm ODE interfaces with the USDOT LTS, as defined in LTS-REQ-1 (Section 3.2). * Confirmation shows the Operational Data Environment interface with the USDOT LTS, as defined in LTS-REQ-1, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDWDOC-1 -- Inspection of DW Design and Test Documents	DW-REQ-3.1 -- Maintain System Data Tables	The DW shall maintain (i.e., update data columns for additional data fields as necessary, build views for authorized audiences needing to	* Perform Test Case WDWDOC-1 * Confirm the DW maintains (e.g., update data columns for additional data fields as necessary, build views for authorized audiences needing to interact with the data) tables of data coming from	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		interact with the data) tables of data coming from connected vehicles and other sources used by the connected vehicle pilot.	connected vehicles and other sources used by the connected vehicle pilot * Confirmation shows the DW maintain (e.g., update data columns for additional data fields as necessary, build views for authorized audiences needing to interact with the data) tables of data coming from connected vehicles and other sources used by the connected vehicle pilot, thereby verifying the requirement is satisfied.	
WDWDOC-1 -- Inspection of DW Design and Test Documents	DW-REQ-3.1.1 -- CVE Data	The DW shall maintain the tables for CVE Data. This includes space for data from BSM related application data, driver/fleet related data, and performance management data.	* Perform Test Case WDWDOC-1 * Confirm the DW maintains the tables for CVE Data. This includes space for data from BSM related application data, driver/fleet related data, and performance management data * Confirmation shows the DW maintain the tables for CVE Data. This includes space for data from BSM related application data, driver/fleet related data, and performance management data, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDWDOC-1 -- Inspection of DW Design and Test Documents	DW-REQ-3.2 -- Manage Data Storage Security	The Data Warehouse shall have a designated TMC data storage administrator who will maintain security for data collected by the CV pilot within compliance of Sections 7(D), 7(E), 7(F), 7(G) and Appendix 11 – SMOC (Section 6.2) of the Institutional Review Board (University of Wyoming, 2016).	* Perform Test Case WDWDOC-1 * Confirm the Data Warehouse has a designated TMC data storage administrator who will maintain security for data collected by the CV pilot within compliance of Sections 7(D), 7(E), 7(F), 7(G) and Appendix 11 Section 62 of the Institutional Review Board * Confirmation shows the Data Warehouse has a designated TMC data storage administrator who will maintain security for data collected by the CV pilot within compliance of Sections 7(D), 7(E), 7(F), 7(G) and Appendix 11 Section 62 of the Institutional Review Board, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDWDOC-1 -- Inspection of DW Design and Test Documents	DW-REQ-3.2.1 -- User Access	The DW shall be implemented to control granular access to the CV data storage at the column to the table space resolution to people with a need to know and	* Perform Test Case WDWDOC-1 * Confirm the DW is implemented to control granular access to the CV data storage at the column to the table space resolution to people with a need to know and that have been approved by	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		that have been approved by the WYDOT program manager.	the WYDOT program manager * Confirmation shows the DW is implemented to control granular access to the CV data storage at the column to the table space resolution to people with a need to know and that have been approved by the WYDOT program manager, thereby verifying the requirement is satisfied.	
WDWDOC-1 -- Inspection of DW Design and Test Documents	DW-REQ-3.2.2 -- Unauthorized Access	The DW shall be implemented to notify the TMC administrator of attempted access by unauthorized personnel to the CV data storage to all users that have not been specifically approved by the WYDOT program manager.	* Perform Test Case WDWDOC-1 * Confirm the DW is implemented to notify the TMC administrator of attempted access by unauthorized personnel to the CV data storage to all users that have not been specifically approved by the WYDOT program manager * Confirmation shows the DW is implemented to notify the TMC administrator of attempted access by unauthorized personnel to the CV data storage to all users that have not been specifically approved by the WYDOT program manager, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDWDOC-1 -- Inspection of DW Design and Test Documents	DW-REQ-3.3 -- Manage Data System	The Data Warehouse shall have a designated TMC data storage administrator who will manage the data systems for the CV pilot.	* Perform Test Case WDWDOC-1 * Confirm the Data Warehouse has a designated TMC data storage administrator who will manage the data systems for the CV pilot * Confirmation shows the Data Warehouse has a designated TMC data storage administrator who will manage the data systems for the CV pilot , thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDWDOC-1 -- Inspection of DW Design and Test Documents	DW-REQ-3.3.1 -- System Back-ups	The DW shall provide the TMC administrator the ability to back up the data, provided by the WYDOT CV System, using WYDOT best practices for data protection, as stated in Section 2.5 of the Data Management Plan (FHWA-JPO-17-470) (Kitchener et al., 2017). This will be done for the development,	* Perform Test Case WDWDOC-1 * Confirm the DW provides the TMC administrator the ability to back up the data, provided by the WYDOT CV System, using WYDOT best practices for data protection, as stated in Section 25 of the Data Management Plan * Confirmation shows the DW provide the TMC administrator the ability to back up the data, provided by the WYDOT CV System, using WYDOT best practices for data protection, as	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		test, quality assurance and production environments.	stated in Section 25 of the Data Management Plan, thereby verifying the requirement is satisfied.	
WDWDOC-1 -- Inspection of DW Design and Test Documents	DW-REQ-3.3.2 -- Import/Export	The DW shall provide the TMC administrator the ability to perform import/export operation as needed for the CV pilot data.	* Perform Test Case WDWDOC-1 * Confirm the DW provides the TMC administrator the ability to perform import/export operation as needed for the CV pilot data * Confirmation shows the DW provides the TMC administrator the ability to perform import/export operation as needed for the CV pilot data, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDWDOC-1 -- Inspection of DW Design and Test Documents	DW-REQ-3.3.3 -- Version Control	The DW shall provide the TMC administrator the ability to maintain version control for the data systems in use by the CV pilot.	* Perform Test Case WDWDOC-1 * Confirm the DW provides the TMC administrator the ability to maintain version control for the data systems in use by the CV pilot * Confirmation shows the DW provides the TMC administrator the ability to maintain version control for the data systems in use by the CV pilot, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
WDWDOC-1 -- Inspection of DW Design and Test Documents	DW-REQ-3.4 -- Manage Data Archive	The DW shall provide the TMC administrator the ability to archive data used by the CV pilot data to be retained using WYDOT best practices for data archival, as stated in Section 2.5 of the Data Management Plan (FHWA-JPO-17-470) (Kitchener et al., 2017).	* Perform Test Case WDWDOC-1 * Confirm the DW provides the TMC administrator the ability to archive data used by the CV pilot data to be retained using WYDOT best practices for data archival, as stated in Section 25 of the Data Management Plan * Confirmation shows the DW provide the TMC administrator the ability to archive data used by the CV pilot data to be retained using WYDOT best practices for data archival, as stated in Section 25 of the Data Management Plan, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

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Connected Vehicle Pilot Deployment Program Phase 2

Operational Readiness Plan – WYDOT CV Pilot

Attachment C - Operational Readiness Demonstration Plan

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Final

FHWA-JPO-17-472C

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Produced by DTFH6116H00027

U.S. Department of Transportation

Notice

Technical Report Documentation Page

1. Report No. FHWA-JPO-17-472C	**2. Government Accession No.**	**3. Recipient's Catalog No.**
4. Title and Subtitle Connected Vehicle Pilot Deployment Program Phase 2, Operational Readiness Plan – WYDOT CV Pilot Attachment C - Operational Readiness Demonstration Plan		**5. Report Date** Final 3/16/2018 **6. Performing Organization Code**
7. Author(s) Denny Stephens (Vital Assurance), Tony English (Trihydro), Nayel Ureña Serulle (ICF), Deepak Gopalakrishna (ICF), Vince Garcia (Wyoming DOT)		**8. Performing Organization Report No.** Task 2G Operational Readiness Test and Demonstration Planning Report Number T2G.02.01
9. Performing Organization Name and Address Wyoming DOT, 5300 Bishop Boulevard, Cheyenne, WY 82009 ICF International, 1725 Eye St NW, Washington DC, 20006 Trihydro Corporation, 1252 Commerce Drive, Laramie, WY 82070 Vital Assurance, 175 S. Third St., Suite 200, Columbus, OH 43215		**10. Work Unit No. (TRAIS)** **11. Contract or Grant No.** DTFH6116H00027
12. Sponsoring Agency Name and Address U.S Department of Transportation 1200 New Jersey Ave, SE Washington, DC 20590		**13. Type of Report and Period Covered** Operational Readiness Plan, 09/01/2016 to 3/20/2018 14. Sponsoring Agency Code
15. Supplementary Notes Kate Hartman (COR), Sarah Tarpgaard (CO)		

16. Abstract

The Wyoming Department of Transportation's (WYDOT) Connected Vehicle (CV) Pilot Deployment Program is intended to develop a suite of applications that utilize vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communication technology to reduce the impact of adverse weather on truck travel in the I-80 corridor. These applications support a flexible range of services from advisories, roadside alerts, parking notifications and dynamic travel guidance. Information from these applications are made available directly to the equipped fleets or through data connections to fleet management centers (who will then communicate it to their trucks using their own systems). The pilot will be conducted in three Phases. Phase I includes the planning for the CV pilot including the concept of operations development. Phase II is the design, development, and testing phase. Phase III includes a real-world demonstration of the applications developed as part of this pilot.

This document is the WYDOT CV Pilot Operational Demonstration Plan which is Attachment C to the Operational Readiness Plan (ORP) for The WYDOTCV Pilot project for the United States Department of Transportation's (USDOT) CV program. The purpose of this document is to describe plans for end-to-end demonstration of the WYDOT CV Pilot System to demonstrate to WYDOT leadership, USDOT, and other stakeholders that the WYDOT Connected Vehicle Pilot Deployment (CVPD) meets functional and performance requirements and is ready for full deployment in Phase 3 of the program.

17. Key Words Connected Vehicle Technology, I-80 Corridor, Road Weather, Truck Safety, System Architecture	**18. Distribution Statement** This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161

19. Security Classif. (of this report) None	**20. Security Classif. (of this page)** None	**21. No. of Pages** 58	**22. Price** NA

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

Acknowledgements

The Operational Readiness Plan development team would like to thank USDOT and Noblis for their technical assistance throughout the development of this document.

Table of Contents

1 Introduction 1
1.1 Project Scope 1
1.2 Purpose of the Operational Readiness Demonstration Plan 2
1.3 Scope of the Operational Readiness Demonstration Plan 2
1.3.1 Schedule and Timing of the Operational Readiness Demonstration 3
1.4 Document Organization 5
2 References 6
3 Overview of WYDOT CV Pilot End-to-end System Operational Readiness Demonstrations .. 7
3.1 Readiness Demonstration Overview 9
3.2 Readiness Demonstration Event 9
3.3 Demonstration Test Cases 10
3.3.1 Requirements Verification 13
3.4 Demonstration Test Case Detailed Descriptions 13
3.5 Demonstration Locations 13
3.6 Participating Vehicles 14
3.7 WYDOT CV Pilot System Configuration 14
3.8 Applications Being Demonstrated 15
3.9 Test Tools 15
3.10 Demonstration Schedule 15
3.11 Demonstration Personnel 15
3.12 Participation 15
3.13 Security 15
3.14 Safety Checklist 16
4 Detailed Operational Readiness Demonstration Test Case Descriptions 17
4.1 Forward Collision Warning Track Demonstration Test Procedure and Test Cases 18
4.1.1 Forward Collision Warning Track Demonstration Test Procedure 18
4.1.2 Forward Collision Warning Track Demonstration System Component Configuration and Initialization 21
4.1.3 Forward Collision Warning Track Demonstration Test Cases 25
4.1.4 Forward Collision Warning Track Demonstration Requirements Analysis 27

4.2 I2V Situational Awareness Demonstration Test Procedure and Test Cases 31
4.2.1 I2V Situational Awareness Track Demonstration Test Procedure 31
4.2.2 I2V Situational Awareness Track Demonstration System Component Configuration and Initialization 34
4.2.3 I2V Situational Awareness Track Demonstration Test Cases........................... 38
4.2.4 I2V Situational Awareness Track Demonstration Requirements Analysis 40
5 Glossary and Acronyms 46

List of Figures

Figure 1-1. Sequencing from Pilot development to Fully Operational Deployment (Source: WYDOT). 4
Figure 3-1. WYDOT CV Pilot Performance Measurement Categories (Source: WYDOT). 7
Figure 3-2. WYDOT CV Pilot System Physical Architecture (Source: WYDOT). 8
Figure 3-3. Satellite view of Laramie County Fairgrounds (Source: WYDOT). 14

List of Tables

Table 2-1. References. 6
Table 3-2. Cross tabulation of Demonstration Cases against ConOps Objectives....................... 12
Table 5-1. Glossary of Terms. 46
Table 5-2. Acronym List.. 47

1 Introduction

1.1 Project Scope

Wyoming is one of the first wave of CV Pilot sites selected to showcase the value of and spur the adoption of CV technology in the United States. CV technology is a broad term to describe the applications and the systems that leverage dedicated short-range communications (DSRC) for vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I) and infrastructure-to-vehicle (I2V) communication to improve safety, mobility and productivity of the users of the nation's transportation system.

