Connected Vehicle Pilot Deployment Program Phase 1

Partnership Coordination Summary – ICF/Wyoming

U.S. Department of Transportation

Notice

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7. Author(s) Deepak Gopalakrishna (ICF), Vince Garcia (Wyoming DOT), Ali Ragan (Wyoming DOT), Tony English (Trihydro), Shane Zumpf (Trihydro), Rhonda Young (University of Wyoming), Mohamed Ahmed (University of Wyoming), Fred Kitchener (McFarland Management), Nayel Ureña Serulle (ICF), Eva Hsu (ICF)		**8. Performing Organization Report No.** Task 10 Report
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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 a summary of the partnership coordination activities that are necessary for Phases 2 and 3 of the pilot. In addition, this document presents the plan for continuing the operations of the CV Pilot.

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1 Introduction

1.1 System Overview

Wyoming Department of Transportation (WYDOT) is one of the first wave of Connected Vehicle (CV) Pilot sites selected to showcase the value of and spur the adoption of Connected Vehicle Technology in the United States. Connected Vehicle Technology is a broad term to describe the applications and the systems that take advantage of dedicated short-range communications (DSRC) between vehicle to vehicle (V2V), vehicle to infrastructure (V2I) and infrastructure to vehicle (I2V) 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 will work in a planning phase through September 2016. The deployment process will happen in the second phase (ending in September 2017) followed by an 18-month demonstration period in the third phase (starting in October 2017). At a very high level, the pilot scope includes the following implementation elements:

- **Deployment of 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 would be heavy trucks. All vehicles are expected to be regular users of I-80. Several types of OBU 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 and V2I (and I2V) applications** that will enable communication with drivers for 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 better activation of variable speed limits (VSL) and improved road condition dissemination via 511, Dynamic Message Sings (DMS) and other WYDOT sources.

Systems and applications developed in the pilot will enable drivers of connected vehicles to have awareness of hazards and situations they cannot even see. The CV Pilot is considered a System

of Systems, with two system of interest: The Vehicle System and the Wyoming CV System, see Figure 1-1. The *Vehicle System* includes four subsystems that represent the various vehicle and equipment types to be used in the pilot. These subsystems vary in their data collection and sharing capabilities. The *Wyoming CV System* includes the infrastructure used in the pilot and back-office systems in charge of the various processes that lead to the generation and distribution of advisories and alerts. Together, the Vehicle and Wyoming CV Systems support a variety of V2V and V2I applications. Both systems interface with external systems, including WYDOT, USDOT and the National Weather Service (NWS).

The CV Pilot Project will, at its core, provide key information to the drivers through five on-board applications: i) Forward Collision Warning (FCW); ii) I2V Situational Awareness (SA); iii) Distress Notification (DN); iv) Work Zone Warning (WZW); and v) Spot Weather Impact Warning (SWIW). Through them, WYDOT hopes to improve operations on the corridor especially during periods of adverse weather and when work zones are present. By means of the anticipated outcomes of the pilot, fleet managers will be able to make better decisions regarding their freight operations on I-80, truckers will be made aware of downstream conditions and provided guidance on parking options as they travel the corridor, and automobile travelers will receive improved road condition and incident information through various existing, improved and new information outlets.
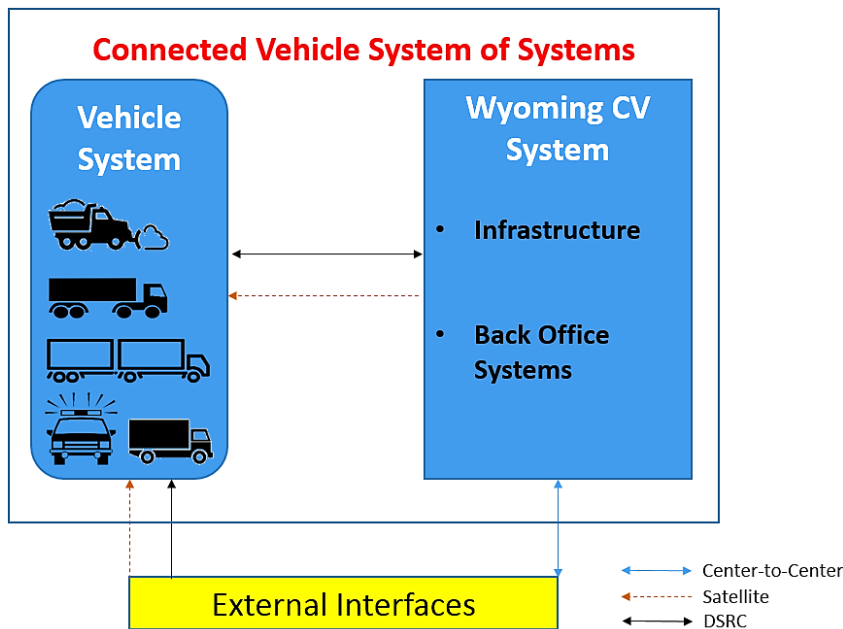
Figure 1-1 Wyoming CV Pilot System of Systems.

A detailed explanation of the Wyoming CV Pilot project can be found in *Connected Vehicle Pilot Deployment Program Phase I, Concept of Operations (ConOps) (*Gopalakrishna, et al., 2015).

1.2 Purpose of Document

This document describes the status of developing and implementing agreements, contracts and subcontracts among partner organizations. Furthermore, it provides documentation of stakeholder agreement on concept, objectives, institutional and financial arrangements necessary

for the successful deployment and operation of the pilot deployment. Finally, the Partnership Status Summary also include a vision of how these arrangements are expected to be altered or adapted in the post-deployment period to ensure a transition to permanent operational practice.

1.3 Organization of the Report

This report is divided into five sections that tackle the different aspects of the Partnership Coordination Plan. Particularly:

- Section 2 provides a list of the references used in this document.
- Section 3 overviews partnerships in Phase 2 and 3.
- Section 4 details such partnerships and agreements.
- Section 5 explains the expected post-pilot transition partnerships.

2 References

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

Table 2-1. References.

#	Documents, Sources Referenced
1	Deepak Gopalakrishna, et al. (2015). *Connected Vehicle Pilot Deployment Program Phase I, Concept of Operations (ConOps), ICF/Wyoming.* U.S Department of Transportation.
2	Deepak Gopalakrishna, et al. (2015b). *Connected Vehicle Pilot Demonstration: Phase I, ICF/Wyoming: Privacy and Security Management Operating Concept.* U.S Department of Transportation.
3	Deepak Gopalakrishna, et al. (2015c). *Connected Vehicle Pilot Demonstration: Phase I, ICF/Wyoming: Safety Management Plan.* U.S Department of Transportation.
3	Deepak Gopalakrishna, et al. (2015d). *Connected Vehicle Pilot Demonstration: Phase I, ICF/Wyoming: Performance Measurement and Evaluation Support Plan.* U.S Department of Transportation.
4	Deepak Gopalakrishna, et al. (2015e). *Connected Vehicle Pilot Demonstration: Phase I, ICF/Wyoming: Human Use Approval Summary.* U.S Department of Transportation.

3 Phase 2 and Phase 3 Partnership Overview

3.1 Phase 2 and Phase 3 Governance Framework

The Wyoming Department of Transportation (WYDOT), as the grant recipient for the pilot is the overall lead and responsible for the governance of the Phase 2 and Phase 3 of the pilot.

The Wyoming GIS/ITS program will be responsible for delivering the scope of work identified in the grant award. WYDOT will be supported by a contractor team and partners to deliver the pilot per the agreement between USDOT and WYDOT. WYDOT will use their approved contracting and procurement methods and other processes will be defined in the agreements. WYDOT will be supported by fleet partners who will sign a memorandum of understanding (MoU) identifying roles and responsibilities for the pilot.

With an eye towards the post-pilot operations, Wyoming DOT is intending to set up a new CV-Pilot Freight Advisory Council (FAC) to provide advisory support for the pilot. The freight advisory council will consist of representatives from WYDOT, fleet partners who are participating in the pilot, local freight stakeholders who use CVOP, Transportation Safety Council, and the Wyoming Trucking Association (WTA). Wyoming DOT anticipates that the freight advisory council will meet quarterly starting in the middle of Phase 2 (1st Qtr of 2017). The freight advisory council is a sounding board for WYDOT to discuss pilot development in Phase 2 and Phase 3. As the project progresses, the advisory council will support WYDOT in the post pilot transition planning assisting in setting priorities for application updates, and supporting growth in number of fleets that have access to this technology. More details on the CV Freight Advisory Council are provided in Section 4.

3.2 Partnering Entities

Table 3-1 lists the different entities will be partnering with WYDOT to support the pilot. The following chapter describes the details of the agreements

Table 3-1. Partnering Entities.

Entity	Role
WYDOT	Grant Recipient for Phase 2 and Phase 3 of this project and responsible for delivery of Phase 2 and Phase 3 of the pilot. WYDOT will be supported by a contractor team with defined scopes for the pilot:
ICF	Provide overall program management support, support to various systems engineering tasks, lead the performance management, evaluation, and outreach activities.

Trihydro	Lead the system design, application development, testing during Phase 2 and monitoring the operations of the system in Phase 3. Furthermore, it will provide access to its vehicle fleet.
University of Wyoming	Support the testing and training of CV pilot elements using the university truck and car simulators. The university will also support the performance management and evaluation of the CV Pilot system in Phase 2 and Phase 3.
McFarland Management	Coordinate all performance management and evaluation activity for the pilot.
Vital Assurance	Provide support in defining the system architecture, system design and testing approaches for the pilot in Phase 2.
NCAR	Help develop the weather-related application portions for the CV Pilot including integration of the Pikalert® system with the overall CV pilot.
CV Vendors	Provide the hardware and software for the CV Pilot, as well as related installation, training and maintenance support.

Fleet Partners	WYDOT is partnering with several fleet partners to provide the vehicles to be equipped with CV technology. These fleet partners will sign a Memorandum of Understanding (MoU) with WYDOT to support the pilot. Fleet partners that have signed letters of intent to participate in the project are UPS, Ralph Smith Co., Fremont Contract Carriers, Double D Transportation, Burgener Transpro and Dooley Oil. WYDOT is actively recruiting additional fleet partners.
Wyoming Trucking Association	WYDOT is partnering with Wyoming Trucking Association to support identification of drivers for testing and developing the human machine interface. In addition WYDOT will coordinate with WTA for pilot related outreach.
Institutional Review Board	WYDOT is partnering with the University of Wyoming's (UoW) Institutional Review Board (IRB). UoW will be the IRB of record and overall all aspects of human subject related efforts in the pilot to ensure safety, security and privacy of all participants.
Governor's Transportation Safety Council	WYDOT is supporting by the Governor's Transportation Safety Council who will assist in outreach activities for the pilot.
Adjacent State DOTs	WYDOT continues to work adjacent State DOTs (Utah, Nebraska and Colorado) for travel coordination on the I-80 corridor. As a part of CV Pilot outreach, WYDOT will collaborate on related connected vehicle efforts.
Other CV Pilot Sites	Building from the successful collaboration in Phase I, WYDOT will continue to work closely with the New York City and Tampa Hillsborough Expressway Authority in developing a CV-Pilot system that is nationally inter-operable
Independent Evaluator	WYDOT will continue to support the independent evaluation for the CV Pilot.

3.3 Agreement on Pilot Elements

The following sections provide a quick summary on the broad agreement of the pilot elements between the various partnering entities.

3.3.1 ConOps

WYDOT brings together the technical team that has been instrumental in the development of the ConOps as part of the Phase 2 and Phase 3. Beyond the stakeholder engagement that went into the development of the ConOps, WYDOT's vision and the concept have been shared with our fleet partners in soliciting their letters of support for Phase 2 and 3. As part of our vendor engagement activities in Phase 1, WYDOT has shared our ConOps as well as the high-level system requirements with several vendors to ensure their ability to provide equipment that would meet the needs of the pilot.