As one of the three selected pilots, WYDOT is focusing on improving safety and mobility by creating new ways to communicate road and travel information to commercial truck drivers and fleet managers along the 402 miles of Interstate 80 (I-80 henceforth) in the State. For the pilot project, WYDOT concluded Phase 1 (planning) in September 2016 and then initiated Phase 2 (deployment) which is scheduled to conclude in mid-2018. This will be followed by an 18-month demonstration period in the third phase.

Systems and applications developed in the pilot will enable drivers of connected vehicles to have improved awareness of potential hazards and of situations they cannot see. At a very high level, the pilot scope includes the following implementation elements:

- **Deploy about 75 roadside units (RSU)** that can receive and broadcast messages using DSRC along various sections on I-80.
- **Equip around 400 vehicles, a combination of fleet vehicles and commercial trucks, with on-board units (OBU).** Of the 400 vehicles, at least 150 are planned to be heavy trucks. All vehicles are expected to be regular users of I-80. Several types of OBUs are being procured as part of the pilot and differ based on their communication capabilities, ability to integrate with the in-vehicle network, and connectivity to ancillary devices and sensors. All OBUs will have the functionality to broadcast Basic Safety Messages (BSM) Part I and will include a human-machine interface (HMI) to share alerts and advisories to drivers of these vehicles.
- **Develop several V2V, V2I, I2V applications** that will enable communication to drivers of alerts and advisories regarding various road conditions. These applications include support for in-vehicle dissemination of advisories for collision avoidance, speed management, detours, parking, and presence of work zones and maintenance and emergency vehicles downstream of their current location.
- **Enable overall improvements in WYDOT's traffic management and traveler information practices** by using data collected from connected vehicles. Targeted improvements include ingesting more location specific mobile road weather information system (RWIS) data, using Pikalert®1 to provide for more accurate and road segment specific conditions to define better variable speed limits (VSLs), and improving road

[1] Pikalert is a trademark of the University Corporation for Atmospheric Research.

condition dissemination via 511, Dynamic Message Signs (DMS) and other WYDOT sources.

1.2 Purpose of the Operational Readiness Demonstration Plan

This document is the WYDOT CV Pilot Operational Demonstration Plan which is Attachment C to the Operational Readiness Plan (ORP) for The Wyoming Department of Transportation (WYDOT) Connected Vehicle (CV) Pilot project for the United States Department of Transportation's (USDOT) CV program. The purpose of this document is to describe plans for conducting end-to-end demonstration of the WYDOT CV Pilot System to demonstrate to WYDOT leadership, USDOT, and other stakeholders that the WYDOT Connected Vehicle Pilot Deployment (CVPD) meets functional and performance requirements and is ready for full deployment in Phase 3 of the program.

The WYDOT Team has identified ten operational readiness measures by which it will track and monitor progress toward readiness for Phase 3 deployment. These ten measures, described in detail in the WYDOT CV Pilot Operational Readiness Plan, document, are

1. End-to-end System Development and Integration
2. End-to-End System Operational Readiness Testing
3. Acquisition, Installation, and Production Deployment Readiness
4. Operational Readiness Demonstration
5. Performance Measurement and Evaluation Support Readiness
6. Planning and Design Readiness
7. Operations and Maintenance Procedures Readiness
8. Training and IRB Readiness
9. Institutional, Staff, and Financial Readiness
10. Safety, Security, and Privacy Readiness

An important part of the program is conducting operational readiness demonstrations under Measure 3. The WYDOT Team will conduct a demonstration of a subset of Test Cases, described in Attachment B WYDOT CV Pilot Operational Readiness Test Plan, for USDOT and other stakeholders, to show that the primary project objectives have been achieved and that the system and team are ready to follow through with full deployment and implementation.

1.3 Scope of the Operational Readiness Demonstration Plan

The WYDOT Team demonstrations will focus on conducting End-to-end Applications Performance Test Cases from the Test Plan. These demonstrations cases are selected by the Team to verify the functionality and performance of WYDOT CV Pilot applications:

- Forward Collision Warning
- I2V Situational Awareness Spot Weather Impact Warning (from RSU)

These demonstrations will verify that valuable traveler information from WYDOT back office systems are sent to the DB and are accurately captured in CV traveler information messages (TIMs). They verify that receiving vehicles accurately parse the TIMs and deliver traveler information to the drivers at the right location. These demonstrations also confirm the implementation of Forward Collision Warning application.

This approach for demonstration of System Operational Readiness is designed to confirm that the component development and integration (outlined under Measure 1 in Chapter 3 of the Operational Readiness Plan) has been completed correctly and that the system delivers the functionality and performance it has been designed to.

This approach assumes that developers have performed component and subsystem testing and requirements verification as part of their development and integration process. These demonstrations provide objective confirmation, at the end-to-end system level, that requirements are satisfied and that development and integration has been completed successfully. Demonstration Plans in Section 4 of this document show requirements traceability for the demonstrated test cases.

1.3.1 Schedule and Timing of the Operational Readiness Demonstration

Operational Readiness Demonstrations will take place at a major milestone in the project, when the system is nearly completely developed and before Winter 2017-2018 shakedown testing. One of the major emphases of this project is to improve safety of trucks operating on I-80 during the winter. Consequently, it is critical that the Team conduct shakedown testing during the Winter 2017-2018 season. The USDOT SCMS is not ready to support system operations during this Winter shakedown period. At this milestone, the Team can demonstrate the functionality and performance of the system, but it is not ready for comprehensive final testing and requirements verification. Figure 1-1 Illustrates the WYDOT CV Pilot System development, integration and test process, showing timing of the Operational Readiness Demonstration, following development and development team testing, prior to shakedown, system refinement and final system testing and requirements documentations.

This version of the demonstration plan represents status of plans approximately one month prior to conducting the demonstration. Plans for this event are expected to vary, up until the date of the event. Final adjustments to the plan will be provided to participants in handouts at the Event.

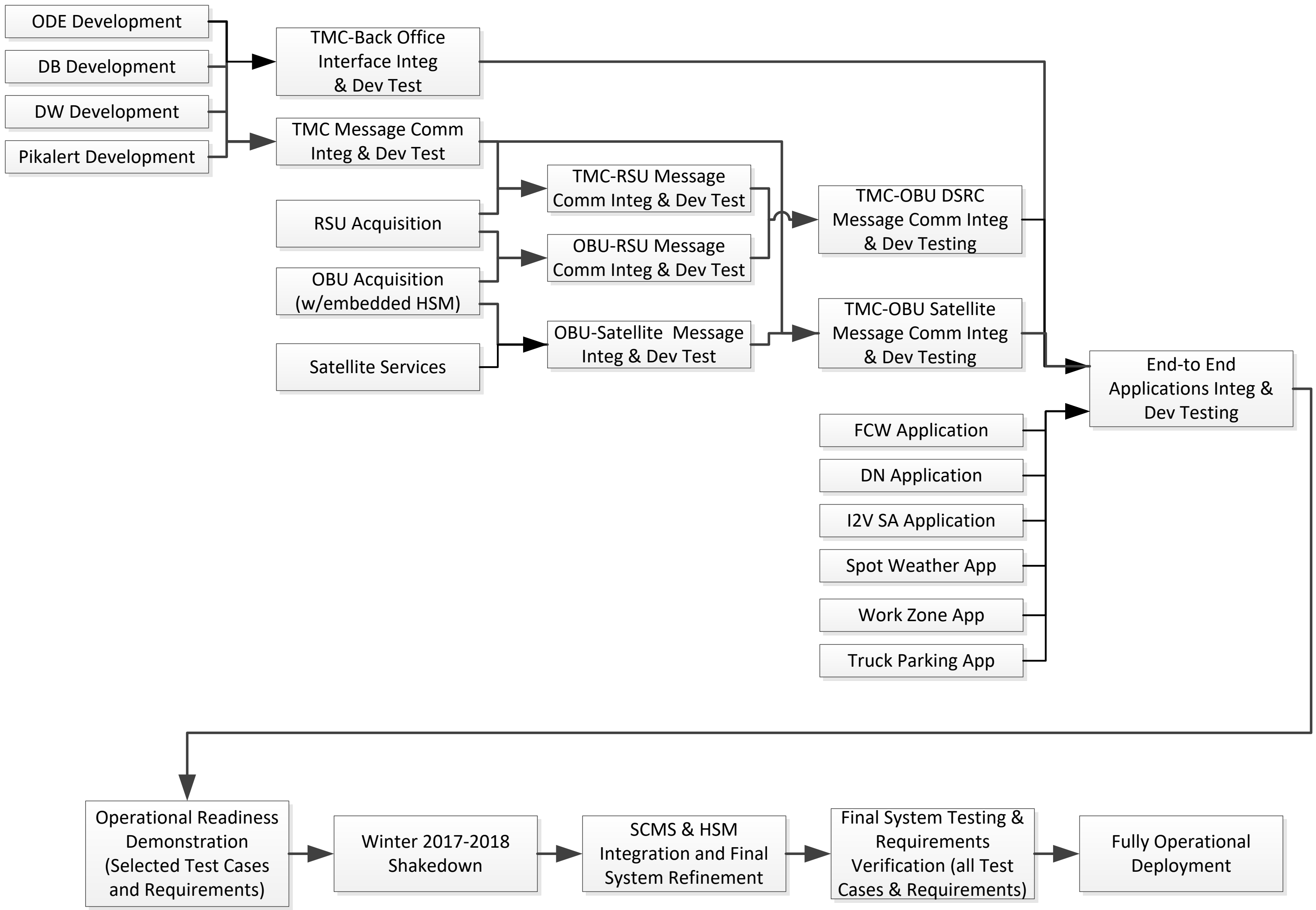

Figure 1-1. Sequencing from Pilot development to Fully Operational Deployment (Source: WYDOT).

1.4 Document Organization

This WYDOT CV Pilot Operational Readiness Test Plan is organized into 5 chapters

1. Introduction
2. References
3. Overview of WYDOT CV Pilot End-to-end Operational Readiness Demonstrations
4. Detailed Operational Readiness Demonstration Descriptions
5. Glossary and Acronyms

2 References

The following table lists the documents and sources used and referenced to develop the concepts in this document.

Table 2-1. References.