3.3.2 Performance Measures

A clear set of performance measures and targets have been documented in the Performance Measurement and Evaluation Support Plan (PMESP) developed in Phase 1. These measures have been extensively reviewed and adopted by all Wyoming Pilot team members (including subcontractors). Methods to collect the data are incorporated in our system requirements. These topics will be appropriately addressed in any future agreements with partners and stakeholders to ensure they will support data collection required. Staff and stakeholder training will include a performance measurement topic to ensure all project participants will understand the need for various data collection activities and their involvement in same.

3.3.3 Operational Changes

With the close integration of the CV Pilot with WYDOT Transportation Management Center (TMC), back-office operational changes have been discussed with TMC Operations managers and the TMC software development team. These changes have been factored into our system requirements documents. The training plan developed in Phase 1 identifies the operator training needs at the TMC.

WYDOT Fleets (snow plows and highway patrol vehicles) will continue operations normally but drivers of these vehicles will be trained as per the training plan to effectively understand the alerts and advisories provided by the CV pilot.

From a fleet partner perspective, they will be expected to operate their vehicles normally during the pilot. Participating drivers will be trained on the CV Pilot system as defined in the training plan.

3.3.4 Governance Elements and Financial Agreements

Additional details of the governance framework for the pilot described in Section 3.1 and information of the financial agreements for the various agreement types are provided in Section 4.

4 Phase 2 and Phase 3 Partnerships and Agreements Details

The Wyoming Connect Vehicle Pilot Deployment team comprises a wide variety of organizations (public and private) with complementary capabilities to contribute to a successful pilot deployment. It is essential that these partnerships are strong, committed and sustainable throughout the life of project and beyond into a permanent operational deployment. As the concept develops, new partners might be necessary and requirements of partners may change.

This document provides a summary on the partnerships and agreements for Phase 2 and 3. This documents is intended to describe all current and envisioned stakeholder agreement on concept, objectives, institutional and financial arrangements necessary for the successful deployment and operation of the pilot deployment. Figure 4-1 illustrates the agreement structure, to date, that WYDOT will follow for this pilot.
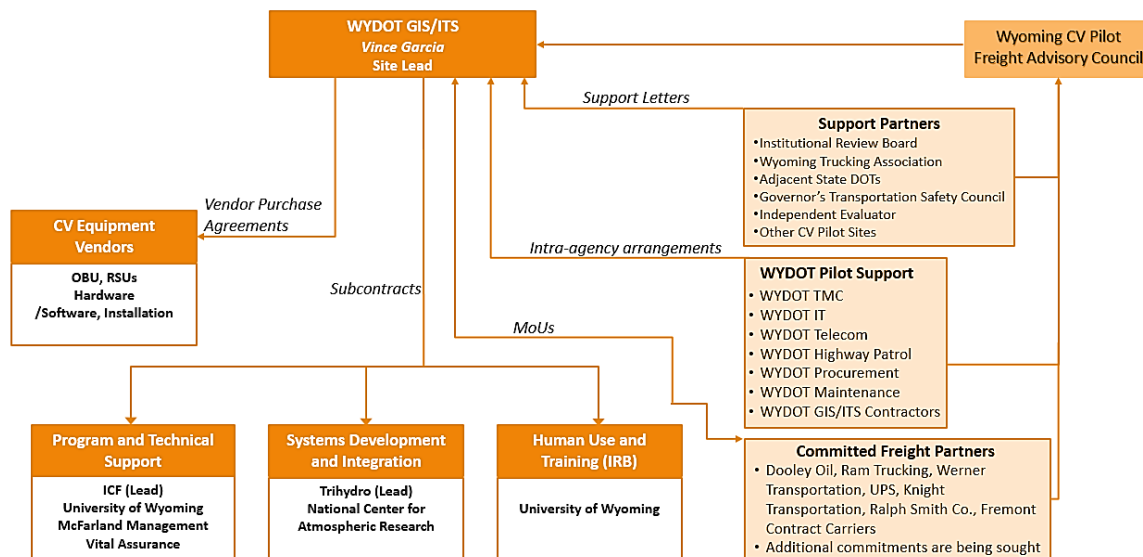
Figure 4-1. WYDOT's agreement structure (Source: ICF)

It should be noted that performance measures and targets have been documented in the Performance Measurement and Evaluation Support Plan (PMESP). These measures have been extensively reviewed and adopted by all Wyoming Pilot team members (including subcontractors). These topics will be appropriately addressed in any future agreements with partners and stakeholders to ensure they will support data collection required. Staff and stakeholder training will include a performance measurement topic to ensure all project participants will understand the need for various data collection activities and their involvement in same.

4.1 Grant Agreement

4.1.1 Documentation

The Grant Agreement signed between WYDOT and U.S DOT governs the deliverables and the schedule for Phase 2 and Phase 3. The grant agreement specifies the key activities in Phase 2 and 3 as follows:

- Phase 2: Design/Build/Test – up to 20 months. In this phase, the pilot deployment concept is designed in detail, built, and tested prior to operation. Key Phase 2 activities include:
  - System Architecture and System Design development
  - Application development and integration
  - Pilot Deployment System planning and installation
  - Operational readiness test planning and development
  - Operational readiness testing and test reporting
- Phase 3: Operate and maintain – 18 months. In this phase, the tested system is placed into operational practice and maintained in good working order. The impact of the deployment on a set of key performance measures will be monitored and reported periodically.

4.1.2 Financial Arrangements

Financial Arrangements are specified in the Grant Agreement and describe the Federal and Wyoming Cost Share. The total project cost is $5,755,972, which includes $4,439,493 in federal share. Of WYDOT's cost share, $1,193,873 is in cash and $122,606 is an in-kind match.

4.2 Internal WYDOT Partnerships

Several departments within WYDOT will collaborate with the WYDOT GIS/ITS, to support the internal WYDOT services required for the pilot. Table 4-1 details the different internal partners and the nature of their support.

Table 4-1. Internal WYDOT Partnerships.

Internal Partner	Nature of Support
GIS/ITS	Project oversight, application development. Provide two vehicles to participate in the evaluation.
Traffic Management Center	Use of information from the CV pilot to improve center operations. Provide data for project evaluation.
Telecommunications	Provide support for installation and maintenance of roadside devices and in-vehicle equipment. Support DSRC licensing
Highway Patrol	Provide highway patrol vehicles and patrol officers along the entire I-80 corridor to be equipped with DSRC radios, interface. Participate in the evaluation of CV technology.
Maintenance	Provide snow plow vehicles and drivers to be equipped with DSRC radios, weather sensors, interface. Participate in the evaluation of CV technology. Snow plows that will be equipped include Sterling, Freightliner, Mack and International models.

Contracts/Procurement	Oversee contracting and purchasing for the project to ensure internal rules are followed and U.S DOT agreement clauses are followed. .
Information Technology	Provide support for back-office administration of the Wyoming CV System including hardware, software and technology support. Will also support the CV Pilot website development.
Public Affairs Office	Support for providing information about the project to the public, including posting information on existing social media pages and helping to organize press conferences.
WYDOT Safety and Planning Groups	Support engagement with various internal stakeholders around safety data, freight planning

4.2.1 Documentation

Most intra-agency support will be done as part of the department's normal operating functions. As such, no formal arrangements will need to be made among the partners identified in Table 4-1. WYDOT's Executive Leadership continues their strong support to the project and WYDOT GIS/ITS group is responsible for internal coordination of WYDOT's activities. The only exception is an amendment to the existing Service Level Agreement with Telecommunications (internal agreement) to specify DSRC equipment is considered critical.

4.2.2 Financial Arrangements

Funding for Phases 2 and 3 of the pilot project will primarily be used to obtain and install roadside and onboard units, fund work by contractors, and pay for travel. WYDOT expects the use of roadside DSRC devices and DSRC radios in state-owned vehicles to become a standard part of the department's operation after the completion of the pilot project. As such, much of the work involved in the pilot project will be completed by department staff as part of their regular duties.

4.3 Contractual Agreements

Several contractual agreements are in place for the development of Phases 2 and 3 of the CV Pilot, detailed in Table 4-2.

Table 4-2. Contractual Agreements.

Contract Owner	Contract Party	Scope of Agreement
WYDOT	ICF	Provide overall program management support, support to various systems engineering tasks, lead the performance management, evaluation, and outreach activities.
WYDOT	Trihydro	Lead the system design, application development, testing during Phase 2 and monitoring the operations of the system in Phase 3. Furthermore, it will provide access to its vehicle fleet.
WYDOT	University of Wyoming	Act as the Institutional Review Board (IRB) of record and will support continued human use approvals and trainings, including amendments to the IRB and support the testing and training of CV pilot elements using the university truck and car simulators. The university will also support the performance management and evaluation of the CV Pilot system in Phase 2 and Phase 3.

WYDOT	McFarland Management	Coordinate all performance management and evaluation activity for the pilot.
ICF	Vital Assurance	Provide support in defining the system architecture, system design and testing approaches for the pilot in Phase 2.
Trihydro	NCAR	Help develop the weather-related application portions for the CV Pilot including integration of the Pikalert® system with the overall CV pilot.

4.3.1 Supporting Documentation

4.3.1.1 Contractor Scope of Work (SOW)

WYDOT will create individual scopes of work that provide clear deliverables and milestones for each contractor as per WYDOT contract regulations. An example of such document is provided in Appendix A for ICF International. WYDOT's contractor scopes of work are consistent and closely aligned with the U.S DOT grant agreement.

4.3.2 Financial Arrangements

The scope of work will include a level of effort estimate and not to exceed limit for the contracts that will be awarded.

4.4 Fleet Partner Agreements

The participation of non-WYDOT private fleet vehicles is critical to the success of the project. Participation includes making vehicles available for on-board equipment installation, subscriptions to WYDOT's commercial vehicle operator portals, training, and participation in performance measurement activities.

With the IRB approval, WYDOT has made great progress in lining up private fleet partners for the pilot. WYDOT is seeking a diversity of trucking firms to participate in the pilot starting with small local firms to large national carriers. The response from the trucking community has been supportive. WYDOT has shared the key concepts and the on-board applications that will be made available to the fleet partners.

Currently, letters of support have been obtained from the Wyoming Trucking Association as well as from the fleets listed below. These partnerships will be formalized and converted to full MoUs once the grant for Phases 2 and 3 is awarded.
- United Parcel Service (UPS) – National freight carrier.
- Dooley Oil Transport - A family owned and operated petroleum distributor based in Laramie, Wyoming, Dooley Oil Transport will be installing the On-Board Units (OBUs) in up to 20 vehicles that are frequent users of Interstate 80 (I-80).
- Transpro Burgener Trucking - Transpro Burgener is a dry bulk materials transporter and plans to install OBUs in up to 25 vehicles that frequently traverse I-80.
- Trihydro – In addition to their participation in the system development, Trihydro offers up to 15 small trucks that frequently travel the corridor for installation of OBUs.

WYDOT fully anticipates that this list of Non-WYDOT fleets will grow. WYDOT continues to engage major freight distribution partners in the region including Lowes and Walmart. Together, WYDOT is confident that it can identify the necessary 300 non-WYDOT trucks that will be

instrumented for this pilot. At this time, WYDOT is in ongoing discussions with three national carriers including:

- Swift Transportation
- Knight Transportation
- Werner Transportation

WYDOT expects to get letters of support from one or more these national firms shortly. All of these support letters will transition to MoUs early in Phase 2. During this transition process, fleet partners will be able to specify at which level they would like to participate in the process (full vehicle integration into the CAN or retrofit) and whether they would like to participate in center-to-center data sharing with WYDOT's TMC. The MoU will include specific information about the type of equipment (OBU, HMI, etc.) that will be installed in vehicles, responsibilities related to equipment installation and maintenance, driver responsibilities and other issues. Because many of the details necessary for the MoU will not be available until Phase 2 work commences, a sample is not available.