#	Documents, Sources Referenced
1	Deepak Gopalakrishna, et al. (2015). *CV Pilot Deployment Program Phase 1, Concept of Operations (ConOps), ICF/Wyoming (FHWA-JPO-16-287)*. US Department of Transportation.
2	Deepak Gopalakrishna, et al. (2016b). *Connected Vehicle Pilot Deployment Program Phase 1, System Requirements Specification (FHWA-JPO-16-291) – ICF/Wyoming.* U.S Department of Transportation.
3	Deepak Gopalakrishna, et al. (2016a). *Connected Vehicle Pilot Deployment Program Phase 1, Application Deployment Plan – ICF/Wyoming (FHWA-JPO-16-292).* U.S Department of Transportation.
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11	Tony English, et al. (2017). *Connected Vehicle Pilot Deployment Program, Interface Control Document, WYDOT CV Pilot (FHWA-JPO-17-468a).* U.S Department of Transportation.
12	Tony English, et al. (2017). *Connected Vehicle Pilot Deployment Program, Comprehensive Acquisition Plan, WYDOT CV Pilot.* U.S Department of Transportation.
13	Tony English, et al. (2017). *Connected Vehicle Pilot Deployment Program, Comprehensive Installation Plan, WYDOT CV Pilot (FHWA-JPO-17-471).* U.S Department of Transportation.
14	Denny Stephens, et al. (2017). *Connected Vehicle Pilot Deployment Program, Operational Readiness Plan, WYDOT CV Pilot (FHWA-JPO-17-472).* U.S Department of Transportation.

3 Overview of WYDOT CV Pilot End-to-end System Operational Readiness Demonstrations

The WYDOT CV Pilot Team has identified 21 potential improvements in efficiency, safety, and mobility performance offered by this Pilot Deployment. These 21 performance measures are organized in eight (8) performance categories as shown in Figure 3-1. These eight performance categories focus represent the primary activities and outcomes of the Wyoming CV Pilot system, including data collection, information dissemination, alerts, and advisories shared between vehicles and roadside, improved speed adherence and reduced crash rates. The performance measures are detailed in the project Performance Measurement and Evaluation Support Plan.

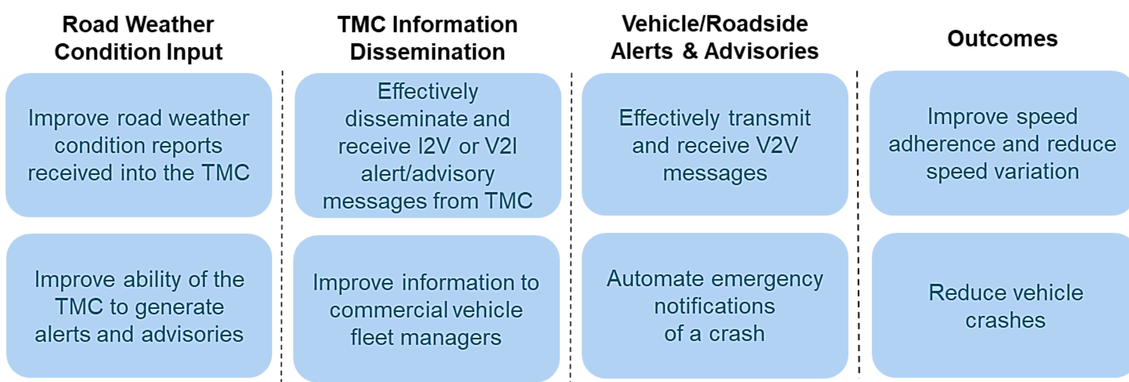
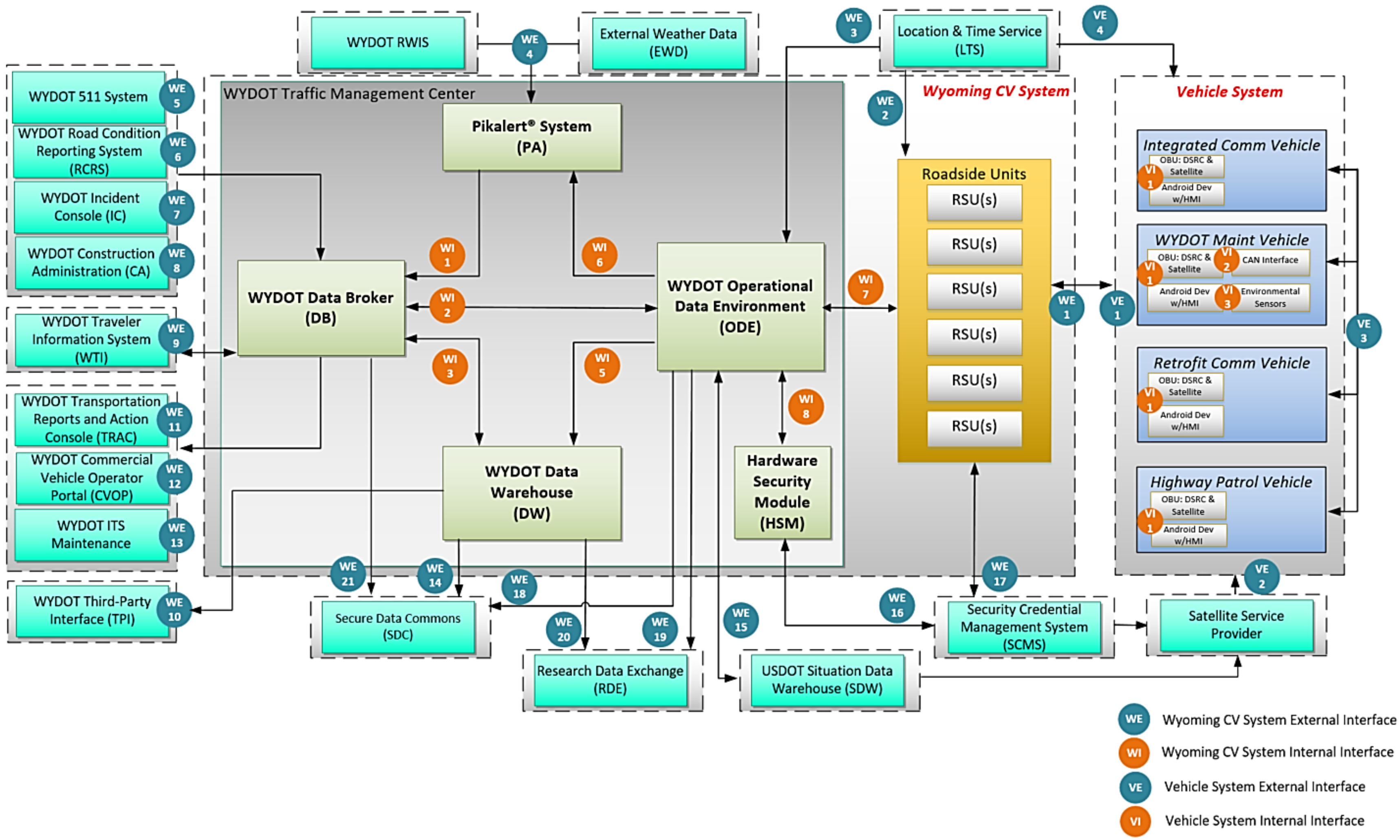


Figure 3-1. WYDOT CV Pilot Performance Measurement Categories (Source: WYDOT).

The WYDOT CV Pilot System developed to accomplish these enhancements is described in the project system engineering reports, including the Concept of Operations (ConOps), System Architecture Document (SAD), System Design Document (SDD), and Interface Control Document (ICD) identified in Chapter 2 References. This system is illustrated by the physical architectural diagram, shown below in Figure 3-2. Readiness to support full operations requires the successful development and testing of each of the components identified in this diagram, and the successful integration through each interface, enabling the system to communicate information and messages from back office systems on the left side of the diagram to vehicles and drivers on the right side of the diagram. Detailed descriptions are provided in the aforementioned project system engineering reports.



NOTE: The Wyoming CV System Interface WI4 (PA→DW) was not implemented in the final system design.

Under Measure 2 of Operational Readiness the WYDOT Team will undertake a series of tests, organized as test cases, which will verify that component development and integration has been successfully completed, that messages and information are accurately communicated across the system, and that the system is fully operational and ready for Phase 3 deployment. These tests are expected to take place over a period of weeks. Each test will be repeated multiple times to verify robustness of the system.

This Demonstration Plan identifies a subset of the test cases that will be performed as part of a demonstration event.

3.1 Readiness Demonstration Overview

A key component of readiness will be a demonstration for the USDOT and stakeholders demonstrating that the WYDOT CV Pilot system is fully functional and operational, ready for full deployment. The WYDOT Team proposes to conduct an in-person demonstration of its systems near the completion of system development, in mid-November, prior to Winter 17-18 shakedown period. This in-person demonstration will be followed as needed by virtual demonstrations of system operations, prior to full deployment and implementation in Phase 3 of the program.

Readiness demonstrations will consist of TMC tours and ride-along demonstrations of application end-to-end functionality, showing that the WYDOT CV Pilot has the functionality and performance to support WYDOT’s current and future needs for CV support. The agenda for this demonstration event will include the following:

- Repeat selected Application End-to-End System Level Acceptance Tests which demonstrate end-to-end functionality and performance, and readiness for deployment. These demonstrations will verify
    - System Components Readiness
    - System Functions Readiness
    - Applications Readiness
    - Operational Scenarios Readiness
- Review plans for Requirements Verification

3.2 Readiness Demonstration Event

The WYDOT Team envisions the Pilot Readiness Demonstration as part of a two-day event. The first day will be the formal project application end-to-end system readiness demonstrations by the WYDOT Team for the USDOT and Noblis. The second day will expand to provide demonstrations for Wyoming transportation and governmental agencies and officials and fleet partners in a mini-showcase. This mini-showcase will provide opportunities for dialogue between the USDOT, Wyoming agencies and officials and fleet partners. On the second day, in parallel with the mini-showcase, WYDOT system engineers will provide a review of Requirements Verification and Acceptance Test documentation for Noblis and interested USDOT stakeholders.

The Operational Readiness Event will provide participants with an opportunity to inspect key components of the system including

- Vehicles
    - Integrated Commercial Vehicle with Lear Roadstar OBU
    - WYDOT Maintenance Vehicle with Lear Roadstar OBU

- Lear RSUs
- TMC Back Office Systems
    - WYDOT 511 System
    - WYDOT Road Condition Reporting System (RCRS)
    - WYDOT Incident Console (IC)
    - WYDOT Construction Administration (CA)
    - WYDOT Traveler Information System (WTI)
    - WYDOT Third Party Interface (TPI)
    - WYDOT Trans Reporting and Action Console (TRAC)
    - WYDOT Commercial Vehicle Operator Portal (CVOP)
    - WYDOT Maintenance Dispatch
- CV Pilot TMC Components with visual displays
    - Pikalert System

Functionality of the Data Broker, Operational Data Environment, and Data Warehouse will be demonstrated through end-to-end System demonstrations.

3.3 Demonstration Test Cases

The WYDOT Team will provide USDOT and stakeholder with ride-along demonstrations of application end-to-end functionality. Following demonstration of the initiation of I2V advisories for drivers from WYDOT back office systems, participants will observe Forward Collision Warning, and I2V Situational Awareness application performance. These demonstrations will be repetitions of the selected test cases being performed by WYDOT Team members. The test procedures and test cases planned for the event include:

- Test Procedure DWFCWT Forward Collision Warning Track Demonstration
    - Objectives
        - Verify the FCW application issues an advisory FCW alert when there is a potential for forward collision with a vehicle directly ahead in the same lane of travel.
        - Verify the FCW application issues an imminent FCW alert when there is an imminent threat of forward collision with a vehicle directly ahead in the same lane of travel and immediate action is required from the driver to avoid the collision.
        - Verify requirements associated with Demonstration Case.
    - Test Cases to be performed
        - DWFCWT-1 -- FCW Stopped Vehicle Ahead
- Test Procedure DWI2VSAT I2V Situational Awareness Track
    - Objectives
        - Verify that Back Office Component compiles and delivers Driver Advisory/Warning information to DB
        - Verify that DB correctly compiles I2VSA TIM from Back Office Component information
        - Verify TIM is delivered to vehicles via DSRC
        - Verify I2VSA TIM is received by OBU
        - Verify TIM is parsed correctly and Driver Advisory/Warning display begins and ends display at correct geofence milepost or does not display as required.
    - Test Cases to be performed

    - DWI2VSAT-Pikalert - Pikalert TIM

These Test Procedures and Test Cases are detailed in Chapter 4 of this document.

Table 3-1 provides a cross-tabulation of Demonstration Cases versus objectives from the WYDOT CV Pilot Concept of Operations illustrating that these demonstration cases will verify

- System components readiness,
- System functions readiness,
- Applications readiness, and
- Operational scenarios readiness.

Table 3-1. Cross tabulation of Demonstration Cases against ConOps Objectives

Demo Case No. and Demo Case Title	**Demonstrate System Components Readiness**					**Demonstrate System Functions Readiness**							**Demonstrate Applications Readiness**		**Demonstrate Op Scenario Readiness**		
	Vehicles	Roadside Infrastructure	Centers	Personnel	Communications Infrastructure	Collect Road and Weather Data	Share Integrated and Fused Advisories	Provide Dynamic Travel Information	Share Safety and Road Condition Mess	Collect Messages from Other CVs	Collect Messages from Infrastructure	Forward Collision Warning	Situational Awareness	Spot Weather Impact Warning	Corridor Monitoring & Operations Support	Truck Advisories	Truck Warning
DWFCWT-1 -- FCW Stopped Vehicle Ahead	X									X		X					
DWI2VSAT-Pikalert -- Pikalert TIM	X	X	X	X	X	X	X	X	X		X		X	X		X	X

3.3.1 Requirements Verification

As shown in the *Attachment B. WYDOT CV Pilot Operational Readiness Test Plan*, a majority of the system requirements are verified by inspection of event and component logs from the system, after completion of the test procedure. The *Test Plan* identifies all requirements that are verified by completion of each test case. As part of the Operational Readiness Demonstration, test engineers will perform that document inspection and show verification of selected, key requirements. Because of the sheer number of requirements addressed by these key Test Cases, a representative subset will be verified as part of the demonstration event.

3.4 Demonstration Test Case Detailed Descriptions

Chapter 4 of this document describes the details of the demonstration test procedures and demonstration test cases to be performed, including requirements verified.

3.5 Demonstration Locations

For convenience and cost management, demonstrations outlined here are planned to be performed near Cheyenne, Wyoming where WYDOT's Headquarters is located. Demonstrations outlined here consist of demonstrations to performed on a "test track" and demonstrations to be performed "on-road." For the test track demonstration, the facilities and roads within the Laramie County Fairgrounds will be used, see Figure 3-3. Prairie Center Circle is a good track for tests which simulate in-cab display of weather and other advisories and alerts to the driver at the right time and location as a car, a snow plow, and a tractor-trailer traverse the roadway. Additionally, Archer Parkway is a good location for testing forward collision warning in cars approaching slow moving snowplows. Parking areas within the location support preparation and staging of vehicles. In addition, the classrooms and other facilities at the Cheyenne/Laramie County Emergency Management Agency are very helpful for supporting meetings and guests during demonstrations.

Figure 3-3. Satellite view of Laramie County Fairgrounds (Source: WYDOT).

3.6 Participating Vehicles

Demonstrations are planned to be conducted using Test Engineer vehicle using Lear Roadstar OBU and Lear FCW and I2V SA applications

WYDOT Maintenance Vehicles (including snowplows) will be present at the demonstration to illustrate installation of the WYDOT CV Pilot System in the vehicle.

3.7 WYDOT CV Pilot System Configuration

As discussed in the introduction, Operational Readiness Demonstrations will take place at a major milestone in the project, when the system illustrated in Figure 3-2 and described in the SDD, is nearly completely developed and before Winter 2017-2018 shakedown testing. One of the major emphases of this project is to improve safety of trucks operating on I-80 during the winter. Consequently, it is critical that the Team conduct shakedown testing during the Winter 2017-2018 season. The USDOT SCMS is not ready to support system operations during this Winter shakedown period. At this milestone, the Team will demonstrate the functionality and performance of the system, but it is not ready for comprehensive final testing and requirements verification. Figure 1-1 Illustrates the WYDOT CV Pilot System development, integration and test process, showing timing of the Operational Readiness Demonstration, following development and development team testing, prior to shakedown, system refinement and final system testing and requirements documentations.

3.8 Applications Being Demonstrated

Because demonstrations described here are end-to-end demonstrations of the WYDOT CV Pilot system, they will be conducted with the complete applications described in the SDD, configured for full operations. These include

- Forward Collision Warning
- I2V Situational Awareness with Spot Weather Impact Warning from Pikalert

3.9 Test Tools

No specialized test tools are planned for conducting these demonstrations. Results of most tests will be confirmed through inspection of logs from relevant components or inspection of the contents of relevant databases.

3.10 Demonstration Schedule

It is anticipated that these demonstrations will be conducted November 15-16, 2017. Scheduling details will be provided as soon as they can be confirmed by USDOT, Noblis and the WYDOT Team.

3.11 Demonstration Personnel

All demonstrations defined within this document will be performed by the WYDOT CV Pilot Team and/or its vendors.

3.12 Participation

USDOT and Noblis representatives are invited to participate in these demonstrations. Demonstrations may be repeated for stakeholders selected by WYDOT and the WYDOT Team.

3.13 Security

The WYDOT CV Pilot Team developed a detailed Security Management Operating Concept (SMOC) during Phase 1 of the program. The SMOC describes, at a high level, the elements to be implemented to meet system security and address how this pilot will use the Security Credential Management System (SCMS) for proposed applications. As described in the Operational Readiness Plan, security will be tracked and reported through verification of security and SCMS requirements by inspection and by security compliance inspection of each component and each interface (data encryption, transport encryption, signature validation, etc.).

3.14 Safety Checklist

There will be multiple vehicles moving at a high rate of speed during demonstrations, which greatly increases the risks for an adverse incident. WYDOT will assign a single Safety Officer for the duration of the demonstrations, who will have the responsibility for coordinating all elements of the demonstration and the full authority to halt the demonstrations at any time for any reason if they believe that there is a safety risk. To further mitigate these risks, the following safety checklist will be exercised immediately prior to the execution of a demonstrations.

- Verify that all drivers, and test coordinators have working operational radio's or similar devices for two-way communication to the Safety Officer.
- Verify that safety vests or other approved uniforms for traffic incidents are being worn by all participants and observers who are outside of a vehicle.
- Verify an "all-clear" status of the track prior to initiation of any vehicle lap on the track
- All Observers and Participants are accounted for and are at the appropriate position/location for the test.
- Perform a safety briefing for all Observers and Participants.
- Verify that all vehicles are in full operational condition.
- Verify weather conditions support the demonstration (i.e., no lightning and visibility issues)
- Verify that the appropriate equipment for convenience and safety is available including:
    - Water for participants and observers
    - Bathroom accommodations for participants and observers
    - Fire extinguishers
    - Shelter from adverse weather events
    - Rendezvous point should a site evacuation be needed.

4 Detailed Operational Readiness Demonstration Test Case Descriptions

Following are the detailed descriptions of the Demonstration Test Cases summarized in Chapter 3. The individual demonstration test cases may be located from the List of Tables at the beginning of this document.

4.1 Forward Collision Warning Track Demonstration Test Procedure and Test Cases

4.1.1 Forward Collision Warning Track Demonstration Test Procedure

Table DWFCWT-1. Forward Collision Warning Track Demonstration Test Procedure

Demonstration Test Procedure ID	DWFCWT	Test Staff remarks
Demonstration Test Procedure Name	Forward Collision Warning Track Demonstration Test Procedure	Adapted from Attachment B Test Procedure WFCWT
Priority	Required	
Objectives	• Verify the FCW application issues an advisory FCW alert when there is a potential for forward collision with a vehicle directly ahead in the same lane of travel. • Verify the FCW application issues an imminent FCW alert when there is an imminent threat of forward collision with a vehicle directly ahead in the same lane of travel and immediate action is required from the driver to avoid the collision. • Verify requirements associated with Demonstration Case.	
Relationship to Other Procedures	• DWFCWT Demonstration Cases may not be performed concurrently to avoid interaction between multiple host vehicles.	
Discussion, Guidance, and Rationales	• The test speed of 35 mph was selected by experience in prior tests (Bogard, 2014) as an FCW test speed that can be safely handled by test engineers. 35 mph is the posted speed for the Archer Facility Prairie Center Circle used as test track. Higher test speeds for FCW require professionally trained test drivers and driver protection equipment such as that used by race car drivers. • 300m is the design communication range for DSRC, per SAE J2945/1.	
Prior to Conducting Test	• Verify configuration of each system and test component complies with Configuration for Forward Collision Warning Track Demonstration Test Procedure and Test Cases described in Table DWFCWT-2. • Prepare each system and test component in accordance with Initialization for Forward Collision Warning Track Demonstration Test Procedure and Test	

Table DWFCWT-1. Forward Collision Warning Track Demonstration Test Procedure

Demonstration Test Procedure ID	DWFCWT	Test Staff remarks
	Cases described in Table DWFCWT-2. • Conduct dry runs of Demonstration Test Procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Demonstration Test Procedure Steps:	Conduct following Demonstration Test Procedure Step for each Demonstration Test Case described in Table DWFCWT-3.	

1 (Verify Readiness for Test)	• Verify WYDOT CV Pilot TMC System is operational and ready for test
	• Verify RSUs are operational and ready for test
	• Cycle Remote Vehicle power and reboot vehicle system.
	• Verify Remote vehicle systems are operational and ready for test
	    ○ OBU to HMI communications
	    ○ GPS fix
	• Cycle Host Vehicle power and reboot vehicle system.
	• Verify Host vehicle systems are operational and ready for test
	    ○ OBU to HMI communications
	    ○ GPS fix
	• Conduct Safety Inspection of the test area and vehicle path and confirm ready for test
	    ○ No obstructions or interference
	    ○ All staff where they are supposed to be, no staff where they aren't supposed to be
	    ○ Weather is acceptable and will not lead to hazardous driving conditions
	    ○ Road surface is acceptable and will not lead to hazardous driving conditions	

2 (Test Start Up)	• Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational • Remote vehicle driver inspects visual indicators to confirm that vehicle system is fully operational • Host and remote vehicle drivers inspect driving area and confirm track is clear and ready for test.	

Table DWFCWT-1. Forward Collision Warning Track Demonstration Test Procedure

Demonstration Test Procedure ID	DWFCWT	Test Staff remarks
	• Host and Remote Vehicle Drivers notify each other that vehicles, drivers and track are ready to conduct Demonstration Test Procedure	
3 (Conduct Demonstration Test Case)	• Conduct Demonstration Test Case Described in **Error! Reference source not found.**3. • Remote vehicle enters track or roadway and performs Remote Vehicle Driving Scenario (TC Input 1). • Host vehicle enters track or roadway and performs Host Vehicle Driving Scenario (TC Input 2). • Test Staff observe Driver Advisory/ Warning Displayed (TC Output).	•
4 (Stop and wrap up)	• Host Vehicle and Remote Vehicle each drive past RSU and upload OBU and HMI Event Logs to ODE through RSU via DSRC. • Host Vehicle and Remote Vehicle return to staging area • Test Staff record visually observed actual results	
5 (Post-test record capture)	Test Staff download and store Log Files on External Test File Folder • Remote Vehicle OBU and HMI Event Log files • Host Vehicle OBU and HMI Event Log files Test Staff make backup Copy of External Test File Folder	
6 (Post-test log analysis)	Test Analysts analyze system logs and verify Demonstration Test Case actual results from log analysis.	.
7 (Post-test Requirements Verification)	Test Analysts perform the Requirement Verification Processes for Demonstration Test Case described in Table DWFCWT-4.	