4.4.1 Supporting Documentation

4.4.1.1 Letters of Support

An initial agreement with the fleet partner is through a Letters of Support. Figure 4-2 presents a sample of a letter of support. The letters of support generally describe the number of vehicles involved and a commitment to subscribe to WYDOT's Commercial Vehicle Operator Portal (CVOP). Because of the amount of time that will elapse between the time freight partners were asked to sign a letter of support and when vehicles will be outfitted with equipment, many were not able to provide specific information about the makes, models and trailers that will be made available as part of this project. This is in large part because the fleet owners have intentions to replace a significant percentage of their fleet in each of the next three years. Vehicles that have been identified include Kenworth tractors pulling a 42-foot lead trailer and 39-foot pup trailer, Kenworth tractors pulling 53-foot vans and Freightliner tractors pulling 53-foot vans.

To
Ms. Kate Hartman
Program Manager
Connected Vehicle Pilot Program
U.S. Department of Transportation
1200 New Jersey Avenue SE
Washington DC

Dear Ms. Hartman:

Dooley Oil Transport is pleased to be a partner for the Wyoming DOT's Connected Vehicle Pilot implementation. We are very pleased to participate in a ground-breaking effort that will improve safety of not only our fleets but of other travelers on I-80 in Wyoming. Our drivers and vehicles are frequent travelers on I-80 and we are keenly aware on how valuable real-time and forecast information on road conditions are to our operations.

As part of our partnership, Dooley Oil Transport plans to support the installation of on-board equipment that enables Dedicated Short Range Communications (DSRC) with other similarly connected vehicles and an in-vehicle display that provides alerts to our drivers. This installation will be supported in up to 20 vehicles that are frequent users of I-80 during the demonstration phase that is scheduled to run from mid-2018-2019. Through the on-board equipment, we anticipate our drivers getting advance warning of road conditions, crashes, weather, and vehicle restrictions on I-80.

In addition, Dooley Oil Transport will subscribe/will continue to subscribe to the WYDOT Commercial Vehicle Operations Portal (CVOP). The CVOP provides decision-making support for our dispatchers and fleet managers during the course of the pilot who can make informed route, time, and location decisions for their fleets.

Dooley Oil Transport has discussed the partnership with the Wyoming Department of Transportation in detail and is ready to move forward with a formal memorandum of understanding (MoU) with Wyoming DOT upon U.S. DOT approval of Wyoming DOT's proposal. We expect the MoU to formalize the following aspects of the pilot which have been discussed with the Wyoming DOT:
- Installation guidelines/roles and responsibilities
- Data privacy and management
- Driver training requirements
- Maintenance/ trouble shooting
- Feedback gathering from drivers
- Feedback and information gathering from dispatchers and users of CVOP
- End of pilot transition plans

I-80 is a lifeline for our operations and reducing crashes and crash severity is a priority for our company. Connected Vehicle technology is a valuable tool in ensuring that our employees return home safely after every trip. We look forward to our participation in the pilot.

Figure 4-2. Sample Letter of Support.

4.4.1.2   Memorandums of Understanding

In Phase 2, the letters of support will be transitioned to formal Memorandums of Understanding (MOUs) with each of the fleet partners. The MoUs will be signed in early 2017 as the system architecture, installation guidelines and the vendor procurement are finalized. The MoUs will define:
- Commercial Vehicle Fleet Partner Roles and Responsibilities
  - Providing make and model year of vehicles that will be equipped
  - Installation support for on-board equipment
  - Testing of on-board equipment and commitment to use the on-board equipment
  - Supporting driver training and consent for pilot period

- o Supporting evaluation of applications through driver feedback and surveys of drivers
- o Maintenance/update of on-board equipment
- o Subscribing to the commercial vehicle operators portal
- o Data sharing plan for performance measurement
- o Post pilot transition plan
- o Financial requirements
- o Support demonstration and outreach activities
- o To the extent possible, provide vehicles that frequently traverse through I-80 (relative to their regular operation)

- WYDOT Roles and Responsibilities
  - o Procurement of on-board equipment
  - o Installation guides
  - o System operations and trouble-shooting support
  - o Driver incentives
  - o Driver training plan and materials
  - o CV Data management
  - o Post pilot transition plan
  - o Financial support

4.4.2 Financial Arrangements

Financial arrangements, if any, will be included as part of the MoUs. As part of the participation in the pilot, WYDOT will procure the on-board equipment that will be installed on fleet partner vehicles. Fleet partners are expected to support the installation by providing access to their vehicles at their site. Installation will either be done by WYDOT team or by the fleet partner depending on the location of the partner. Regardless, WYDOT will provide the installation guides necessary for the fleet partner. WYDOT also has included a budget for incentives/ reimbursements for drivers when they are taken out of their daily operations for pilot operations (for installation, training, survey/feedback/demonstrations, etc.). However, support from the fleet partners is voluntary, as such, they are not expected to be contractual partners for the pilot.

4.5 CV-Equipment Procurement

WYDOT intends to procure all the equipment necessary for the pilot and has already reached out to various vendors and used their initial estimates to build the cost model for the pilot. WYDOT expects the following equipment and technology to be procured through WYDOT procurement guidelines in Phase 2 of the pilot:

- OBUs – Several types of these units, including Aftermarket Safety Devices, are being procured from one or more vendors. OBU procurement costs will also include support costs and some installation costs. They may also include costs for supporting equipment such as cabling, tablet interfaces, antennas, etc.
- Roadside Units (RSUs) – RSU procurement costs include the equipment and maintenance support costs.
- Mobile Weather Sensors – Procurement of these sensors will include the equipment.
- Support for 3rd Party Integration – These include anticipated costs to support integration of CV pilot data by external 3rd parties (DriveWyze, Omnitracs, Inrix, etc.).

- Hardware/Software Costs – These costs will be used to support back-office systems including data warehouses and databases.

Table 4-3 details the different procurement categories, scope, and status.

Table 4-3. Procurement Categories

Category	Scope of Partnership	Status
OBU	Vendors to provide hardware, software, customization (when needed), and support for three years.	Proposal received for off the shelf set of devices for general testing. Proposal received for fully customized device for use with trucks. Proposal received for partially customized device (custom software only).
RSU	Vendor to provide hardware, software, customization, limited installation assistance and support for three years.	Proposal received with costs, scope of project, and schedule.
Mobile Weather Sensors	Vendor to provide hardware, software, some customization, and support for three years.	Proposal received with costs and high level scope activities with timeline.
Support for 3rd Party Integration	Vendor to ingest CV data and make available to non CV equipped trucks.	Proposal received from one vendor, negotiating with second vendor.

4.5.1 Supporting Documentation

4.5.1.1 Specification Documents

The CV procurement will be made based on the specification documents below.

- Connected Vehicle Pilot Deployment Program Phase 1, Security Management Operational Concept – ICF/Wyoming (Report No FHWA-JPO-16-288)
- Connected Vehicle Pilot Deployment Program Phase 1, Application Deployment Plan – ICF/Wyoming (Report No FHWA-JPO-16-292)
- Connected Vehicle Pilot Deployment Concept Phase 1, System Requirements Specification (SyRS), ICF Wyoming (Report No FHWA-JPO-16-291)

4.5.2 Financial Arrangements

WYDOT will procure all equipment for the pilot using State of Wyoming procurement standards (see Appendix B. Operating Policy 24-9) and in compliance with the USDOT oversight and requirements based on the Phase 2/Phase 3 contract.

4.6 Other Supporting Partnerships

WYDOT will seek the support of relevant and necessary entities in the field of freight transportation, connected vehicles and project development. These entities are explained in the following subsections, although it should be noted that this list of entities will continue to change and grow as the project continues to evolve.

4.6.1 Other CV Pilot Sites

WYDOT will continue to work closely with the other CV Pilot sites. Most of these activities will be coordinated through the USDOT as part of Phase 2 and Phase 3 activities. WYDOT in particular envisions participating in the technical roundtables as the system design and architecture become finalized. No financial arrangements are required for this partnership and contractual scope for WYDOT will include support for appropriate coordination activities.

4.6.2 Institutional Review Board (IRB)

University of Wyoming (UoW) will serve as the IRB of record for the pilot. Currently, IRB approval has been granted for a year. WYDOT will apply for an extension for the IRB with amendments to the original IRB proposal in the spring of 2017 (which would be in the middle of Phase 2). It is likely that multiple amendments will be required. WYDOT has hired one UoW professor (Dr. Mohamed Ahmed) to support the IRB process as part of the human use plan. WYDOT and other team members will enter into the required IRB agreements with University of Wyoming to allow it to act as the IRB of record.

4.6.3 Wyoming Trucking Association (WTA)

The WTA is an important partner to WYDOT in supporting outreach efforts for the CV Pilot. The WTA also will help WYDOT with some of the Phase 2 testing of the human machine interface development by helping recruit drivers who go through the simulator testing and training at University of Wyoming. An initial letter of support has been received from WTA. No financial arrangements are necessary with WTA.

4.6.4 Governor's Wyoming Transportation Safety Coalition

The Wyoming Transportation Safety Coalition includes trucking industry representatives, energy industry representatives, WYDOT, Department of Workforce Services, the governor's office, state epidemiologist, federal agencies including FMCSA, NHTSA, FHWA, representatives from local government (city and county, local traffic enforcement groups), the Wyoming Contractors Association and the Wyoming State AFL-CIO. The Safety Council has provided a letter of support to WYDOT and will be a valuable partner in outreach for the CV Pilot. No financial arrangements are necessary.

4.6.5 Independent Evaluator

WYDOT continues to support the independent evaluation effort. As part of the contracts, WYDOT expects to hire support for performance management and evaluation. While all of the team will be involved in performance measurement, performance measurement activities will be led by McFarland Management and supported by ICF, University of Wyoming and Trihydro.

4.6.6 Adjacent State DOTs

WYDOT continues to be a part of the I-80 corridor coalition and will continue coordinating with the Utah Department of Transportation Traffic Operations Center, the Colorado Department of transportation Systems Management and Operations program, and Nebraska Department of Roads as part of current operations.

In the discussions, WYDOT is looking for various potential sources of collaboration including:

- Use of WYDOT's third-party interface by adjacent State DOTs. WYDOT plans to make their data available to public and private third parties
- Coordination and standardization of the traveler information message (TIM) between adjacent State DOT's connected vehicle pilot efforts
- Including adjacent state conditions/closures as part of WYDOT's TIM messages to CV Pilot users

5 Post-Pilot Transition

WYDOT fully expects the CV Pilot to result in an operational system that will continue to be used beyond Phase 3. As part of Phase 1 ConOps and system planning, WYDOT has carefully considered the financial and partnership requirements beyond the pilot demonstration. The following elements are critical to WYDOT's transition concept:

- A significant population of WYDOT-owned fleets are part of the CV-Pilot
- The CV-Pilot system is conceived to be fully integrated with WYDOT TMC operations
- A reliance on standards and protocols to ensure that applications are broadly available to a diversity of on-board units and ensure interoperability of RSUs between different vendors

The following sub-sections present WYDOT's current thinking on the transition plan. However, as Phase 2 and Phase 3 progress, the topic of transition will be revisited before the conclusion of the pilot. WYDOT's GIS/ITS program intends to include $400,000 each fiscal year for the next three fiscal years in its proposed budget to cover Phase 2 and Phase 3. The budget must be approved by the department's executive staff. The executive staff has given its support to the project and are aware of the financial obligation to the pilot. At the conclusion of Phase 3, WYDOT would have 400 vehicles with DSRC technology coupled with about 75 roadside units. Five on-board applications would have been successfully demonstrated as part of Phase 3. CV Pilot elements would be effectively integrated to support WYDOT traffic and traveler information services.