4.1.2 Forward Collision Warning Track Demonstration System Component Configuration and Initialization

Table DWFCWT-2. Forward Collision Warning Track Demonstration System Component Configuration and Initialization

System Component	Applicable Test Cases	Configuration for Forward Collision Warning Track Demonstration Test Procedure and Test Cases	Initialization for Forward Collision Warning Track Demonstration Test Procedure and Test Cases
Track	All DWFCWT Demonstration Test Cases	• Controlled environment “track” test facility. • Staging area outside DSRC communication range from stopped or slowing remote vehicle location.	• Identify FCW interaction event location and place traffic cones on both sides of roadway clearly visible to drivers where remote vehicle is to be stopped and approximate location of FCW alert • Place cautionary signage and boundary markers in advance of geofence to warn test staff and visitors • On-roadway, place any additional signage required by WYDOT Safety Manager • Verify vehicle preparation and staging area is outside DSRC communication range of FCW interaction event location
Operational Data Environment (ODE)	All DWFCWT Demonstration Test Cases	Prototype ODE integrated with WYDOT TMC development environment per SDD and ICD.	• Archive and Delete (all) existing Event Log Files • Remove old log files • Verify ODE configuration files are correct for this test case • Download/Copy ODE configuration files to Test Case Folder for Test Record • Reinitialize, if practical
Data Warehouse (DW)	All DWFCWT Demonstration Test Cases	Prototype DW integrated with WYDOT TMC development environment per SDD and ICD.	• Verify DW configuration files are correct for this test case • Download/Copy DW configuration files to Test Case Folder for Test Record

Table DWFCWT-2. Forward Collision Warning Track Demonstration System Component Configuration and Initialization

System Component	Applicable Test Cases	Configuration for Forward Collision Warning Track Demonstration Test Procedure and Test Cases	Initialization for Forward Collision Warning Track Demonstration Test Procedure and Test Cases
Security Credential Management System (SCMS)[2]	Not Available	SCMS is not available for Demonstration.	• Not Available
RSU(s)	All DWFCWT Demonstration Test Cases	RSU on Test Track integrated with WYDOT CV Pilot System development environment. RSU is located outside DSRC communication range from DWFCWT stopped or slowing remote vehicle event location.	• Verify RSU is located outside DSRC communication range from DWFCWT stopped or slowing remote vehicle event location. • Delete (all) existing TIMs on RSU (avoid interfere with V2V communications) • Remove old log files • Verify RSU configuration files are correct for this test case • Download/Copy RSU configuration files to Test Case Folder for Test Record • Reboot RSU, if practical
Data Logging	All DWFCWT Demonstration Test Cases	Data logging for each of the following components fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment: • ODE (for Event Log Files) • OBU (all vehicles) • HMI (all vehicles)	• Remove old log files after storage and archival • Initialize Test Log Folder with Unique Test Identifier

[2] SCMS integration will include installation and integration of Hardware Security Module (HSM) which will be described in a forthcoming update of the SDD and SCD.

Table DWFCWT-2. Forward Collision Warning Track Demonstration System Component Configuration and Initialization

System Component	Applicable Test Cases	Configuration for Forward Collision Warning Track Demonstration Test Procedure and Test Cases	Initialization for Forward Collision Warning Track Demonstration Test Procedure and Test Cases
External Storage Location for Each Test Set	All DWFCWT Demonstration Test Cases	Storage location external to the system for backup and archiving of log files and test records.	• Initialize Test Record Folder with Unique Test Identifier
Host Vehicle/ OBU	All DWFCWT Demonstration Test Cases	Sedan TBD/ Lear Roadstar OBU with antenna and HMI integrated with WYDOT CV Pilot development environment.	• Remove old log files • Initialize log file folders for this Test Case with Unique Identifier • Verify OBU and HMI configuration files are correct for this test case • Download/Copy OBU and HMI configuration files to Test Case Folder for Test Record
Remote Vehicle/ OBU	All DWFCWT Demonstration Test Cases	Sedan TBD/ Lear Roadstar OBU with antenna and HMI integrated with WYDOT CV Pilot development environment.	• Remove old log files • Initialize log file folders for this Test Case with Unique Identifier • Verify OBU and HMI configuration files are correct for this test case • Download/Copy OBU and HMI configuration files to Test Case Folder for Test Record
Drivers	All DWFCWT Demonstration Test Cases	Drivers qualified and experienced in driving the assigned vehicles. Drivers trained in what to expect from DWFCWT Applications and practiced in conducting driving scenarios safely and reliably with existing traffic.	• Conduct driver safety briefing • Review and practice test scenario, as required to ensure maneuvers can be conducted safely and reliably with existing traffic
Test Staff	All DWFCWT Demonstration Test Cases	Test staff trained in what to expect from FCW Applications and practiced in supporting driving scenarios safely and reliably with existing traffic.	• Conduct safety briefing and review danger zones • Verify that Test Staff wear safety vests • Review and practice test scenario, as required to ensure maneuvers can be conducted safely and reliably with existing traffic

Table DWFCWT-2. Forward Collision Warning Track Demonstration System Component Configuration and Initialization

System Component	Applicable Test Cases	Configuration for Forward Collision Warning Track Demonstration Test Procedure and Test Cases	Initialization for Forward Collision Warning Track Demonstration Test Procedure and Test Cases
Visitors and Non-Test Staff	All DWFCWT Demonstration Test Cases	Visitors and Non-Test Staff instructed in what to expect from FCW Applications and informed in observing driving scenarios safely and reliably with existing traffic.	• Review test scenario • Conduct safety briefing and review danger zones

4.1.3 Forward Collision Warning Track Demonstration Test Cases

Table DWFCWT-3. Forward Collision Warning Track Demonstration Test Cases

Demonstration Test Case ID	**DWFCWT-1**	**Test Staff Remarks**
Demonstration Test Case Name	FCW Stopped Vehicle Ahead	Adapted from Attachment B Test Case WFCWT-1
Priority	Required	
Requirements Verified (Tracing)	Identified in Table DWFCWT-4	
Objective	Verify FCW application issues a warning in time for driver to avoid forward collision.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for Forward Collision Warning Track Demonstration Test Procedure and Test Cases described in Table DWFCWT-2. • Prepare each system and test component in accordance with Initialization for Forward Collision Warning Track Demonstration Test Procedure and Test Cases described in Table DWFCWT-2. • Conduct dry runs of Demonstration Test Procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Host Vehicle OBU/ Vehicle	Sedan TBD/ Lear Roadstar OBU with antenna and HMI integrated with WYDOT CV Pilot development environment.	
Remote Vehicle OBU/ Vehicle	Sedan TBD/ Lear Roadstar OBU with antenna and HMI integrated with WYDOT CV Pilot development environment.	
Roadway Geometry	Straight	
Remote Vehicle Driving Scenario (TC Input 1)	Remote vehicle enters track, approaches and stops at designated test location.	
Host Vehicle Driving Scenario (TC Input 2)	Host vehicle enters track from outside communication range. Host Vehicle approaches stopped remote vehicle at 35 mph. After receiving FCW warning, driver stops or veers to clear adjacent lane and proceeds past stopped vehicle.	
Driver Advisory/ Warning Displayed (TC Output)	FCW Advisory Alert (Level 1) FCW Imminent Alert (Level 2)	

Table DWFCWT-3. Forward Collision Warning Track Demonstration Test Cases

Demonstration Test Case ID	**DWFCWT-1**	**Test Staff Remarks**
Expected Result (Pass/Fail Criteria)	* FCW Application issues an advisory alert when the Time-to-Collision is below a configurable threshold indicating there are chances of a collision with a stopped vehicle ahead in the same lane of travel. * FCW Application issues an imminent FCW alert when the Time-to-Collision is below a configurable threshold indicating there is an imminent threat of forward collision with a stopped vehicle ahead in the same lane of travel and immediate action is required from the driver to avoid the collision.	
Analysis and Verification Method	*Test staff visual observation followed by inspection and analysis of OBU and HMI event logs	
Visual Observation Actual Result		
Log Analysis Actual Result	*Time-to-Collision when FCW Advisory Alert is Issued *Time-to-Collision when FCW Imminent Alert is Issued	
Pass/Fail Assessment & Remarks		

4.1.4 Forward Collision Warning Track Demonstration Requirements Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
DWFCWT-1 -- FCW Stopped Vehicle Ahead	VS-REQ-9.1 -- Rear-End Crash in Straight Road	The Vehicle System shall identify imminent danger of a rear-end crash with a remote vehicle lead vehicle in its lane of travel in a straight roadway geometry.	* Perform Test Case DWFCWT-1 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped remote vehicle ahead * Confirm issuance of imminent danger alert * Issuance of imminent danger alert verifies Vehicle System identifies imminent danger of a rear-end crash with a remote vehicle lead vehicle in its lane of travel in a straight roadway geometry, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
DWFCWT-1 -- FCW Stopped Vehicle Ahead	VS-REQ-26 -- IVAA FCW	The Vehicle System shall alert the vehicle operator for forward collision warning based on the warning distance calculation algorithm in section 3.1 of the Connected Commercial Vehicles—Retrofit Safety Device Kit Project Safety Applications and Development Plan (FHWA-JPO-14-106) and guidance for FCW Time-to Collision, Advisories and Alerts provided in SyRS Section 6.1.1. This could be an inform message, warning 1 or warning 2 based on the calculated deceleration rate required. During the design phase a deceleration rate will be selected for a warning 1 and for warning 2 based on vehicle type and weight.	* Perform Test Case DWFCWT-1 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped remote vehicle ahead * Confirm issuance of imminent danger alert * Issuance of imminent danger alert verifies the Vehicle System alerts the vehicle operator for forward collision warning based on the warning distance calculation algorithm in section 3.1 of the Connected Commercial Vehicles—Retrofit Safety Device Kit Project Safety Applications and Development Plan (FHWA-JPO-14-106) and guidance for FCW Time-to Collision, Advisories and Alerts provided in SyRS Section 6.1.1, thereby verifying the requirement is satisfied. (Note: As a system integrator, WYDOT Team tests to verify basic functionalities are present in vendor supplied systems, but does not have the resources to verify detailed implementation of algorithms.)	Requirement Verification Confirmed by:
DWFCWT-1 -- FCW Stopped Vehicle Ahead	FCWP-REQ-1 -- FCW Advisory Alert Performance	The Vehicle System shall issue an advisory FCW alert when the Time-to-Collision is below a configurable threshold for advising the driver of potential for collision with a stopped vehicle ahead in the same lane of travel. Guidance for FCW Time-to	* Perform Test Case DWFCWT-1 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped remote vehicle ahead * Confirm issuance of advisory alert * Issuance of advisory alert verifies Vehicle System issues an advisory FCW alert when the Time-to-Collision is below a configurable threshold for advising the driver of potential for collision with a	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		Collision, Advisories and Alerts is provided in SyRS Section 6.1.1.	stopped vehicle ahead in the same lane of travel, thereby verifying the requirement is satisfied.	
DWFCWT-1 -- FCW Stopped Vehicle Ahead	FCWP-REQ-2 -- FCW Imminent Alert Performance	The Vehicle System shall issue an imminent FCW alert when the Time-to-Collision is below a configurable threshold for alerting the driver that there is an imminent threat of forward collision with a stopped vehicle ahead in the same lane of travel and immediate action is required from the driver to avoid the collision. Guidance for FCW Time-to Collision, Advisories and Alerts is provided in SyRS Section 6.1.1.	* Perform Test Case DWFCWT-1 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped remote vehicle ahead * Confirm issuance of imminent FCW alert * Issuance of imminent FCW verifies Vehicle System issues an imminent FCW alert when the Time-to-Collision is below a configurable threshold for alerting the driver that there is an imminent threat of forward collision with a stopped vehicle ahead in the same lane of travel and immediate action is required from the driver to avoid the collision, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
DWFCWT-1 -- FCW Stopped Vehicle Ahead	VS-REQ-1 -- Receive BSM	The Vehicle System shall receive Basic Safety Message (as defined in SAE J2945/1) over DSRC from other connected vehicles consistent with Section 6.3.8 of SAE J2945/1 (BSM Scheduling and Congestion Control).	* Perform Test Case DWFCWT-1 * Inspect Host Vehicle OBU Logs * Confirm detection of stopped remote vehicle ahead * Confirm issuance of imminent danger alert * Issuance of imminent danger alert verifies Vehicle System receives Basic Safety Message (as defined in SAE J2945/1) over DSRC from other connected vehicles consistent with Section 6.3.8 of SAE J2945/1 (BSM Scheduling and Congestion Control), thereby verifying requirement. (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	Requirement Verification Confirmed by:
DWFCWT-1 -- FCW Stopped Vehicle Ahead	VS-REQ-33 -- BCVI Messages	The Vehicle System shall wirelessly broadcast over DSRC a basic safety message (BSM) to other connected devices.	* Perform Test Case WV2VMCT-1(DWFCWT-1) * Inspect Host Vehicle OBU Logs and identify 1 or more instances of BSMs sent from Host Vehicle to Remote Vehicle * Inspect Remote Vehicle OBU logs and identify corresponding receipt of BSMs * Confirmation shows the Vehicle System wirelessly broadcasts over DSRC a basic safety message (BSM) to other connected devices, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
DWFCWT-1 -- FCW Stopped Vehicle Ahead	WCVS-REQ-1.1 -- Collect BSM Data	The Wyoming CV System shall collect Basic Safety Message Parts I and II (as defined in J2945/1) from the Vehicle System consistent with Section 6.3.8 (BSM Scheduling and Congestion Control) of J2945/1	* Perform Test Case WV2IMCT-2(DWFCWT-1) * Inspect OBU Logs and identify 1 or more instances of BSMs sent to RSUs * Inspect RSU logs and identify corresponding 1 or more instances of BSMs received * Inspect ODE Logs and identify corresponding 1 or more instances of BSMs received * Inspect Pikalert logs and identify corresponding 1 or more instances BSMs received Confirmation shows Wyoming CV System collects Basic Safety Message Parts I and II (as defined in J2945/1) from the Vehicle System consistent with Section 6.3.8 (BSM Scheduling and Congestion Control) of J2945/1, thereby verifying the requirement is satisfied. (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	Requirement Verification Confirmed by:
DWFCWT-1 -- FCW Stopped Vehicle Ahead	WCVS-REQ-11.1 -- Store BSM	The Wyoming CV System shall store processed BSM Parts I and II data received from the Vehicle System. As the BSM will be previously validated, only core data elements will be stored (defined in sections 6.8, 6.147, 6.128, and 6.133 of J2735).	* Perform Test Case WV2IMCT-2(DWFCWT-1) * Inspect ODE logs and confirm receipt of BSM Part 1 and 2 from OBU. * Inspect DW logs and confirm receipt of BSM Part 1 and 2 from OBU for storage. * Receipt of BSM by DW confirms the Wyoming CV System stores processed BSM Parts I and II data received from the Vehicle System, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
DWFCWT-1 -- FCW Stopped Vehicle Ahead	RSU-REQ-11 -- Distribute to ODE	The Roadside Units shall share all collected information with the Operational Data Environment, as described in Section 5.18.1 of the ICD.	* Perform Test Case WV2IMCT-2(DWFCWT-1) * Inspect RSU logs and identify 1 or more instances of BSMs received from Vehicles * Inspect ODE logs and identify receipt of corresponding BSMs. * Confirmation shows the Roadside Units share all collected information with the Operational Data Environment, as described in Section 5.18.1 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
DWFCWT-1 -- FCW Stopped Vehicle Ahead	ODE-REQ-3.4.1 -- Distribute to Data Warehouse-BSM	The Operational Data Environment shall distribute all collected and processed BSM	* Perform test case WV2IMCT-2(DWFCWT-1) * Inspect DW logs * Confirm receipt of BSMs	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		information to the Data Warehouse, as described in Section 5.20 of the ICD.	* Confirmation shows the Operational Data Environment distributes all collected and processed BSM information to the Data Warehouse, as described in Section 5.20 of the ICD, thereby verifying the requirement is satisfied. * Confirmation shows the Operational Data Environment distribute all collected and processed BSM information to the Data Warehouse, as described in Section 520 of the ICD , thereby verifying the requirement is satisfied.	
DWFCWT-1 -- FCW Stopped Vehicle Ahead	VS-REQ-36.2 -- TVI Data Management-Log	The Vehicle System shall transmit log files via secure copy (SCP) to the Wyoming CV System over DSRC that contain event logs data defined in VS-REQ-41.	* Perform Test Case WV2IMCT-4(DWFCWT-1) * Confirm secure copy to the Wyoming CV System of Event Logs. * Confirmation shows the Vehicle System transmits log files via secure copy (SCP) to the Wyoming CV System over DSRC that contain event logs data, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:

4.2 I2V Situational Awareness Demonstration Test Procedure and Test Cases

4.2.1 I2V Situational Awareness Track Demonstration Test Procedure

Table DWI2VSAT-1. I2V Situational Awareness Track Demonstration Test Procedure

Demonstration Test Procedure ID	DWI2VSAT	Test Staff remarks
Demonstration Test Procedure Name	I2V Situational Awareness Track Test Procedure	Adapted from Attachment B Test Procedure WI2VSAT-1
Priority	Required	
Objectives	• Verify that Back Office Component compiles and delivers Driver Advisory/Warning information to DB • Verify that DB correctly compiles I2VSA TIM from Back Office Component information • Verify TIM is delivered to vehicles via DSRC • Verify I2VSA TIM is received by OBU • Verify TIM is parsed correctly and Driver Advisory/Warning display begins and ends display at correct geofence milepost or does not display as required. • Verify requirements associated with each Test Case.	
Relationship to Other Procedures	• Test cases may be performed concurrently within the same test procedure, with the limitation that message geofences are separated by at least 300 meters* (*300 meters is a nominal distance selected to avoid interference and interaction display of I2V SA messages and to be clearly distinguished by drivers.)	
Discussion, Guidance, and Rationales	• 35 mph is the posted speed for the Archer Facility Prairie Center Circle used as test track. • 300m is the design communication range for DSRC, per SAE J2945/1.	
Prior to Conducting Test	• Verify configuration of each system and test component complies with Configuration for I2V Situational Awareness Track Demonstration Test Procedure and Test Cases described in Table DWI2VSAT-2. • Prepare each system and test component in accordance with Initialization for I2V Situational Awareness Track Demonstration Test Procedure and Test Cases described in Table DWI2VSAT-2. • Conduct dry runs of Demonstration Test Procedure and test cases and prepare	

Table DWI2VSAT-1. I2V Situational Awareness Track Demonstration Test Procedure

Demonstration Test Procedure ID	DWI2VSAT	Test Staff remarks
	detailed execution steps for each system component to support consistent implementation by test staff.	
Demonstration Test Procedure Steps:	Conduct the following steps for DWI2VSAT-Pikalert Demonstration Test Procedure	

1 (Verify Readiness for Test)	• Verify WYDOT CV Pilot TMC System is operational and ready for test
	• Verify RSUs are operational and ready for test
	• Cycle Host Vehicle power and reboot vehicle system.
	• Verify Host vehicle systems are operational and ready for test
	  o OBU to HMI communications
	  o GPS fix
	• Conduct Safety Inspection of the test area and vehicle path and confirm ready for test
	  o No obstructions or interference
	  o All staff where they are supposed to be, no staff where they aren't supposed to be
	  o Weather is acceptable and will not lead to hazardous driving conditions
	  o Road surface is acceptable and will not lead to hazardous driving conditions	

2 (Test Start Up)	• Host vehicle driver inspects visual indicators to confirm that vehicle system is fully operational • Host vehicle driver inspects driving area and confirms roadway is clear and ready for test. • Host vehicle driver notifies BackOffice Component Operator that Host Vehicle and roadway are ready to conduct Test Procedure • BackOffice Component Operators and System send information to DB to initiate generation of TIM • Host and Remote Vehicle Drivers notify each other that vehicles, drivers and track are ready to conduct Demonstration Test Procedure	
3 (Conduct Demonstration Test Case)	• Conduct Demonstration Test Case Described in **Error! Reference source not found.**3. • TIM is generated by DB and sent to RSU for vehicle download. (TC Input 1) • Host vehicle enters track or roadway and performs Host Vehicle Driving Scenario (TC Input 2).	

Table DWI2VSAT-1. I2V Situational Awareness Track Demonstration Test Procedure

Demonstration Test Procedure ID	DWI2VSAT	Test Staff remarks
	• Test Staff observe Driver Advisory/ Warning Displayed (TC Output).	
4 (Stop and wrap up)	• Host Vehicle drives past RSU and uploads OBU and HMI Event Logs to ODE through RSU via DSRC. • Host Vehicle returns to staging area • Test Staff record visually observed actual results	
5 (Post-test record capture)	Test Staff download and store Log Files on External Test File Folder 1. Back Office Component Log files 2. Host Vehicle OBU and HMI Event Log files Test Staff make backup Copy of External Test File Folder	
6 (Post-test log analysis)	Test Analysts analyze system logs and verify Demonstration Test Case actual results from log analysis.	.
7 (Post-test Requirements Verification)	Test Analysts perform the Requirement Verification Processes for Demonstration Test Case described in Table DWI2VSAT-4.	

4.2.2 I2V Situational Awareness Track Demonstration System Component Configuration and Initialization

Table WI2VSAT-3. I2V Situational Awareness Track Demonstration System Component Configuration and Initialization

System Component	Applicable Test Cases	Configuration for I2V Situational Awareness Track Test Procedure and Test Cases	Initialization for I2V Situational Awareness Track Test Procedure and Test Cases
Track or Roadway	All DWI2VSAT Test Cases	• Controlled environment “track” test facility and I 80 demonstration zones. • Staging area outside DSRC communication range from geofence. • Test case may be performed on a highway to more easily accommodate testing multiple messages, each with a different geofence. If performed on a highway, test speed should be adjusted to be safe highway travel speeds.	• Identify geofence locations and place traffic cones on both sides of roadway clearly visible to drivers at plus and minus 8 meters from beginning of geofence and plus and minus 8 meters from beginning of geofence end • Place cautionary signage and boundary markers in advance of geofence to warn test staff and visitors • On-roadway, place any additional signage required by WYDOT Safety Manager • Verify vehicle preparation and staging area is outside DSRC communication range of geofence engagement location
Pikalert	DWI2VSAT-Pikalert	Pikalert prototype integrated with WYDOT TMC development environment per SDD and ICD.	• Prepare Pikalert inputs for Spot Weather Impact Warning for Message Display in Travel Lanes • Formulate and document Pikalert inputs that will generate Spot Weather Impact Warning I2V Situational Awareness TIM • Formulate and document Geofence inputs (manual and computer input file) for Spot Weather Impact Warning I2V Situational Awareness TIM • Formulate and document Pikalert inputs (manual and computer input file) for distribution of Spot Weather Impact Warning I2V Situational Awareness TIM through RSUs via DSRC.

Table WI2VSAT-3. I2V Situational Awareness Track Demonstration System Component Configuration and Initialization

System Component	Applicable Test Cases	Configuration for I2V Situational Awareness Track Test Procedure and Test Cases	Initialization for I2V Situational Awareness Track Test Procedure and Test Cases
Transportation Reporting and Action Console	All DWI2VSAT Test Cases	TRAC integrated with WYDOT TMC development environment per SDD and ICD.	• Verify TRAC configuration files are correct for this test set • Download/Copy DB configuration files to Test Case Folder for Test Record
Data Broker (DB)	All DWI2VSAT Test Cases	DB prototype integrated with WYDOT TMC development environment per SDD and ICD.	• Delete (all) existing TIMs messages • Remove old log files • Verify DB configuration files are correct for this test set • Download/Copy DB configuration files to Test Case Folder for Test Record • Reinitialize, if practical
Operational Data Environment (ODE)	All DWI2VSAT Test Cases	ODE prototype integrated with WYDOT TMC development environment per SDD and ICD.	• Delete (all) existing TIMs messages • Remove old log files • Verify ODE configuration files are correct for this test case • Download/Copy ODE configuration files to Test Case Folder for Test Record • Reinitialize, if practical
Data Warehouse (DW)	All DWI2VSAT Test Cases	DW prototype integrated with WYDOT TMC development environment per SDD and ICD.	• Verify DW configuration files are correct for this test case • Download/Copy DW configuration files to Test Case Folder for Test Record
Security Credential Management System (SCMS)[3]	Not Available	SCMS is not available for Demonstration.	• Not Available

[3] SCMS integration will include installation and integration of Hardware Security Module (HSM) which will be described in a forthcoming update of the SDD and SCD.