WYDOT will continue to maintain and operate connected vehicle equipment on their fleets (about 100) including expanding as appropriate to other corridors in the State. WYDOT, as part of their normal ITS program, will maintain the roadside equipment and the back-office system necessary to support the V2I applications demonstrated in the pilot.

Private fleet partners will be encouraged to continue to support the on-board equipment for the pilot but it is likely that they would have to take ownership of maintenance and support. Ultimately, the partnering private fleet carriers will have to make a business decision based on the utility of the applications to the driver.

WYDOT would not be able to procure additional on-board equipment for private fleets post Phase 3. As such, the penetration on DSRC-enabled onboard devices in passenger vehicles or trucks is outside the control of WYDOT. Growth in DSRC equipped vehicles is dependent on factors like DOT rule-making, adoption of such technology by OEMs (and especially truck OEMs), and Independent Evaluation/Return on Investment benefits that may result from this Pilot as well as Outreach activities. As more and more vehicles become available, the value of the V2I applications become more evident.

With DSRC adoption timelines still in question, WYDOT will continue to maximize the utility of the existing CV technology in their fleets. WYDOT will focus in the near-term on expanding the ability to push the traveler information to as many on-road vehicles and fleet managers as possible. This will primarily be accomplished through:

- Supporting and encouraging the integration of the third-party interface created as part of WYDOT. The third party interface is intended to support private vendors who can use WYDOT data to provide value-added information to their consumers.
- Encouraging the delivery of TIMs through Satellite and other wide-area communication methods.
- Growing the subscriber base for CVOP which currently includes about 800 freight stakeholders.
- Actively using data from connected fleets for traffic management on I-80.

WYDOT is committed to the national growth of CV Technology and will continue to actively engage with standards development organizations (SDOs) and AASHTO V2I Deployment Coalition. WYDOT I-80 will serve as an important test bed for DSRC technology and testing of CV applications with a focus on adverse weather mitigation.

5.1 Post Pilot Governance Framework

WYDOT, at this point, expects to continue operations of its connected fleets and the roadside equipment as part of their ITS program. WYDOT will procure contractor, vendor support services as required to update elements of the CV Pilot that will continue to be WYDOT's responsibility.

5.2 Partnerships

WYDOT expects the following partnerships to be continued or pursued beyond Phase 3.

5.2.1 Research and Development (R&D) Support

WYDOT sees I-80 as a real-world test bed of Connected Vehicle Technology. With operational DSRC infrastructure on the roadside and on its fleet, WYDOT supports the continued development of CV capability both internally and externally. Internally, R&D support will be led by WYDOT's GIS/ITS group. WYDOT GIS/ITS will continue to refine applications and roll out new features and applications as desired by WYDOT stakeholders. Examples of such updates could be updates to the I2V Situational Awareness, Spot Weather Impact Warning and Work Zone Warning applications, improvements to traveler information services such as 511 and CVOP.

Externally, research partnerships include working with Universities and other R&D efforts on CV-related projects, analysis of CV data, and performance evaluation. For example, there continues to be research needed on vehicle configuration and blow-over risk.

5.2.2 Fleet Engagement Partnerships

WYDOT will work closely with WTA, WTSC and other freight partners to promote CV technology and the adoption of DSRC-based on-board technology if proven useful. WYDOT will continue to grow their subscriber base for the CVOP as well. The Wyoming Trucking Association has proven to be a valued partner for WYDOT, and the existing relationship will continue to be leveraged throughout this project.

5.2.3 Information Service Provider Partnerships

WYDOT will continue to strengthen partnerships with information service providers post Phase 3 both as a receiver and distributor of information on the corridor. While probe data is currently available, WYDOT fully expects the quality and the quantity of data derived mobile sources to grow nationally. Early discussions in Phase 1 have revealed private sector interest in collecting and distributing not only speed data but also road weather data. WYDOT will explore the availability of such data sets for their operational needs to support additional mobile data collection needs.

As a distributor of data, WYDOT will continue to look for opportunities to provide interfaces to WYDOT-owned data for third parties. In Phase 3, WYDOT would have demonstrated the value of such an interface to fleet technology providers. Post Phase 3, WYDOT will continue to support the interface and make it available to other parties that wish to integrate the data.

5.2.4 National CV Technology Adoption

WYDOT will also work with AASHTO V2I Deployment Coalition to foster state-level collaboration on connected vehicle technology deployment. WYDOT will also play an active role in standards development for CV technology. WYDOT regularly attends the National Rural ITS Conference and is scheduled to speak in October 2016 with McFarland Management about Wyoming's planning process for the pilot deployment. In addition, other venues targeted at freight will be identified and included as part of the outreach implementation schedule.

5.2.5 Maintenance and Support Contract

Through a maintenance and support contract, WYDOT will ensure that the RSUs and the back-office systems are maintained beyond Phase 3. Maintenance and support contracts ensure that hardware, software and communication equipment are kept up-to-date and are compliant with latest standards to enable national inter-operability. If successful, WYDOT intends to continue the operation of CV technology beyond the pilot period through funding in the GIS/ITS program budget. The amount of funding available is dependent on economic conditions of the state. A focus on roadside technology is one of the department's priorities,

5.3 Financial Plan

At this point, WYDOT will support continued operation of WYDOT-owned CV Pilot deployment through their program budgets. WYDOT's fiscal year is Oct. 1 through Sept. 30 and is subject to regulations put in place by the Wyoming Legislature. Programs submit funding requests to WYDOT's executive staff for review in late spring by the Transportation Commission. Funding is reviewed and budgets are approved to coincide with the start of the fiscal year. The GIS/ITS program intends to include funding for CV technology as part of its operating budget. If successful, DSRC sites will be added to road construction projects, becoming part of the State Transportation Improvement Program. Funding approval cannot be guaranteed for future years, but WYDOT's executive staff has repeatedly shown support for ITS technology in general and connected vehicle technology in particular. If the pilot demonstrates positive results via performance measures, it is very likely that other areas of the state will adopt the technology and it will become fundamental to WYDOT operations.

Alternate financial and business models for CV Pilot are premature for WYDOT to identify at this stage of the pilot.

Appendix A. ICF Scope of Work

Connected Vehicle Pilot – Phase 2 and 3

Scope of Work for ICF International

1   Introduction

Wyoming Department of Transportation is one of the three grantees of the U.S Department of Transportation (USDOT) Connected Vehicle Pilot Deployment Program. WYDOT intends to hire consultant support to deliver the pilot deployment scope described in *Notice of Funding Opportunity Number DTFH6116RA00007, Connected Vehicle (CV) Pilot Deployment Program – Phases 2 and 3.* The following sections outline the scope of work for ICF International for Phase 2 and 3 of the CV Pilot Deployment Project in Wyoming.

2   Statement of Work

ICF shall perform the following Phase 2 and 3 activities based on the most recent USDOT-accepted version of the final deliverables from the Phase 1 contract where applicable as identified below. Phase 3 activities shall not commence until notified by WYDOT. ICF will closely work with WYDOT and the other members of the WYDOT contracting team to either support or lead the following tasks identified in the USDOT scope of work.

Phase 2 Tasks

- 2-A. Program Management (LEAD)
- 2-B. System Architecture and Design (SUPPORT)
- 2-C. Data Management Planning (SUPPORT)
- 2-D. Acquisition and Installation Planning (SUPPORT)
- 2-E. Application Development (SUPPORT)
- 2-F. Participant and Staff Training (LEAD)
- 2-G. Operational Readiness Test and Demonstration Planning (LEAD)
- 2-H. Installation and Operational Readiness Testing (LEAD)
- 2-I. Maintenance and Operations Planning (SUPPORT)
- 2-J. Stakeholder Outreach (LEAD)
- 2-K. Performance Measurement and Independent Evaluation Support (SUPPORT)
- 2-L. Participation in Standards Development (SUPPORT)

Phase 3 Tasks

- 3-A. Program Management (LEAD)

- 3-B. System Operations and Maintenance (SUPPORT)
- 3-C. Stakeholder Outreach (LEAD)
- 3-D. Performance Measurement and Independent Evaluation Support (SUPPORT)
- 3-E. Post-Pilot Deployment Transition Planning (SUPPORT)
- 3-F. Participation in Standards Development (SUPPORT)

Task 2-A Program Management (LEAD)

For the entire pilot, ICF shall conduct effective program management activities to include:

- **Scope Management.** This includes ensuring that all required activities are performed and that only required activities are performed. The Recipient should have mechanisms in place for verifying and controlling the overall scope of the CV Pilot Deployment.
- **Schedule Management.** This includes managing the timely execution of work activities. A Project Schedule should list all activities required to bring all required work to a successful completion. Successful schedule management should identify how the team will monitor the project schedule and manage changes after a baseline schedule has been approved. Schedule management includes identifying, analyzing, documenting, prioritizing, approving or rejecting, and publishing all schedule-related changes.
- **Communications Management.** This includes the systematic planning, implementing, monitoring, and revision of all the channels of communication within the project partners and with other stakeholders. For the purposes of the CV Pilot Deployment program, a *partner* refers to an organization or individual on the deployment team. A *stakeholder* refers to an organization or individual potentially impacted by the deployment itself, regardless of whether they are team members (partners) or not. Communications management ensures effective internal team communications and governance methods, as well as communications with the USDOT's Agreement Officer Representative (AOR).
- **Cost Management.** This includes the process of planning and controlling the budget for the CV Pilot Deployment. Effective cost management should ensure that any issues with funding surface quickly, before cost overruns can occur.
- **Quality Management.** This includes effectively managing the quality of the products produced, from planning to delivery. Quality management includes procedures to be followed to implement a quality program and provide the USDOT with visibility into product quality (e.g., process and product evaluations, record keeping, nonconformance tracking, and reporting channels). Quality management addresses both Quality Control (QC) and Quality Assurance (QA) processes. QC is defined as the monitoring and controlling actions required during a project to ensure that a product – or performed service – adheres to a defined set of quality criteria. QA ensures that the appropriate quality planning and QC mechanisms are defined and utilized to prevent mistakes or defects.
- **Configuration Management.** This includes managing how items to be placed under configuration control are identified, when they are identified, and when they are placed into a configuration control process or system. Configuration management may include establishing a Configuration Control Board (CCB) and

include procedures for handling proposed changes to items under configuration control, and the role of the USDOT in configuration control.

- **Risk Management.** This includes identifying, prioritizing, and managing program risks in a timely and efficient manner. Risks that may impact the schedule, scope, or costs of activities performed under the program should be identified, documented, and tracked. Plans for mitigating risks should be identified and implemented.

ICF shall prepare a Program Management Plan (PMP) that describes the activities required to perform the work, per current PMBOK guidance1. The PMP shall explain the roles and responsibilities of all key individuals within the program/project team. At a minimum, the PMP shall contain a Scope Management Plan, a Schedule Management Plan, a Communications Management Plan, a Cost Management Plan, a Quality Management Plan, Configuration Management Plan, and a Risk Management Plan. The PMP shall be accompanied by a detailed CV Pilot Deployment Project Schedule, considered to be a logical component of the PMP, although it may be a physically separate electronic file. The Project Schedule shall list all activities required to bring all required work to a successful completion and shall contain – at a minimum – three levels of the Work Breakdown Structure (WBS).

The Project Schedule shall be updated monthly. The Project Schedule shall describe the following:
- Name of the work activity;
- Expected start and end dates;
- Name of the individual with the primary responsibility for accomplishing the work;
- Dependencies with other work activities in the Project Schedule; and
- All deliverables, procurements, or milestones resulting from the work activity.

ICF shall deliver a draft PMP to WYDOT who will provide it to USDOT. After receiving USDOT comments and resolving them, ICF shall provide a revised version of the PMP and its related documents. During the course of the deployment, WYDOT may propose modifications to the PMP. Any such modifications shall go through the cycle of draft submission, USDOT review and comment, comment resolution, and submission of a revised version.

Within four weeks after the effective date of the award, representatives from WYDOT deployment team shall attend a kick-off meeting to be held in Washington, DC with the USDOT and its representatives to ensure that all parties have a common understanding of the award requirements and expectations. ICF shall bring their project management lead to this meeting.

ICF shall compile monthly reports from other contractor and provide a comprehensive monthly progress reports that identify all deliverables and deliverable status (not initiated, in progress X% complete, draft delivered, in revision X% complete, final delivered, accepted). Monthly reports shall contain a narrative of accomplishments by task and projected activities in the next quarterly period. Monthly reports shall also contain an updated project schedule with a schedule risk narrative, a technical risk narrative, a partnership risk narrative, a retrospective cost narrative, and a projected cost-to-complete narrative.

Coordination Teleconference Participation. The USDOT requires WYDOT to organize and participate in a site-specific *bi-weekly deployment coordination teleconference* with the AOR and federal team members to cover work in progress, identify issues and risks, and coordinate technical assistance. ICF will help coordinate these calls and participate in them.

To assist in coordination across sites and encourage collaboration among deployment sites, ICF will have a minimum of one representative to participate in a *monthly all-site coordination teleconference* to be conducted with all Phase 2 and Phase 3 Recipients.

Required Deliverables
• Kick-off Meeting
• Project Management Plan (PMP)
• Revised PMP (as required)
• Project Schedules (updated monthly)
• Monthly Progress Reports
• Participation in site-specific bi-weekly coordination teleconferences
• Participation monthly all-site coordination teleconferences

Task 2-B. System Architecture and Design (SUPPORT)

This task area builds on systems engineering work conducted in Phase 1 and documented in key Phase 1 deliverables, including the Concept of Operations, System Requirements, and Comprehensive Deployment Plan. The objective of this task is to first develop a well-structured architecture for the site deployment concept; and second to prepare a detailed design based on that architecture that embodies the deployment concept.
Systems Architecture.

ICF shall support Trihydro in developing a Systems Architecture Document with a Standards Plan (appended to the Systems Architecture document) to describe the architecture for systems associated with the deployment and associated standards that will be used as per the scope set out in the USDOT NOFO application.

The System Architecture document shall include a Standards Plan that identifies the nature of required interfaces to other systems, which should be defined to utilize existing networking or other standards when available. In following the systems engineering process, ICF shall support the identify information exchange needs and/or use cases. To the extent that such exchanges are supported by standards, ICF shall support the cataloging of applicable standards that will be used. Where new standards are needed, these needs should be fully documented in the Standards Plan.

After the delivery of the draft Systems Architecture, ICF will support a System Architecture Walkthrough (see IEEE Standard 1028-2008) with USDOT and federal team members in the Washington DC metropolitan area (including a Walkthrough Workbook to structure and expedite the Walkthrough process) to demonstrate the completeness and technical soundness of the architectural approach. A minimum of two full working days shall be allocated to this Walkthrough.

In response to USDOT comments (both written comments provided prior to the Walkthrough and verbal comments provided during the Walkthrough), ICF shall support a revised System Architecture document and an accompanying comment resolution report.

Based on USDOT review of the revised document, the ICF will support a final System Architecture document.

Systems Design Document (SDD). Based on the system requirements specification (SyRS) and the system architecture, a system design is created that describes the full scope of the system. Subsystems of the system are identified and decomposed further into components. Requirements are allocated to the system components, and interfaces are specified in detail. Detailed specifications are created for the hardware and software components to be developed, and final product selections are made for off-the-shelf components. IEEE Standard 1016-1998 (IEEE Recommended Practice for Software Design Descriptions) includes guidelines for format and content to develop a System Design Document (SDD). After the delivery of the draft SDD, ICF shall support a System Design Walkthrough (see IEEE Standard 1028-2008) led by Trihydro within or near the deployment site (as well as a webinar or remote access capability) to demonstrate the completeness and technical soundness of the system design (including a Walkthrough Workbook to structure and expedite the Walkthrough process). A minimum of two full working days shall be allocated to this Walkthrough. In response to USDOT comments (both written comments provided prior to the Walkthrough and verbal comments provided during the Walkthrough), ICF shall support the development of a revised SDD and an accompanying comment resolution report.

Based on USDOT review of the revised SDD, ICF shall support the development of the final SDD.

When the SDD is complete, as needed, ICF shall update versions of Phase 1 deliverables. At a minimum, these updates will include: Concept of Operations, System Requirements Specification, and Comprehensive Pilot Deployment Plan.

Required Deliverables
- Inputs to Draft Systems Architecture Document (SAD)
- Inputs to Systems Architecture Walkthrough and Workbook (DC metro area)
- Inputs to Revised SAD with Comment Resolution Report
- Inputs to Final Systems Architecture Document
- Inputs to Draft Systems Design Document (SDD)
- Inputs to Systems Design Walkthrough and Workbook (deployment site)
- Inputs to Revised SDD with Comment Resolution Report
- Inputs to Final Systems Design Document
- Updated Phase 1 Deliverables, at a minimum
  - Revised Concept of Operations
  - Revised Systems Requirements
  - Revised Comprehensive Deployment Plan

Task 2-C. Data Management Planning (SUPPORT)

In this task, ICF shall support Trihydro, McFarland Management and University of Wyoming in the development of a Data Privacy Plan (DPP) and a Data Management

Plan (DMP) that relate to how data will be collected, integrated, managed, and disseminated during Phase 2 and Phase 3. This includes real-time and archived data (specifically identifying data to be shared on the Research Data Exchange (RDE)) that are used to control or are generated by systems managed by the Recipient and its partners. Note that this task is related to Data Management Planning; the **execution** of activities related to data collection and data sharing in accordance with the approved DPP and DMP is included as part of tasks 2-H, 2-K, 3-B and 3-D.

ICF shall support the delivery a draft DMP to the USDOT for review. ICF shall support the preparation of a revised DMP in response to USDOT comments with an accompanying Comment Resolution Report. Based on USDOT review of the revised DMP, the Recipient will deliver a final DMP.

Required Deliverables
- Inputs to Draft Data Privacy Plan (DPP)
- Inputs to Revised DPP with Comment Resolution Report
- Inputs to Final Data Privacy Plan (DPP)
- Inputs to Notice of Privacy Management Consistency
- Inputs to Draft Data Management Plan (DMP)
- Inputs to Revised DMP with Comment Resolution Report
- Inputs to Final Data Management Plan (DMP)

Task 2-D. Acquisition and Installation Planning (SUPPORT)

This task area covers planning for the acquisition, configuration, and installation of all in-vehicle, roadside, mobile device, center, and other equipment, software and supporting capabilities required to design, build, integrate and test the designed system. The phrase "other equipment, software, and supporting capabilities" includes software development outside of connected vehicle/traveler application-specific development explicitly covered under Task 2-E (Application Development).

ICF shall support Trihydro in developing a Comprehensive Acquisition Plan (CAP) that identifies the type and number of devices, equipment, and software-based capabilities to be acquired. The Plan shall have one section for vehicles and in-vehicle equipment, one for roadside equipment, one for mobile devices, one for management center equipment/capabilities.

ICF shall support Trihydro in developing a Comprehensive Installation Plan (CIP) that incorporates the CAP and further identifies the types and number of equipment required to be configured, and installed.

Required Deliverables
- Inputs to Draft Comprehensive Acquisition Plan (CAP)
- Inputs to Revised CAP with Comment Resolution Report
- Inputs to Final Comprehensive Acquisition Plan
- Inputs to Draft Comprehensive Installation Plan (CIP)
- Inputs to Revised CIP with Comment Resolution Report
- Inputs to Final Comprehensive Installation Plan

Task 2-E. Application Development (SUPPORT)

The deployment approach shall be consistent with the Phase 1 Application Deployment Plan (ADP). While some application development activities may have to wait until the system design work is complete, some activity may be initiated earlier in Phase 2. Given the short time frame of the Phase 2 period and uncertainties in software/application development, planning and managing this aspect of the deployment process is a critical action to mitigate risks with technical, schedule, and cost implications.

Based on the ADP, ICF will work with Trihydro to prepare an Application Development Schedule (ADS) that identifies the work breakdown structure (noting all dependencies among activities) required to make the applications deployment-ready. This includes the development/enhancement of individual applications to meet deployment-specific needs, the integration of applications in a synergistic collection (e.g., "bundle"), interfacing (as required) with security and credential management systems, and interfacing with existing legacy systems. The ADS shall include a testing plan and report progress against these tests as an element of updated ADS submittals.

ICF will support progress reporting on a bi-weekly basis. Progress should be provided as a minimum bi-weekly update to the ADS, which for each application/work breakdown element shows progress against milestones denoting (at a minimum) initiation, 20% complete, 50% complete, 80% complete, and completed activities. As they arise, technical risks and issues should be tracked and appended to the ADS.

Required Deliverables
- Inputs to Initial Application Development Schedule (ADS)
- Support ADS Update with Progress/Risk Summary (bi-weekly)

Task 2-F. Participant and Staff Training (LEAD)

In this task, relevant participants, operators, installers, maintenance staff, and other personnel are trained to install, interact with, operate, maintain, and/or repair the deployed system. This activity is guided by the Participant Training and Stakeholder Education Plan (PTSEP) prepared in Phase 1. This includes the development and/or acquisition of recruitment and training materials, recruiting, and the delivery of training to all required personnel. Some training activities will be dependent on the completion of the system design and/or installation planning activities; others will not be dependent. Some training activities will be related to applications and some to core functions (e.g., the SCMS). An update to the PTSEP may be required as an initial step in this task. In this task, a work breakdown structure of activities required to implement the PTSEP in Phase 2 is created and documented in a Training Implementation Schedule (TIS) that shall be created by ICF.

ICF shall lead the implementation of the training material development with support from Trihydro and University of Wyoming. ICF will identify and lead the development of the training materials identified in the PTSEP. ICF will also coordinate with University of Wyoming on the human use plan and ensuring that IRB approval is maintained.

Required Deliverables
- Initial Training Implementation Schedule (TIS)

- Training Materials (Initial and Updates, as specified in the PTSEP and TIS)
- Updated TIS with Progress/Risk Summary (monthly)

Task 2-G Operational Readiness Test and Demonstration Planning (LEAD)

In this task, ICF along with Trihydro prepare plans for a series of coordinated tests and demonstrations (potentially including participants) used to ensure the operational readiness of the system (the execution of these plans occurs under task 2-H). The objectives of these activities are to demonstrate the deployed system operates as designed in a safe and secure manner. Operational readiness conceptually applies to the system itself as well as the implemented institutional and financial framework that supports, finances and governs the deployed system.

Operational readiness is established with a comprehensive set of tests and supporting demonstrations to be designed and conducted by the Recipient. In general, the Recipient will conduct a set of relevant tests to verify that the system performs according to the documented System Requirements. Test results are documented and reported to USDOT. Demonstrations are at a higher-level, and show that the system performs as expected in key use cases/scenarios. Relevant testing is conducted *prior* to conducting a demonstration. Demonstrations are differentiated from tests by the following general features:
- Exhibit a set of selected integrated, end-to-end system capabilities central to the deployment concept of operations (e.g., key use cases); and
- Conducted as a live, real-time activity for the AOR and federal team wherein success and failure of the demonstration are directly observable.

ICF shall develop an Operational Readiness Concept Briefing, which outlines the aspects of the deployment to be considered in the assessment of operational readiness. As indicated above, this includes comprehensive systems engineering considerations (i.e., unit, subsystem and system testing identified in the System Requirements) as well as assessments of whether the deployment can operate safely and securely, whether staff and participants are suitably trained, human use approval has been obtained for all deployment participants, institutional and financial arrangements have been finalized, and whether the impact of the deployment can be discerned, measured, and reported. The briefing will be held in the Washington DC metro area (also available for remote participants through a webinar). The briefing summarizes the general approach to be used in Operational Readiness Test Planning and Operational Readiness Demonstration planning. The briefing shall describe the planned structure of the ORP Walkthrough (see below). The briefing shall include a preliminary list of proposed demonstrations. Demonstrations must cover, among other topics:
- Key use cases illustrating the capability of the system to perform in accordance with the Phase 1 Concept of Operations.
- Safety-focused demonstration elements illustrating the capability of the system to address key scenarios identified in the Phase 1 Safety Management Plan.
- Security-focused demonstration elements illustrating the capability of the system to successfully interact with the SCMS and carry out key security-related capabilities identified in the Phase 1 Security Management Operational Concept (SMOC). One or more demonstration elements will explicitly consider misbehavior detection.