Table WI2VSAT-3. I2V Situational Awareness Track Demonstration System Component Configuration and Initialization

System Component	Applicable Test Cases	Configuration for I2V Situational Awareness Track Test Procedure and Test Cases	Initialization for I2V Situational Awareness Track Test Procedure and Test Cases
RSU(s)	All DWI2VSAT Test Cases	One RSU integrated with WYDOT TMC development environment per SDD and ICD. RSU is located outside DSRC communication range from WI2VSAT geofence.	• Verify RSU is located outside DSRC communication range from WI2VSAT geofence. • Delete (all) existing TIMs on RSU • Remove old log files • Verify RSU configuration files are correct for this test case • Download/Copy RSU configuration files to Test Case Folder for Test Record • Reboot RSU, if practical
Data Logging	All DWI2VSAT Test Cases	Data logging for each of the following components fully developed, integrated with WYDOT TMC per SDD and ICD, ready for production deployment: • Back Office components • Data broker • OBU • HMI • TRAC	• Remove old log files after storage and archival • Initialize Test Log Folder with Unique Test Identifier
External Storage Location for Each Test Set	All DWI2VSAT Test Cases	Storage location external to the system for backup and archiving of log files and test records.	• Initialize Test Record Folder with Unique Test Identifier
Host Vehicle/ OBU	All DWI2VSAT Test Cases	Sedan TBD/ Lear Roadstar OBU with antenna and HMI integrated with WYDOT CV Pilot development environment.	• Remove old log files • Initialize log file folders for this Test Case with Unique Identifier • Verify OBU and HMI configuration files are correct for this test case • Download/Copy OBU and HMI configuration files to Test Case Folder for Test Record
Backoffice System Operators	All DWI2VSAT Test Cases	Backoffice System Operators trained in what to expect from I2V SA Applications and practiced in supporting I2V Situational Awareness Application Advisories and Alerts.	• Train Backoffice System Operators to initiate TIM and distribute to RSU • Backoffice System Operators practice initiating TIM and distribution to RSU

Table WI2VSAT-3. I2V Situational Awareness Track Demonstration System Component Configuration and Initialization

System Component	Applicable Test Cases	Configuration for I2V Situational Awareness Track Test Procedure and Test Cases	Initialization for I2V Situational Awareness Track Test Procedure and Test Cases
Drivers	All DWI2VSAT Test Cases	Drivers qualified and experienced in driving the assigned vehicles. Drivers trained in what to expect from I2V SA Applications and practiced in conducting driving scenarios safely and reliably with existing traffic.	• Conduct driver safety briefing • Review and practice test scenario, as required to ensure maneuvers can be conducted safely and reliably with existing traffic
Test Staff	All DWI2VSAT Test Cases	Test staff trained in what to expect from I2V SA Applications and practiced in supporting driving scenarios safely and reliably with existing traffic.	• Conduct safety briefing and review danger zones • Verify that Test Staff wear safety vests • Review and practice test scenario, as required to ensure maneuvers can be conducted safely and reliably with existing traffic
Visitors and Non-Test Staff	All DWI2VSAT Test Cases	Visitors and Non-Test Staff instructed in what to expect from I2V SA Applications and informed in observing driving scenarios safely and reliably with existing traffic.	• Review test scenario • Conduct safety briefing and review danger zones

4.2.3 I2V Situational Awareness Track Demonstration Test Cases

Table DWI2VSAT-3. I2V Situational Awareness Track Demonstration Test Cases

Demonstration Test Case ID	DWI2VSAT-Pikalert	Test Staff Remarks
Demonstration Test Case Name	Pikalert TIM (Snowplow)	Adapted from Attachment B Test Case WI2VSAT-Pikalert and WI2VSAT-1-Rep
Priority	Required	
Requirements Verified (Tracing)	Identified in Table DWI2VSAT-4	
Objective	Verify I2V SA TIM is parsed correctly and message begins and ends display at correct geofence milepost. Verify GPS accuracy supports accurate display of I2V SA Messages.	
Preconditions	• Verify configuration of each system and test component complies with Configuration for I2V Situational Awareness Track Demonstration Test Procedure and Test Cases described in Table DWI2VSAT-2. • Prepare each system and test component in accordance with Initialization for I2V Situational Awareness Track Demonstration Test Procedure and Test Cases described in Table DWI2VSAT-2. • Conduct dry runs of Demonstration Test Procedure and test cases and prepare detailed execution steps for each system component to support consistent implementation by test staff.	
Back Office Component	Pikalert	
TIM (TC Input 1)	Spot Weather Impact Warning TIM	
Host Vehicle OBU/ Vehicle	Sedan TBD/ Lear Roadstar OBU with antenna and HMI integrated with WYDOT CV Pilot development environment.	

Table DWI2VSAT-3. I2V Situational Awareness Track Demonstration Test Cases

Demonstration Test Case ID	DWI2VSAT-Pikalert	Test Staff Remarks
Vehicle direction versus message direction	Same direction	
Vehicle Lane of travel	Roadway Travel lanes	
Host Vehicle Driving Scenario (TC Input 2)	Host vehicle driving in travel lanes in "message direction". This is performed for Pikalert (Spot Weather Impact Warning).	
Driver Advisory/ Warning Displayed (TC Output)	Spot Weather Impact Warning	
Expected Result (Pass/Fail Criteria)	*Driver Advisory/Warning begins display within 8 meters of beginning of TIM specified geofence and ceases display within 8 meters of end of TIM specified geofence. Verified visually and by inspection of HMI logs.	
Analysis and Verification Method	*Test staff visual observation followed by inspection and analysis of OBU and HMI event logs	
Visual Observation Actual Result		
Log Analysis Actual Result	*Distance from specified “begin display” geofence milepost to actual begin display geofence milepost. *Distance from specified “end display” geofence milepost to actual end display geofence milepost.	
Pass/Fail Assessment & Remarks		

4.2.4 I2V Situational Awareness Track Demonstration Requirements Analysis

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
DWI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WCVS-REQ-9 -- Create TIM	The Wyoming CV System shall create a Traveler Information Message (TIM) formatted as defined in J2735 – 5.16 Message: MSG_TravelerInformation Message (TIM).	* Perform test Case DWI2VSAT-1-PIKALERT * Inspect DB Logs and confirm generation of TIMs * Inspect DB Logs and confirm output and distribution of TIM * Confirmation shows Wyoming CV System creates a Traveler Information Message (TIM) formatted as defined in J2735 – 5.16 Message: MSG_TravelerInformation Message (TIM), thereby verifying the requirement is satisfied. * (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	Requirement Verification Confirmed by:
DWI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	VS-REQ-14 -- SA TIM-Region	The Vehicle System shall ingest received TIMs to identify the applicable regions of use geographical path (Part II defined in J2735 section 6.142). Data ingest is defined as obtaining and importing data for use or storage	* Perform Test Case DWI2VSAT-1-PIKALERT * Confirm issuance of advisories and alerts at the location specified in the TIM. * Confirmation shows the Vehicle System ingests received TIMs to identify the applicable regions of use geographical path (Part II defined in J2735 section 6142), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
DWI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	VS-REQ-28 -- IVAA SA-Advisory	The Vehicle System shall alert the vehicle operator for a situational awareness advisory using an inform message when the host vehicle is traveling towards the segment where the situational awareness applies.	* Perform Test Case DWI2VSAT-1-PIKALERT * Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm issuance of advisories and alerts at the location specified in the TIM. * Confirmation shows the Vehicle System alerts the vehicle operator for a situational awareness advisory using an inform message when the following conditions are met: i) Host vehicle is traveling towards the segment where the situational awareness applies; ii) Host vehicle meets the criteria for the advisory, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
DWI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	DB-REQ-5 -- Distribute to ODE	The DB shall share TIM information with the ODE, as defined in Section 5.21.2 of the ICD.	* Perform Test Case DWI2VSAT-1-PIKALERT * Inspect DB logs. * Confirm 1 or more instances of DB generation of representative TIMs	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			* Inspect ODE Logs * Confirm ODE receipt of 1 or more instances of representative DB TIMs * Confirmation shows the DB shares TIM information with the ODE, as defined in Section 5.21.2 of the ICD, thereby verifying the requirement is satisfied.	
DWI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	I2VSAP-REQ-1 -- Message Display in Travel Lanes	Situational Awareness Message(s) shall display in vehicles traveling in all travel lanes of the roadway in the direction specified in the I2V SA TIM.	* Perform Test Case DWI2VSAT-1-PIKALERT * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine Roadway and lane of travel of vehicle. * Confirm Situational Awareness Message displays in vehicles traveling in all lanes of the roadway specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) display in vehicles traveling in all travel lanes of the roadway in the direction specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
DWI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	I2VSAP-REQ-4 -- Message Display Geofence Beginning	Situational Awareness Message(s) shall display within 8 meters, at a speed of 35 miles per hour, of beginning of geofence specified in the I2V SA TIM.	* Perform Test Case DWI2VSAT-1-PIKALERT * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs. * Inspect Host Vehicle BSM logs. * Determine Roadway and lane of travel of vehicle. * Confirm Situational Awareness Message displays within 8 meters of beginning of geofence specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) display within 8 meters, at a speed of 35 miles per hour, of beginning of geofence specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
DWI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	I2VSAP-REQ-5 -- Message Display Geofence Ending	Situational Awareness Message(s) shall cease display within 8 meters, at a speed of 35 miles per hour, of end of	* Perform Test Case DWI2VSAT-1-PIKALERT * Inspect Host Vehicle received TIM logs. * Determine specified roadway, beginning and end of I2VSA Message. * Inspect Host Vehicle HMI Logs.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
		geofence specified in the I2V SA TIM.	* Inspect Host Vehicle BSM logs. * Determine Roadway and lane of travel of vehicle. * Confirm Situational Awareness Message displays within 8 meters of end of geofence specified in the I2V SA TIM. * Confirmation shows Situational Awareness Message(s) cease display within 8 meters, at a speed of 35 miles per hour, of end of geofence specified in the I2V SA TIM, thereby verifying the requirement is satisfied.	
DWI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WCVS-REQ-10.1 -- Distribute TIM to VS	The Wyoming CV System shall distribute TIM to the Vehicle System consistent with Section 3.5.8 (Traveler Information Requirements) of J3067	* Perform Test Case DWI2VSAT-1-PIKALERT * Inspect DB logs and verify generation of TIMs. * Inspect DB Logs and verify output and distribution of TIM to Vehicle Systems via DSRC. * Confirmation shows Wyoming CV System distributes TIM to the Vehicle System consistent with Section 3.5.8 (Traveler Information Requirements) of J3067, thereby verifying the requirement is satisfied. * (Note: WYDOT Team assumes that communications interoperability between components developed by different vendors and developers verifies consistent implementation of standards formats and specifications.)	Requirement Verification Confirmed by:
DWI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	VS-REQ-2.1 -- Receive TIM through DSRC	The Vehicle System shall wirelessly receive a packet containing traveler information from the Wyoming CV System through DSRC	* Perform Test Case DWI2VSAT-1-PIKALERT * Inspect DB Logs and locate 1 or more instances of formation of TIMs. * Inspect OBU logs and locate corresponding instances of TIMs received by OBU via DSRC. * Confirmation shows the Vehicle System wirelessly receives a packet containing traveler information from the Wyoming CV System through DSRC, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
DWI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	ODE-REQ-7 -- Receive from Data Broker	The Operational Data Environment shall receive information from the Data Broker, as defined in Section 5.21.2 of the ICD.	* Perform Test Case DWI2VSAT-1-PIKALERT * Inspect DB Logs and locate 1 or more instances of formation of TIMs. * Inspect ODE logs and locate corresponding 1 or more instances of TIMs received. * Confirmation shows the Operational Data Environment receive information from the Data	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			Broker, as defined in Section 5212 of the ICD, thereby verifying the requirement is satisfied.	
DWI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	TRAC-REQ-1.2.2 -- Segment Alerts-Pikalert	The Wyoming CV System shall transmit Pikalert segment-level alerts, defined in WCVS-REQ-4, to TRAC	* Perform Test Case DWI2VSAT-1-PIKALERT * Inspect DB logs. * Verify generation of TIMs for alerts for Spot Weather Impact Warning * Inspect TRAC logs and verify receipt of each of the corresponding alerts, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
DWI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WTI-REQ-1.1.1 -- Transmission Time	They Wyoming CV System shall transmit alerts within five minutes of its generation in the system to the WTI.	* Perform Test Case DWI2VSAT-1-PIKALERT * Inspect DB logs. * Verify receipt of information from System * Verify generation of TIMs for alerts and time TIM was generated * Inspect WTI logs and verify receipt of the corresponding alerts within five minutes of its generation in the system. * WTI log of TIM within 5 minutes verifies the Wyoming CV System transmits alerts within five minutes of its generation in the system to the WTI, thereby verifying requirement.	Requirement Verification Confirmed by:
DWI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WI-REQ-2 -- Fixed Data Acquisition	The Wyoming CV System shall receive road weather information system (RWIS) data from the WYDOT RWIS Server as defined in Section 4.1 – Data Ingest Module Requirements of the Motorist Alert and Warning Application (NCAR 2014).	* Perform Test Case DWI2VSAT-1-PIKALERT. * Inspect Pikalert Logs * Confirm receipt of road weather information system (RWIS) data from the WYDOT RWIS Server * Receipt confirms the Wyoming CV System receives road weather information system (RWIS) data from the WYDOT RWIS Server as defined in Section 4.1 – Data Ingest Module Requirements of the Motorist Alert and Warning Application (NCAR 2014), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
DWI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	WCVS-REQ-6 -- Associate Alerts and Forecast to Segments	The Wyoming CV System shall associate each alert and forecast to one or more road segments on I-80. Roadway segments are defined by WYDOT as sections of roadway between variable mileposts.	* Perform Test Case DWI2VSAT-1-PIKALERT * Inspect Pikalert Logs and verify each alert and forecast is associated with one or more road segments on I-80. * Inspect DB logs and verify generation of TIMs for alerts from Pikalert (Spot Weather Impact Warning) * Inspect TIMs and verify each alert and forecast is associated with one or more road segments on I-80.	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			* Confirmation shows Wyoming CV System associate each alert and forecast to one or more road segments on I-80, thereby verifying the requirement is satisfied.	
DWI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	VS-REQ-21 -- SWIW TIM	The Vehicle System shall ingest received TIMs to identify advisories for wind and weather conditions (Part III content choice advisories defined in J2735 section 6.142 for ITIS - data elements 6.54 Weather Conditions and 6.55 Winds defined in J2540_2). Data ingest is defined as obtaining and importing data for use or storage.	* Perform test Case DWI2VSAT-1-PIKALERT. * Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm receipt of TIMs identifying Spot Weather Impact Warning alert from Pikalert * Confirmation shows the Vehicle System ingests received TIMs to identify advisories for wind and weather conditions (Part III content choice advisories defined in J2735 section 6.142 for ITIS * data elements 6.54 Weather Conditions and 6.55 Winds defined in J2540_2), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
DWI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	VS-REQ-22 -- SWIW TIM-Region	The Vehicle System shall ingest received TIMs to identify the applicable regions of use geographical path (Part II defined in J2735 section 6.142). Data ingest is defined as obtaining and importing data for use or storage.	* Perform test Case DWI2VSAT-1-PIKALERT. * Inspect OBU logs. * Confirm receipt of TIMs by OBU. * Confirm receipt of TIMs identifying Spot Weather Impact Warning alert from Pikalert * Confirm message begins and ends display at correct geofence milepost * Confirmation shows the Vehicle System ingests received TIMs to identify advisories for wind and weather conditions (Part III content choice advisories defined in J2735 section 6.142 for ITIS * data elements 6.54 Weather Conditions and 6.55 Winds defined in J2540_2), thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
DWI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	VS-REQ-30 -- IVAA SWIW	The Vehicle System shall alert the vehicle operator of a spot weather incident when the host vehicle is traveling toward and within five miles of the incident's location using an inform message as defined in Section 2.6.5 of the SyRS.	* Perform test Case DWI2VSAT-1-PIKALERT * Inspect OBU logs. * Confirm receipt of TIMs by OBU. -Confirm receipt of TIMs identifying Spot Weather Impact Warning alert from Pikalert * Confirm issuance of advisories and alerts at the location specified in the TIM. * Confirmation shows the Vehicle System alerts the vehicle operator of a spot weather incident when the	Requirement Verification Confirmed by:

Test Case ID and Name	Requirement ID and Name	Requirement Description	Requirement Verification Methodology	Test Engineer Verification and Remarks
			host vehicle is traveling toward and within five miles of the incident’s location using an inform message as defined in Section 2.6.5 of the SyRS, thereby verifying the requirement is satisfied.	
DWI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	PA-REQ-4.1 -- Distribute to DB	The Pikalert System shall transmit generated information to the Data Broker, as described in Section 5.27 of the ICD.	* Perform Test Case DWI2VSAT-1-PIKALERT * Inspect Pikalert logs * Identify 1 or more instances of alerts or advisories generated * Inspect DB logs * Confirm receipt 1 or more instances of alerts or advisories generated by DW * Confirmation shows the Pikalert System transmits generated information to the Data Broker, as described in Section 5.27 of the ICD, thereby verifying the requirement is satisfied.	Requirement Verification Confirmed by:
DWI2VSAT-1-Pikalert -- Message Display in Travel Lanes - Pikalert	DB-REQ-4.1 -- Receive Alerts and Advisories	The DB shall receive all generated segment-level alerts and advisories from Pikalert, as described in Section 5.27.1 of the ICD	* Perform Test Case DWI2VSAT-1-PIKALERT * Inspect DB logs. * Confirm DB receipt of generated segment-level alerts and advisories from Pikalert, as described in Section 5.26.2 of the ICD * Confirmation shows the DB receives all generated segment-level alerts and advisories from Pikalert, as described in Section 5.27.1 of the ICD, thereby verifying the requirement is satisfied. * (Note: For system integration testing, WYDOT Team assumes demonstration of functionality in a single instance verifies functionality for "all" instances.)	Requirement Verification Confirmed by:

5 Glossary and Acronyms

Table 5-1. Glossary of Terms.

Term	Definition
Basic Safety Message	Connected V2V safety applications are built around the capability to transmit BSMs, following the Society of Automotive Engineers (SAE) J2735 standard. The BSM is transmitted over DSRC over a range of approximately 300 meters. In general, BSMs are broadcast frequently to provide connected vehicles with data content necessary for the different safety-oriented applications. The BSM is divided into two parts: • Part I, transmitted approximately 10 times per second, contains the core data elements: Message Count, Temporary ID, Time (through a Second Mark), Latitude, Longitude, Elevation, Positional Accuracy, Transmission State, Speed, Heading, Steering Wheel Angle, Acceleration, Brake System Status, and Vehicle Size. • Part II, transmitted less frequently, is added to Part I depending on events (e.g., Anti-lock Braking System (ABS) activated) and contains a variable set of data elements drawn from many optional data elements (availability by vehicle model varies)
Broadcast	Sharing data with no specific destination. All broadcast data is sent unencrypted but is signed with a certificate (based on the Institute of Electrical and Electronics Engineers (IEEE) standard 1609.2).
Data	Data is raw (unorganized and unprocessed) digital messages sent between components. From SAE J2735: Representations of static or dynamic entities in a formalized manner suitable for communication, interpretation, or processing by humans or by machines.
Data Ingest	Obtaining and importing data for use or storage.
Host Vehicle	A connected vehicle that receives messages from a remote vehicle. In this document, the host vehicle is also used to describe the originator of a vehicular transmission of information to an RSU.
Information	Processed data that is organized, structured or presented in a given context to make it useful
Independent Evaluator	USDOT-sponsored evaluators that will focus on measures not covered by the Wyoming team's evaluation, impacts of larger scale CV deployments, and national programmatic aspects of this CV Pilot project, combined with other similar projects being conducted. The IE works to understand how the project outcomes can contribute to the future of the CV Program nationally.
Message	A well-structured set of data elements and data frames that can be sent as a unit between devices to convey some semantic meaning in the context of the applications (adapted from SAE J2735).

Term	Definition
On-Board Unit	This represents the package of DSRC radios, computing, sensors and HMI that will be installed on a vehicle. This is similar to the Retrofit Safety Device used in the Safety Pilot Program.
Receive Data	A connected device accepts a data package broadcast or transmitted by another connected device.
Remote Vehicle	A connected vehicle that periodically and dynamically broadcasts a message about its general situation to a host vehicle.
Requirements	Set of information necessary to accomplish one action.
Roadside Units	This represents the package of DSRC radios, computing, communications that will be installed on the roadside on I-80
WYDOT Road Segment	A road segment is defined as a link in Traffic Management Data Dictionary (TMDD) v3.03c: a roadway or transit right-of-way between two nodes. WYDOT has implemented road segments to fully cover I-80 in both directions.
Transmit	Sharing data directed to a specific receiver. In the case of transmission between Systems, all transmitted data is signed and encrypted, where required, based on SAE J2945/1.
Transportation Management Center	Center that collects information and informs the public about changing travel conditions.
WGS-84	Latest revision of the standard for use in cartography, geodesy, and navigation including by global positioning systems (GPS).

Table 5-2. Acronym List.

Acronym/ Abbreviation	Definition
ABS	Anti-lock Braking System
BSM	Basic Safety Message
DB	Data Broker
DW	Data Warehouse
CA	Construction Administration
CAN bus	Controller Area Network bus
ConOps	Concept of Operations
CRL	Certificates Revocation List
CV	Connected Vehicle
CVOP	Commercial Vehicle Operator Portal
CVRIA	Connected Vehicle Reference Implementation Architecture
DMS	Dynamic Message Signs
DN	Distress Notification
DOT	Department of Transportation
DSRC	Dedicated Short Range Communications

Acronym/ Abbreviation	Definition
E2E	End-to-end
ESS	Environmental Sensor Station
FCW	Forward Collision Warning
FHWA	Federal Highway Administration
GIS	Geographic Information System
GPS	Global Positioning System
HMI	Human-Machine Interface
I2V	Infrastructure-to-vehicle
I-80	Interstate 80
IC	Incident Console
ICD	Interface Control Document
IE	Independent Evaluator
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IRB	Institutional Review Board
ISO	International Organization for Standardization
ITIS	Integrated Transport Information System
ITS	Intelligent Transportation System
LTS	Location and Time Service
MAP	Mapping for Intersection
MoU	Memorandum of Understanding
NCAR	National Center for Atmospheric Research
NWS	National Weather Service
OBU	On-Board Unit
ODE	Operational Data Environment
OSADP	Open Source Application Development Portal
RCRS	Road Condition Reporting System
RSU	Roadside Units
RWH	Road Weather Hazard
RWIS	Road Weather Information System
SAE	Society of Automotive Engineers
SCMS	Security Credential Management System
SDW	Situation Data Warehouse
SET-IT	Systems Engineering Tool for Intelligent Transportation
SPaT	Signal Phase and Timing
SSP	Satellite Service Provider
SWIW	Spot Weather Impact Warning
SyRS	System Requirements Specification
TIM	Traveler Information Message

Acronym/ Abbreviation	Definition
TMC	Transportation Management Center
TMDD	Traffic Management Data Dictionary
TPI	Third-Party Interface
TRAC	Transportation Reports and Action Console
UoW	University of Wyoming
V2I	Vehicle-to-infrastructure
V2V	Vehicle-to-vehicle
VSL	Variable Speed Limit
WHP	Wyoming Highway Patrol
WYDOT	Wyoming Department of Transportation
WTI	Wyoming Traveler Information system
WZW	Work Zone Warning

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FHWA-JPO-17-472C

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