- Privacy-focused demonstration elements illustrating key aspects of the Phase 1 Privacy Operational Concept and the Phase 2 Privacy Management Plan.
- Performance measurement and evaluation support demonstration elements (e.g., a dry run) illustrating key aspects of the Phase 1 Performance Measurement Plan, including data collection and processing (see Task 2-K, below).
- Institutional coordination and successful execution of governance frameworks, management processes, and financial arrangements, illustrating key aspects of the Phase 1 Partnership Status Summary.
- Maintenance-oriented demonstration elements (see Task 2-I, below).

ICF shall incorporate discussion and/or written comments from the USDOT regarding the briefing into a draft Operational Readiness Plan (ORP), with one section regarding tests (ORTP) and a second section describing demonstrations (ORDP). The ORTP will incorporate (at a minimum) the following elements for each test:

- *Test Descriptions.* Test Descriptions shall include written descriptions of the individual verification and validation processes that will occur as part of the effort to ensure that the system was built correctly and that the correct system was built. Test descriptions shall be linked back to documented System Requirement(s) whose fulfillment they will determine. The document should include a requirements-to-test procedure matrix that shows the test coverage relationship among the tests and the requirements. Every requirement should have at least one test case associated with it and each test case should have at least one requirement associated with it.
- *Test Cases.* Each test case include a set of test inputs, execution conditions, and expected results developed for a particular objective, such as to exercise a particular path within a system or a software application or to verify compliance with a specific requirement or set of requirements.
- *Test Procedures.* Test procedures spell out exactly how one verifies and validates that the component of the system examined actually functions as intended and as desired. If test data are going to be used as part of the verification and validation process in this step, the test procedures should also spell out how one will determine that the system actually performed the correct transformations on the data entered. Verification can use inspection, test, demonstration, and analysis but must be identified in each test.
- *Test Data.* Test Data should include scripts used to execute software operations, data that must be entered by someone as part of the process of verification and validation of the system and its component integration, or a description of what system-generated data will flow through different components of the system to accomplish a system function.
- *Test Results.* Documents that describe the results of each test conducted. The ORTP will also describe how test results will be summarized and documented across all tests and delivered to USDOT in Task H.
- *Test Failure Remediation.* This section describes the actions to be taken in the event of a failed test.

The ORDP will incorporate (at a minimum) the following elements (adapted for the aspect of deployment readiness tested) for each demonstration:

- *Demonstration Descriptions.* The descriptions identify the objective, general location, participants, equipment, and actions to be taken within the demonstration to illustrate the successful deployment of key use cases
- *Demonstration Procedures.* Procedures describe the sequence of events expected to be demonstrated and observable validation criteria associated with the overall purpose of the demonstration.
- *Demonstration Data.* Demonstration data are collected before, during, or after the demonstration to support the observable demonstration validation criteria related to demonstration success (e.g., pass or fail).
- *Demonstration Results.* Documents that capture the results of each demonstration conducted. The ORDP will also describe how demonstration results will be summarized and documented across all demonstrations and delivered to USDOT in Task H.

After the delivery of the draft ORP, ICF shall conduct an Operational Readiness Plan Walkthrough in the Washington DC metropolitan area to demonstrate the completeness and technical soundness of the test plan (including preparing a Walkthrough Workbook to structure and expedite the Walkthrough process). In response to USDOT comments (both written comments provided prior to the Walkthrough and verbal comments provided during the Walkthrough), the Recipient will submit a revised ORP and an accompanying comment resolution report. Based on USDOT review of the revised ORP, the Recipient will deliver a final ORP.

Required Deliverables
- Operational Readiness Concept Briefing (DC metro area)
- Draft Operational Readiness Plan (ORP)
- ORP Walkthrough and Workbook (DC metro area)
- Revised ORP with Comment Resolution Report
- Final Operational Readiness Plan (ORP)

Task 2-H.Installation and Operational Readiness Testing (LEAD)

ICF working with Trihydro will provide a report on progress as a weekly update to the IORS, which for each work breakdown element shows progress against milestones denoting (at a minimum) initiation, 20% complete, 50% complete, 80% complete, and completed activities. As they arise, technical risks and issues should be tracked and appended to the IORS. Weekly updates are expected to be delivered from the time that this task is initiated until the end of Phase 2.

As a part of the weekly IORS update, ICF support shall include an appendix that reports the number of DSRC-equipped devices installed and an operational status indicator (e.g., installed, installed and tested, operational, under repair/not in operation), categorized by type, with their physical locations where appropriate. Device types include: vehicle and in-vehicle equipment, roadside equipment, mobile devices, management center equipment, and any other equipment equipped with a DSRC transmitter or receiver.

ICF shall support Trihydro shall deliver an initial draft IORS to the AOR for review. ICF shall prepare weekly updates to the IORS in response to USDOT comments on format and content, as well as to document progress against plan and track risks/issues. The

updated IORS will be accompanied by a concise summary of activities underway, progress made since the last update, and any/all technical issues/risks with any/all mitigation actions taken since the last update. If critical technical issues are found, regularly scheduled technical working groups may be necessary to help resolve these issues. Test results will be documented and reported according to the processes identified in the ORP. Demonstrations will be scheduled in conjunction with the AOR and key federal staff. Demonstrations will be conducted and documented per the processes identified in the ORP.

Required Deliverables
- Installation and Operational Readiness Testing Schedule (IORS)
- Updated IORS with Progress/Risk Summary (weekly)
- Test Results Summary Documentation (per the ORP)
- Support to Operational Readiness Demonstrations (per the ORP)

Task 2-I. Maintenenance and Operational Planning (SUPPORT)

ICF shall support the development of a Comprehensive Maintenance and Operations Plan (CMOP) that identifies the types and number of equipment required to be maintained. Further, this document shall summarize key operational methods and procedures that ensure safe and efficient operations in Phase 3. The Plan shall have one section for operations and one section for maintenance. The maintenance section shall be further divided into sub-sections, one for vehicles and in-vehicle equipment, one for roadside equipment, one for mobile devices, one for management center equipment, and one for other equipment and supporting capabilities. The CMOP shall provide an overview of the proposed operational methods and processes, a high-level maintenance approach, as well as a high-level plan for inventory and configuration management. The CMOP shall include a description of the required elements of a maintenance-focused demonstration to be included as part of the ORP.

Required Deliverables
- Draft Comprehensive Maintenance and Operations Plan (CMOP)
- Revised CMOP with Comment Resolution Report
- Final CMOP

Task 2-J. Stakeholder Outreach (LEAD)

Stakeholder Outreach activity in Phase 2 is guided by the Deployment Outreach Plan (DOP) prepared in Phase 1. This includes, for example, the development and/or acquisition of outreach materials, web/social media content, trade show and conference materials, and other supporting materials intended to inform and engage stakeholders and the general public. In addition, this task is intended to cover all outreach events held for stakeholders in Phase 2 at the deployment site and the accommodation of requests for site visits by the media, researchers, and other visitors. Some outreach activities will be dependent on progress made in deploying the system; others will not be dependent.

Coordination with Other Deployment Activity. In order to meet overall program goals of accelerating the deployment of connected vehicle technologies, pilot deployment sites are expected to share insights and lessons learned with peers considering or actively deploying connected vehicle technologies. This includes the accommodation of site

visits and other activity/products developed in this task. In addition, in this task ICF shall maintain a Lessons Learned Logbook (LLL) that incorporates a brief summary of the issue identified, the potential impacts, mitigating actions taken, and results identified (to date). This logbook is a sub-element of the Outreach Implementation Schedule (OIS) described below, and compiles risks/issues/lessons learned from other tasks and deliverables, at a minimum the IORTS, TIS, and PMESS.

At the start of this task, ICF revise the DOP and update (as needed) throughout Phase 2. Based on the revised/updated DOP, the Recipient shall create and document in an Outreach Implementation Schedule (OIS), a work breakdown structure of activities required to implement the DOP in Phase 2.

ICF shall provide progress as a (minimum) monthly update to the OIS, which for each activity/work breakdown element shows progress against milestones denoting (at a minimum) initiation, 20% complete, 50% complete, 80% complete, and completed activities. As they arise, risks and issues should be tracked and appended to the OIS as a part of the Lessons Learned Logbook (LLL) sub-element.

ICF shall deliver an initial draft OIS to the AOR for review. ICF shall prepare monthly updates to the OIS in response to USDOT comments on format and content, as well as to document progress against plan and track risks/issues. The updated OIS will be accompanied by a concise summary of activities underway, progress made since the last update, and any/all technical issues/risks with any/all mitigation actions taken since the last update.

Required Deliverables
- Revised Deployment Outreach Plan (DOP)
- Initial Outreach Implementation Schedule (OIS)
- Outreach Materials (as specified in the DOP and OIS)
- Updated OIS with Progress/Risk Summary (monthly)
- Updated Deployment Outreach Plan (minimum one update)

Task 2-K. Performance Measurement and Independent Evaluation Support (SUPPORT)

ICF will support activities under this Task. The Performance Measurement and Evaluation Support Plan (PMESP) developed during Phase 1 will be used as a starting point and guiding document to ensure successfully completion of this task. Specifically, ICF will support:
- Establish a Performance Measurement and Evaluation Support Schedule (PMESS) and provide weekly progress updates
- Document pre-deployment performance conditions, including data, log books, analytical models and other supporting information
- Provide system performance reports
- Update the PMESP
- Support Independent Evaluator activities

As part of the task, McFarland Management will coordinate with ICF and University of Wyoming related to their efforts to support the performance measurement task with input from the driver simulator and VISSIM simulation activities.

The PMESS will include:

- Major PMESP activities and their timeframe
- Key milestones and dates to implement the PMESP successfully
- PMESP deliverables with dates (including performance-related data)
- PMESP dry-run demonstration and the key elements leading up to the demonstration
- Technical issues and risks affecting the execution of the PMESP (as a supplement)

Weekly updates of the PMESS will be provided to USDOT documenting PMESP progress, including percent completion estimates for all major milestones and deliverables. A performance baseline is required to support before-after analyses during the evaluation. A performance baseline will be established and documented in the updated PMESP. Specific baseline condition elements that will be documented include, but are not limited to:

- Traffic characteristics, including truck and private vehicle speeds under various conditions and speed variance results
- Weather events and categorization: type, severity, roadway impacts, etc.
- Number of road weather reports received at the TMC using traditional methods
- I-80 coverage (percentage of total) with road weather reports during severe weather events and identification of any gaps in coverage
- Average refresh time of road condition reports in each designated segment
- Current time for TMC operators to disseminate broad area traveler information
- Number of operational changes (routing, timing, cancelled trips) by commercial vehicle managers from road weather condition information provided by the TMC
- Baseline surveys/interviews of TMC operators, connected vehicle drivers, and commercial vehicle fleet managers. Qualitative data collected will include institutional and organizational aspects
- Vehicle speeds, speed variations, and posted speeds for various road weather conditions
- 5-year history of crash and injury data
- Location, extent, cause, and duration of I-80 closures over past 5 years.

As testing is accomplished in Phase 2 and data collection and performance data is collected, performance reports will be developed and provided to USDOT to document project progress.

The Wyoming Team plans to update the PMESP once, near the end of Phase 2. The Plan revisions will include, but not be limited to:

- Documentation of baseline conditions (pre-deployment)
- Updates/changes to the performance measures or evaluation designs, analytical models, and algorithmic methodologies to reflect system design decisions
- Updates to the performance confounding factors and mitigation approaches that reflect the most current understanding and approaches
- Detailed performance data and data management approaches (in coordination with the Data Management Plan – Task 2-C)
- Results of the performance measurement dry-run demonstration.

A review draft and final versions of the PMESP will be provided to USDOT.

ICF and the team will work collaboratively with the Independent Evaluator 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. Specifically, we will:

- Work closely with the IE to ensure a complete understanding of the Wyoming CV Pilot project, and assist in preparing a complementary evaluation plan and approach
- Provide the mutually agreed-upon data needed for the IE to conduct evaluation activities. The Wyoming team anticipates that the selected IE will produce their own evaluation plan possibly identifying data needs not yet discussed. We will work with the IE to update and finalize the list of data to be collected/provided. Additionally, the IE's data needs may require them to collect specific data not provided by Wyoming. In this case, the Wyoming team will coordinate with them to facilitate their efforts.
- Provide Wyoming PM-based analysis procedures, analytical tools, and models to be used during the Phase 3 evaluation activities
- Facilitate IE access to Wyoming Team staff and relevant stakeholders as needed to support the evaluation plan and activities
- Assist the IE in identifying and recruiting participants related to the evaluation plan and activities.

Required Deliverables
- Inputs to Draft Performance Measurement and Evaluation Support Schedule (PMESS)
- Inputs to Updated PMESS with Progress/Risk Summary (weekly)
- Inputs to Pre-Deployment Performance Data, logbooks, analytical models and other supporting information (per the PMESS)
- Inputs to System Performance Reports (per the PMESS)
- Inputs to Updated PMESP (minimum one update)

Task 2-L. Participation in Standards Development (SUPPORT)

ICF will support Trihydro in assisting the USDOT in improving and expanding ITS architecture and standards to support ITS deployments based on experiences and lessons learned as a part of the deployment activity. Such support includes participation in relevant standards development activities including participation at select Standards Development Organization (SDO) working group/committee meetings, providing input to the SDO working group in the form of technical information (e.g., objectives, user needs, data requirements, and review and contribution to relevant standards documentation. ICF under Trihydro's leadership shall provide appropriate input to expand, correct or otherwise improve ITS architecture(s) based on experiences in executing the Connected Vehicle Pilot Deployment Program.

Required Deliverables
- None

NOTE: The Recipient shall not perform Phase 3 activities without the express written approval of WYDOT.

Task 3-A. Program Management (LEAD)

ICF will continue to provide program management tasks identified in Task 2-A in Phase3. This task is a continuation of the Phase 2 Program Management activity, with the same objectives, activities and scope.

Required Deliverables
• Kick-off Meeting
• Project Management Plan (PMP)
• Revised PMP (as required)
• Project Schedules (updated monthly)
• Monthly Progress Reports
• Participation in site-specific bi-weekly coordination teleconferences
• Participation in monthly all-site coordination teleconferences

Task 3-B.System Operations and Maintenance (SUPPORT)

In this task, ICF shall support the operations and maintenance of the system according to the Comprehensive Maintenance and Operations Plan (CMOP). In this task, a work breakdown structure of activities (and dependencies) required to operate and maintain the system is documented by the Recipient in a System Operations and Maintenance Schedule (SOMS). ICF will support a monthly update to the SOMS, which for each work breakdown element shows progress against milestones denoting (at a minimum) initiation, 20% complete, 50% complete, 80% complete, and completed activities. As they arise, technical risks and issues should be tracked and appended to the SOMS.

Required Deliverables
• Inputs to Initial System Operations and Maintenance Schedule (SOMS)
• Updates to SOMS with Progress/Risk Summary (monthly)

Task 3-C .Stakeholder Outreach (Lead)

ICF shall lead Stakeholder Outreach in Phase 3 as described in the updated Deployment Outreach Plan (DOP). This includes, for example, the development and/or acquisition of outreach materials, web/social media content, trade show and conference materials, and other supporting materials intended to inform and engage stakeholders and the general public. In this task, a work breakdown structure of activities required to implement the DOP in Phase 3 is created and documented by the Recipient in an Outreach Implementation Schedule (OIS). As in Phase 2, activity in this task includes collaboration with domestic and international sites planning for or deploying connected vehicle technologies.

Outreach activities in Phase 3 will include an Operational Capability Showcase no later than the first 12 months of Phase 3. This is not a structured demonstration but is intended as a media event to show the capabilities, intent, and value of the deployment. The showcase will also include an interoperability activity, wherein one or more in-

vehicle or mobile device from a different CV Pilot Deployment site is shown to be interacting successfully with the local deployment.

ICF will prepare a draft Operational Capability Showcase Plan (OCSP) for USDOT comment. Based on the USDOT comments, ICF will prepare a revised OCSP with an accompanying comment resolution summary. Based on USDOT review of the revised OCSP, the Recipient will prepare a final OCSP. Work activities associated with the showcase will be incorporated into the OIS, as necessary.
ICF will conduct the Operational Capability Showcase in coordination with the AOR and federal outreach activity. The showcase will be documented by the Recipient with a draft Operational Capability Showcase Summary (OCSS) indicating how the results/products of the showcase have been integrated into site outreach materials and interactions in workshops, conferences and trade shows.

ICF shall prepare a revised OCSS in response to USDOT comments with an accompanying Comment Resolution Report. Based on USDOT review of the revised OCSS, ICF will deliver a final OCSS.

Progress should be provided by the Recipient as a (minimum) monthly update to the OIS, which for each activity/work breakdown element shows progress against milestones denoting (at a minimum) initiation, 20% complete, 50% complete, 80% complete, and completed activities. As they arise, risks and issues should be tracked and appended to the OIS (including an updated Lessons Learned Logbook).
The Recipient shall deliver an initial draft OIS to the AOR for review. ICF shall prepare monthly updates to the OIS in response to USDOT comments on format and content, as well as to document progress against plan and track risks/issues. The updated OIS will be accompanied by a concise summary of activities underway, progress made since the last update, and any/all technical issues/risks with any/all mitigation actions taken since the last update.

Required Deliverables
- Initial Outreach Implementation Schedule (OIS)
- Outreach Materials (as specified in the DOP and OIS)
- Updated OIS with Progress/Risk Summary (monthly)
- Draft Operational Capability Showcase Plan (OCSP)
- Revised OCSP with Comment Resolution Summary
- Final Operational Capability Showcase Plan (OCSP)
- Operational Capability Showcase
- Draft Operational Capability Showcase Summary (OCSS)
- Revised OCSS with Comment Resolution Report
- Final Operational Capability Showcase Summary

Task 3D – Performance Measurement and Independent Evaluation Support

ICF shall support all activities under this Task. The revised PMESP developed at the conclusion of Phase 2 will guide these performance measurement and evaluation efforts. During the Wyoming CV Pilot Project Phase 3 activities, the CV technologies will be demonstrated in a real-world environment and the performance documented.

The focus of this task will be to define how the PMESP will be executed, report to USDOT the data and performance measurement results, and coordinate efforts with the Independent Evaluator. Specifically, the McFarland Management will:

- Provide weekly updates to the PMESS
- Deliver post-deployment performance materials and reports, including data, log books, analytical models and other supporting information
- Update the PMESP and corresponding DMP
- Support Independent Evaluator Activities

The weekly PMESS updates will include:

- Major PMESP activities (Phase 3) and their timeframe
- Key milestones and dates to implement the PMESP successfully
- PMESP deliverables with dates (including performance-related data and results)
- Technical issues and risks affecting the execution of the PMESP (as a supplement)

Phase 3 performance measurement activities will execute the PMESP by collecting and analyzing data during the Wyoming CV Pilot demonstration. Each performance measure identified in the updated PMESP will be addressed according to the evaluation design defined in the Plan. Extensive data will be collected to support the post-deployment evaluation efforts. Periodically, we will deliver to USDOT and the IE the collected data, logs, analysis results, model results, system performance reports, and other supporting information. Additionally, the available performance measurement results will be delivered in accordance with the PMESS timelines and the final PMESP and DMP.

The Wyoming Team plans to update the PMESP twice. The first update will occur following the first winter season (2017–2018) of data collection and analysis in Phase 2. The second update will be delivered near the end of Phase 3. These updates will include any revisions to the PMs or evaluation designs and the performance measurement results to date. Specifically, the Plan revisions will include, but not be limited to:

- Updates to the performance measures or evaluation designs, analytical models, and algorithmic methodologies to reflect, most accurately, the Wyoming CV Pilot systems deployed
- Updates to the performance confounding factors and mitigation approaches that reflect the most current understanding and approaches
- Results to date of the performance-measurement Phase 3 activities, including data collected and analyses conducted.

The DMP also will be updated twice in Phase 3 along with the PMESP. This document will include the data collected and other supporting information to support the PMESP activities and the management approaches employed to secure, store and share the appropriate data.

ICF will support draft and final versions of the PMESP and DMP to USDOT.

ICF, McFarland Management and University of Wyoming will continue to work collaboratively to ensure a comprehensive and successful evaluation is completed and documented. During Phase 3, we will continue to work closely with the IE to provide assistance, data, and access to stakeholders, and general support to help the IE achieve their goals and objectives (defined in their Evaluation Plan – Phase 2 deliverable). In addition, we will provide the analysis procedures, analytical tools, and models used during Wyoming's Phase 3 evaluation efforts in support of the IE's evaluation activities.

Required Deliverables
- Draft Performance Measurement and Evaluation Support Schedule (PMESS)
- Updated PMESS with Progress/Risk Summary (weekly)
- Post-Deployment Performance Data, logbooks, analytical models and other supporting information (per the PMESS)
- System Performance Reports (per the PMESS)
- Updated PMESP and DMP documents (as required)

Task 3-E. Post-Pilot Deployment Transition Planning (SUPPORT)

This task area covers planning for the transition of the system from operations under the aegis of the Connected Vehicle Pilot Deployment program and into routine operational practice. The recipient shall draw upon and update relevant Phase 1 deliverables, in particular Partnership Coordination and Finalization. This task calls for an agreement regarding the main elements of the ConOps, performance measures and targets, operational changes associated with the Pilot Deployment, governance framework and processes, and financial agreements. This agreement was to include a vision of how these arrangements are expected to be altered or adapted in the post-deployment period to ensure a transition to permanent operational practice. Task 13, Deployment readiness Summary, from Phase 1 is also relevant and calls for governance agreements and financial agreements (updated as required). ICF shall support a Comprehensive Transition Plan (CTP) that identifies the concepts, applications, governance framework, agreements, key documents, and equipment to be maintained as elements of routine operational practice after the completion of Phase 3.

Required Deliverables
- Draft Comprehensive Transition Plan (CTP)
- Revised CTP with Comment Resolution Report
- Final Comprehensive Transition Plan (CTP)

Task 3-F. Participation in Standards Development (SUPPORT)

ICF will support Trihydro in assisting the USDOT in improving and expanding ITS architecture and standards to support ITS deployments based on experiences and lessons learned as a part of the deployment activity. Such support includes participation in relevant standards development activities including participation at select Standards Development Organization (SDO) working group/committee meetings, providing input to the SDO working group in the form of technical information (e.g., objectives, user needs, data requirements, and review and contribution to relevant standards documentation. ICF under Trihydro's leadership shall provide appropriate input to expand, correct or

otherwise improve ITS architecture(s) based on experiences in executing the Connected Vehicle Pilot Deployment Program.

Required Deliverables
- None

3   Period of Performance

Deliverable data and task schedule will be governed by WYDOT's overall project schedule which will be shared by WYDOT at the kick-off meeting. The overall schedule for the phases are

- Phase 2 – Starting in September 2016 for 20 months
- Phase 3 – Starting in May 2018 for 18 months

4   Travel and ODCs

A total of $64,746 has been allocated for travel for this project. Travel details are provided in the table below.

Task	Destination	Number of Trips	Number of Travelers	Per Trip Cost	Total Travel	Purpose
Phase 2					**$ 35,970**	
2A	Cheyenne	1	6	$ 1,199	$ 7,194	Kick-off Meeting in Cheyenne
2B	Cheyenne	1	2	$ 1,199	$ 2,398	Sys Arc Development
2E	Cheyenne	1	2	$ 1,199	$ 2,398	App Dev Support
2F	Cheyenne	1	3	$ 1,199	$ 3,597	Training Activities
2G	Cheyenne	1	4	$ 1,199	$ 4,796	Readiness Planning
2H	Cheyenne	2	4	$ 1,199	$ 9,592	Readiness Testing
2J	Seattle	1	1	$ 1,199	$ 1,199	Outreach. Locations Estimated
	California	1	1	$ 1,199	$ 1,199	Outreach. Locations Estimated
	Austin	1	1	$ 1,199	$ 1,199	Outreach. Locations Estimated
	Columbus	1	1	$ 1,199	$ 1,199	Outreach. Locations Estimated
2K	Cheyenne	1	1	$ 1,199	$ 1,199	Perf Measurment Support
Phase 3					**$ 28,776**	
3A	Cheyenne	1	5	$ 1,199	$ 5,995	Phase 3 KO
3B	Cheyenne	4	2	$ 1,199	$ 9,592	System Operational Visits
3C	Seattle	1	1	$ 1,199	$ 1,199	Outreach Locations Estimated
	California	1	1	$ 1,199	$ 1,199	Outreach Locations Estimated
	Austin	1	1	$ 1,199	$ 1,199	Outreach Locations Estimated
	Columbus	1	1	$ 1,199	$ 1,199	Outreach Locations Estimated
3D	Cheyenne	3	2	$ 1,199	$ 7,194	Performance Management Support
3E	Cheyenne	1	1	$ 1,199	$ 1,199	Transition Planning Meeting
TOTAL					**$ 64,746**	

In addition, $83, 918 for ODCs are estimated for this effort for various outreach elements (such as videos, websites, trade show materials, conference participation, etc.)

5   Overall Cost

The overall cost for the scope of work identified above shall not exceed X,XXX,XXX.00

Appendix B. Operating Policy 24-9

WYOMING DEPARTMENT OF TRANSPORTATION	OPERATING POLICY
ISSUED: March 3, 2006	POLICY NUMBER: 24-9
	DIRECTOR:

SUBJECT: **Purchasing and Contracting**

Purpose: This policy defines the Wyoming Department of Transportation (WYDOT) bidding and negotiation processes for purchasing and contracting of materials, supplies, equipment, printing, services, and construction. It also outlines the procedure to follow for specific dollar amounts.

Purchasing and contracting are delegated at various levels of authority. Quotations may be solicited, advertised, and awarded by the Purchasing Program or the Contracts and Estimates Program or any district office depending on the individual circumstances, requirements, or location of work. District personnel are encouraged to use the services of the Purchasing and Contracts and Estimates programs whenever possible.

Procedures that advise applicable headquarters supervisory personnel concurrently when district personnel call for bids or quotations or make a substantial purchase must be followed.

Minority business enterprises are given full opportunity to submit bids and are not discriminated against on the grounds of race, color, or national origin.

The Federal Highway Administration (FHWA) imposes additional contracting requirements for projects receiving federal-aid highway funds. No resident bidder preference shall apply to contracts that use federal funds.

I.   **Definitions**

    A.   **Service Contracts**:   Service contracts are made with an outside business or individuals and furnish specific services, routine maintenance, or limited services, with no construction work directly involved. The work is repetitive or periodic, (such as cleaning rest areas, spraying weeds, removing snow, and performing routine maintenance) but should not involve more than slight repairs.

    B.   **Construction Contract**:   Construction means any engagement in construction, reconstruction, improvement, enlargement, alteration, or repair of buildings, structures, highways, or their appurtenances. This work is not to be confused with routine maintenance, which may have slight repair work involved as indicated in the preceding service contract definition.

    C.   **Resident Bidder**: A person, partnership, company, or corporation certified as a resident according to the provisions of W.S. 16-6-101 through W.S. 16-6-119 or W.S. 16-6-301.

    D.   **Contracting Agent**: Reference to the contracting agent within this policy refers to:

        1.   The purchasing manager or a member of the purchasing staff.

2. The contracts and estimates engineer or a member of that program's staff.

3. The district engineer or an employee within the district given the authority to negotiate contracts or purchases on the Department's behalf.

II. Methods of Procurement

A. Direct Pay Invoices (Up to $2,500)

1. Direct pay invoices are limited to the purchase of materials, supplies, equipment, printing, services, and construction within prescribed limits for normal day to day operations. Direct pay invoices can be submitted only by authorized personnel–generally those designated as supervisors. Other personnel are eligible if approved by the appropriate district engineer or program manager.

2. At least three verbal quotations should be obtained whenever possible.

3. Using multiple direct pay invoices to circumvent the monetary limit is prohibited.

4. Direct pay invoices are **not** allowed for the following:
   a. Anything in excess of $2,500.
   b. Items listed in the WYDOT Procurement Catalog.
   c. Items requiring a property number (required for items costing $500 and over).
   d. Items on blanket purchase order contracts.
   e. Computer hardware and software.

B. Informal Written Quotations ($2,500 to $7,500)

1. The purchasing manager, the contracts and estimates engineer, a district engineer, or their designees are allowed to solicit, advertise, and make the award for informal quotations within Department monetary limitations and approving authorities as designated in Operating Policy 24-1, Monetary Limitations and Approving Authority, for the purchase of materials, supplies, equipment, printing, services, and construction.

2. At least three informal written quotations should by obtained whenever possible. The written quotation must be documented and include:

   a. The name and address of the vendor.
   b. The vendor's authorized representative's name and signature.
   c. Prices.
   d. The FOB (free on board) point (which determines who pays freight charges).
   e. The terms (Net 45 and so forth).
   f. The date.
   g. The delivery time.

3. A 5 percent preference (or 10 percent for printing contracts) shall be given to Wyoming resident bidders. To figure the preference, add 5 percent (or 10 percent for printing contracts) to the total quotation for any non-resident bidder(s) to determine the low bid.

4. If the district or program does not desire to solicit its own quotations, the Purchasing Program will solicit quotations upon receiving a requisition.

5. The purchasing manager, contracts and estimates engineer, or the district engineer reserves the right to reject any or all quotations.

C. Competitive Sealed Bidding ($7,500 and above)

1. Competitive sealed bidding is the preferred method of source selection, and it should be used whenever possible.

   a. Bids or contracts for materials, supplies, equipment, printing, services, and construction shall be made by competitive sealed bidding when the configuration or performance specifications are sufficiently designed to permit award based on the lowest evaluated price as determined in accordance with objective measurable criteria set forth in the invitation for bids, and when available sources, the time and place of performance, and other conditions are appropriate for using competitive sealed bidding.

   b. Requests for proposals (RFPs) may be used when configuration or performance specifications can not be clearly defined, when the Department has designed a need and requests the bidders to propose the best method for accomplishing it, when cost is only one criteria in determining award, or other factors as the purchasing manager deems appropriate.

2. Formal contracts over $50,000 are awarded by the Transportation Commission of Wyoming. Below $50,000 the approving authority is governed by expenditure limitations in Operating Policy 24-1, Monetary Limitations and Approving Authority. If the Commission declares an emergency condition, the contracting agent determines the best contracting method up to a maximum of $100,000.

3. Professional consultants for contracted services are hired according to the guidelines established by Operating Policy 40-1, Consulting and Special Service Agreements.

D. Construction

1. All federally funded projects are processed through the Contracts and Estimates Program. State-funded projects are processed through the Purchasing Program.

2.   Construction work over $7,500 must be competitively bid. If the Commission declares an emergency condition, the contracting agent determines the best contracting method up to a maximum of $100,000.

3.   All contractors must be prequalified for road and bridge construction bids. The contracts and estimates engineer may waive prequalification if the contract is under $100,000. For contracts over $100,000, the Commission must approve a prequalification waiver. Only contractors selected from an approved bidders list are sent invitations to bid. WYDOT, however, will send bid applications to bidders who are not prequailified or not on the Department's bidders list if requested to do so in writing.

4.   Expenditures for construction exceeding $7,500 require a 10 percent bid bond. A bid bond may be retained as a performance guarantee bond up to a contract amount of $25,000. A performance bond of 100 percent of the contract price is required for contracts over $25,000. See Operating Policy 24-10, Bonding Requirements.

5.   Construction work estimated to cost $25,000 or more requires that the prevailing hourly wage be paid for labor. Labor rate determinations are available through the Construction Program.

E.   Noncompetitive Negotiation

1.   Noncompetitive negotiation may be used to purchase materials, supplies, equipment, printing, services, or construction, if the item or service to be purchased is:

     a.   For an emergency situation.
     b.   For compatibility with existing equipment or systems.
     c.   To support a special program for which the product has unique characteristics essential to the program's needs.
     d.   For items covered by patent or copyright.
     e.   For trial and evaluation prior to specification development.
     f.   The only known source. Documentation must be submitted with requisition.
     g.   One for which users have had extensive training and experience and the use of any other similar piece of equipment would require considerable reorientation and training.
     h.   To secure pre-negotiated cooperative contract pricing, such as with General Services Administration (GSA) pricing, state co-operative agreements, U.S. Communities contracts, WSCA contracts, and so forth. The contract number must be listed on the requisition.

2.   All noncompetitive negotiated purchases up to and including $7,500 must be substantiated in writing and approved by the Purchasing Program, the Contracts and Estimates Program, or applicable district personnel before purchases are made.

3.   Noncompetitive purchases from $7,500 to$50,000 require chief engineer or administrator approval, and purchases over $50,000 require Commission approval.

4.   The individual making the purchase must not give any preference to one specific vendor if more are available.

5.   The purchasing manager, contracts and estimates engineer, or the district engineer reserves the right to reject any noncompetitive negotiations.

F.   General

1.   The Transportation Commission of Wyoming has authorized WYDOT to remove bidders from the active bidders' mailing list as discussed in the following. Bidders retain the right to appeal decisions to the Commission as described in General Section, Chapter 3, Appeals and Hearings, Wyoming Department of Transportation Rules and Regulations.

2.   A bid that is in possession of the purchasing manager may be withdrawn by the bidder up to the time of the bid opening. Bids may not be withdrawn after the bid opening. Failure of the bidder to furnish the materials, supplies, equipment, printing, services, and construction from a bid on which an award is made shall eliminate the bidder from the active bidders' mailing list for a period of one year. The Department, however, reserves the right to waive this sanction when it determines that extraordinary circumstances exist. The vendor will be responsible for requesting reinstatement on the active bidders' list after the one-year period.

References: Operating Policy 24-1, Monetary Limitations and Approving Authority.
Operating Policy 24-10, Bonding Requirements.
Operating Policy 24-15, Bidder Application and Resident Bid Preference.
Operating Policy 24-17, Purchasing Program.
Operating Policy 40-1, Consulting and Special Service Agreements.
W.S. 9-2-1016, General services division.
W.S. 16-6-101 through W.S. 16-6-119, Public Works and Contracts.
W.S. 16-6-301, Public Printing Contracts.
W.S. 24-2-108, Road and bridge construction.
W.S. 27-4-402, Prevailing wage definitions.
W.S. 27-4-403, Prevailing hourly wage on public works projects . . ..
Transportation Commission of Wyoming, minutes of September 25, 1975,
      paragraph 32.
Wyoming Department of Transportation Rules and Regulations, General Section,
Chapters 1, 2, 3, 6, 8, 10, 14, and 18.

U.S. Department of Transportation